6th LIMC 2023

PROCEEDING:

6TH LANGKAWI INTERNATIONAL MULTIDISCIPLINARY CONFERENCE 2023

6TH LIMC 2023

Proceeding:
6th Langkawi International Multidisciplinary Conference 2023
(6th LIMC 2023)

GLOBAL ACADEMIC EXCELLENCE (M) SDN BHD
2023

Proceeding:
6th Langkawi International Multidisciplinary Conference 2023 (6th LIMC 2023)

Date: 9-10 September 2023

eISSN: 2976 - 3223

Published By:

GLOBAL ACADEMIC EXCELLENCE (M) SDN BHD -1257579-U
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Jalan Dato Pati, 15000 Kota Bharu, Kelantan, MALAYSIA
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Preface

The conference proceedings represent the culmination of countless hours of scholarly effort, dedicated to advancing our understanding of diverse subjects spanning the realms of science, technology, social sciences, humanities, and more. These pages are a testament to the intellectual curiosity and dedication of the authors who have contributed their research findings, innovative approaches, and thought-provoking perspectives to this multidisciplinary gathering.

As we delve into these proceedings, we embark on a journey of discovery, where each article offers a window into the evolving landscape of human knowledge. It is our hope that these contributions will not only inform but also inspire further inquiry and collaboration among researchers, academics, and practitioners from around the world.

We extend our deepest gratitude to all the authors for their invaluable contributions, to the peer reviewers for their rigorous evaluations, and to the conference organizers for their unwavering commitment to making this event a resounding success. Without your dedication, this collection of knowledge would not have come to fruition.

The '6th Langkawi International Multidisciplinary Conference 2023 Proceedings' serve as a lasting legacy of our collective pursuit of knowledge and innovation. We encourage readers to explore the diverse array of topics and perspectives presented within these pages, with the aim of fostering interdisciplinary dialogue, sparking new ideas, and enriching the global academic community.

May this compilation of research and insights inspire future generations of scholars and contribute to the ongoing expansion of human understanding. We invite you to immerse yourselves in the wealth of knowledge contained herein and to join us in celebrating the remarkable diversity of thought and inquiry that defines the multidisciplinary spirit of the '6th Langkawi International Multidisciplinary Conference 2023 Proceedings'

Contents

DO WORK LIFE BALANCE, CAREER DEVELOPMENT AND RECOGNITION AFFECT JOB SATISFACTION? AN EMPIRICAL STUDY IN THE PLASTIC MANUFACTURING COMPANY

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Abstract: *Lack of emphasis on the human resource management practices performed by the organizations that involve in manufacturing activity leads to negative implications in employee perspective. Therefore, the organization will be able to lose its internal strength in sustaining high productivity. Identifying the significant strategies that lead job satisfaction mainly by the plastic manufacturing organization is very meaningful. This study intends to examine the influence of human resource practices on job satisfaction in plastic manufacturing industry. Investigating organizational human resource management in this study are based on the strategic practices such as work-life balance, career development and recognition. Instruments for survey questionnaire were adapted from related previous empirical researches and the "IBM Statistical Package for Social Science" (IBM SPSS) version 26.0 was used to analyze the data. This study used random sampling method that involved a total of 248 workers as respondents who seek for the job satisfaction in the organization. The results of the correlation and regression analyses confirmed that work-life balance, recognition and career development had a positive relationship and significant effect on job satisfaction respectively. The results of this study were seen to be able to contribute within the scope of knowledge in managing human resource management practices and, the significant roles of its practices in promoting job satisfaction in the industry.*

Keywords: *Work Life Balance, Career Development, Recognition, Job Satisfaction and Plastic Manufacturing Company*

Introduction

In the age of globalisation, all businesses or organisations must compete for a position as a top-tier organisation by showcasing their competence. The competitive edge of a country is determined by the productivity of its human resources. The competitiveness of the products produced can therefore be greatly increased by having access to high-quality human resources in terms of knowledge, skills, and work ethic. Job satisfaction is a personal matter because every person's level of job satisfaction varies depending on the value system that applies to him. Therefore, satisfaction is an assessment that describes a person feeling happy or unhappy, satisfied or dissatisfied at work (Aisyaturrido et al., 2021). Naturally, when a person is happy at work, he or she will make every effort to carry out his or her obligations to the best of their ability.

Job satisfaction is one of the most crucial elements in achieving the best possible work results. According to a recent interview conducted with a shift supervisor at SPI Plastic Industries Sdn. Bhd. (studied location) revealed that a variety of factors, including work-life balance, career development, and recognition, have an impact on how satisfied employees are with their jobs in that plastic manufacturing factory. This is supported by Aisyaturrido et al. (2021) who cites numerous similar elements of job satisfaction that also exist in other plastic manufacturing company, such as in PT. Trinitan Plastics Industries.

Work-life balance (WLB) is the ability for people to use their working hours flexibly and balance their work with other commitments (Silaban & Margaretha, 2021). If the company develops work-life balance programmes, employees won't spend all of their time at the office. However, they may balance their lives such that they are happier and more fulfilled at work by spending time with their family and participating in extracurricular activities. A better work-life balance often leads to an improvement in job satisfaction, which in turn boosts employee loyalty, creativity, and productivity.

Planning for career development is essential for both individuals and organisations because it is hard to make career plans without first identifying the needs and personnel competencies of the company. As a result, addressing individual needs is necessary in order to address organisational needs. Insofar as people feel appreciated by their managers and organisations as their goals are pursued and realised, employee satisfaction and career development are closely related. Employees are more satisfied with their work and would never want to quit the firm, which is appropriate because the business needs its top performers to achieve its objectives and long-term business goals.

Ndungu (2017) defines recognition as an effort made by an organisation or company's management to show appreciation for its members or employees in response to their serving as role models or for taking acts. One of the key components in employee satisfaction is recognition since it makes them feel good to be appreciated and acknowledged. An employee's motivation to achieve the goals and objectives of the firm is boosted when they are recognised. Job satisfaction is a composite of employees' thoughts and emotions regarding their current position.

One of the most crucial elements to achieving the best possible work results is job satisfaction. Therefore, work-life balance, career development, and recognition will be indicators of job satisfaction. Whether it was maximised at the time of deployment, when they worked, will be evident. There are still many employees who have worked for a long time who are still on contract status, and a job satisfaction is a feeling of pleasure or displeasure with workers seeing and carrying out their work, according to an interview with the chief leader of the production department. This case happened to SPI Plastic Industries in terms of job satisfaction, and it is the same case that happened in the research of Aisyaturrido et al. (2021).

The work-life balance is vital for both employees and the organization since it will make it more comfortable for employees to work, which will help them perform at their best. In an interview, it was said that SPI Plastic Industries' work-life balance has not improved (Aisyaturrido et al., 2021). Job satisfaction is not supportive in terms day and night shift change of workers and determination of shifts that are not equivalent to work time standards. The workplace cannot represent the circumstances that encourage collaboration between superiors and subordinates who have the same rank inside the organisation. The employee's work-life balance can be defined as everything that affects him or her at work, whether directly or indirectly. This includes both physical and non-physical factors.

Aisyaturrido et al. (2021) mentioned that one of the issues is that some employees do not receive promotions to move up to a group of jobs in a reasonably long period of time in their work. Employees experience saturation as a result, which influences job satisfaction. According to Katharina & Dewi (2020), on the other hand, the idea of career development is the provision of movement that sparks an individual's passion, enabling them to cooperate, perform well, and be integrated with all efforts to attain fulfilment. So that a work ethic can grow together with this professional development and lead to employees being happy in their jobs. Therefore, this study is importance and timely to overcome the reality and to achieve the high chances in work-life balance, career development and recognition that to be conducted.

When employee receives recognition, it increases their motivation to meet the company's goals and objectives. It must be ongoing and regularly scattered. There are two types of recognition: informal and formal. Employees' thought and opinions about their current jobs are combined to form their job satisfaction. Employee work satisfaction levels can range from extreme levels of contentment to extreme levels of unhappiness. The welfare of employees is the most important challenge that businesses must address. According to study conducted by SPI Plastic Industries, although employees spend the majority of their time at work, they do not feel contented, same as the research of Nanjundeswaraswamy et al. (2020) shows that recognition have very high impact on job satisfaction in manufacturing sectors.

Literature Review

Relationship Between Work-Life Balance and Job Satisfaction

According to research by Aruldoss et al. (2021) with 331 respondents working in a transportation company in southern part of India found that work-life balance is positively related to job satisfaction because at the higher levels of work environment, work-life balance is associated with an increase in job satisfaction than at lower levels of work environment. The research of Silaban and Margaretha (2021), stated that there is positive relationship between work-life balance and job satisfaction as much as 8.3% by using simple linear regression data analysis with 196 respondents from various fields of Millennial Employees in Bandung City, Indonesia. This study demonstrates that those who have a healthy work-life balance are happier at work because they have played significant roles. According to Shantha (2019), research, which involved 360 employees from the Sri Lankan company ACB Maritime Agencies' shipping and logistics division, there is a favourable association between work-life balance and

job satisfaction. The company should have a scheduling policy that allows employees to be flexible and spend more time with their family. Because of this, these arrangements result in higher levels of job satisfaction. Employees who have more flexibility are happier and report having high job satisfaction. The above-mentioned literatures are possible to develop the hypothesis as below;
H1: There is a positive and significant effect of work-life balance on job satisfaction

Relationship Between Career Development and Job Satisfaction
The results of the study conducted with 74 individuals from the Sengkaling Recreational Park Company, according to Mohyi (2020), revealed that career development initiatives had a large and somewhat significant impact on employee job satisfaction. The study's findings showed that businesses should focus more on fostering employee career development by actively communicating with staff members to better understand and support their requirements in terms of their professional growth. Finding results from Katharina and Dewi (2020), with a total sample of 61 employees and all taken for the census, showed that career growth has a positive and significant effect on job satisfaction at Inna Sindhu Beach Hotel & Resort. This means that the more effectively a company controls employee career development, the more satisfied its employees are with their jobs. Employees will feel appreciated and content with their employment if the organisation manages career development fairly. According to earlier research by Rahayu et al. (2018), which included 200 respondents from 665 populations, career development has a favourable and significant impact on job satisfaction for the Regional Secretariat (SETDA) employees of the Jambi Provincial Government. Therefore, the relevant hypothesis could be as followed;
H2: Impact of career development on job satisfaction is positive and significant.

Relationship Between Recognition and Job Satisfaction
According to Rasool et al. (2018), which included 220 respondents and was conducted in Shanghai, China, suggests that recognition has a favourable link with job satisfaction and motivation in the Chinese banking sector. Therefore, these shortcomings can be eliminated and will raise their job satisfaction if managers encourage, appreciate, and recognise their subordinates. Finding results by Obodoechi et al. (2020), recognition is positively and significantly correlated with job satisfaction and multiple regression analysis also showed that recognition is the strongest detractor of job satisfaction among employees in the Nigerian banking industry, where 384 employees were chosen with a 94% response rate. Based on this study, reward and recognition has the best and commonly used in an organization as a means through which employees' job satisfaction can be ascertained. From previous research by Ali and Ahmad (2017), shows that recognition has a positive and significant impact on job satisfaction. 358 individuals from junior and middle management levels who worked at several commercial banks in Karachi participated in the survey. Those studies are strongly used to develop the third hypothesis as stated below;
H3: Recognition positively and significantly affect job satisfaction.

Conceptual Theory
This research only covers a small substantial part of research theory related to the problem which consist of theories of job satisfaction such as Herzberg's Two-Factor Theory.

Numerous theories, like Herzberg's two-factor theory, describe the connection between the determinants and job satisfaction. Because it uses an inductive technique to identify new determinants and incorporates a wide range of work satisfaction elements, Herzberg's two-factor theory was used in this study to evaluate the job satisfaction factors of non-executive personnel at SPI Plastic Sdn. Bhd. Herzberg (1968) proposed factors to reduce job dissatisfaction, including company policy and administration, job security, salary, supervision, interpersonal relationships, supervisory relationships, physical working conditions, and benefit, as well as motivators related to job satisfaction, including achievement, advancement, recognition, responsibilities, growth, and the work itself (Thant & Chang, 2021).

In accordance with Alshmemri et al. (2017), organisational policies and management principles are examples of how well a company is organised and managed. This element relates to work-life balance that requires proper scheduling of working hours. Employees need to allot enough time for work and time to fulfil personal commitments in order to maintain a healthy balance between their professional and personal lives. However, it could not be accomplished by employees alone; it also calls for organization-wide initiatives. According to company policy and administration, some workplace characteristics help employees feel satisfied in their jobs, whereas another set of factors helps them feel unsatisfied in their jobs. For this reason, these factors are referred to as "hygiene" factors (Hussein et al., 2016).

On the other hand, career development, often known as personal growth, refers to changes that an individual makes to further their personal goals. Employees won't be unhappy, but they won't be satisfied, if those variables are sufficient. Hertzberg advises placing more attention on elements that are connected to the job itself or that have outcomes that may be attained directly from the employment, such professional development or personal development (Katharina & Dewi, 2020). Because the driving variables represent self-esteem, which is essentially acknowledgment, the Herzberg theory provides the basis for the argument of reward and recognition and its impact on employees' job satisfaction (Ullah, 2018).

The literature has been used to develop a conceptual framework for this study as shown in Figure 1.

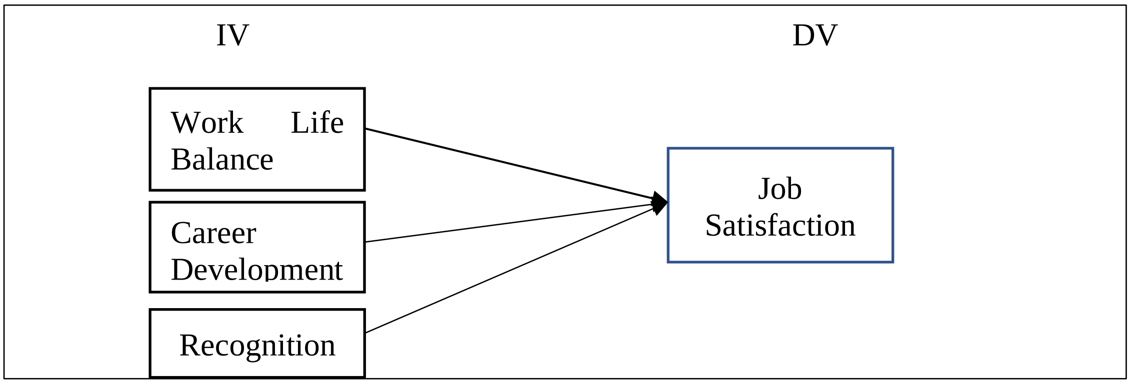

Figure 1: Conceptual Framework

Methodology

A quantitative research design using survey method was performed by distributing the questionnaires. Survey technique was suitable due to the data and information about respondents would be gathered in a possible form that was associated to the issues and scenarios of this study. Thus, the potential respondents who were randomly chosen for this study was based on the Krejcie and Morgan’s (1970) Minimum Determination Table for respondents. The employed sample was the employees of SPI Plastics Industries Sdn. Bhd. The data collected was made by self-administered questionnaire to support the research objective. About 300 questionnaires was distributed to ensure the minimum response achieve the number of sample size (248).

Consequently, the reliability and validity test is need to be examined in finding out the two levels of testing are highly acceptable and reliable. Hair et al. (2017) stated the types of validation namely face validity and content validity should be assessed properly. Thus, the content and face validity for this study were examined that involved each item in the questionnaire through the professional consultations and approvals. Each item on the instrument is measured logically and precisely so that what is meant in measurement can be clearly understood (Zikmund & Babin, 2013). This study also conducted a pilot study by selecting 20 respondents comprising the employees from various departments in the company. The result showed that all items of each variable achieved exceeded Alpha Cronbach values 0.6. The acceptable and high value illustrates that all questionnaire items can be employed for actual research and free from item deletion. Furthermore, according to Sekaran and Bougie (2020), if the Alpha Cronbach value exceeds 0.6 means the items have a good internal consistency level. Finally, the data analyses using IBM SPSS version 26.0 software involving data filtering, descriptive and inferential analyses were performed, involving 248 respondents from the employees who completely answered the questionnaire. The response rate based on number of sample size meets the level in conducting further research as suggested by Zikmund and Babin (2013).

Finding and Analysis

Demographic Data

Based on the demographic profile analysis the results showed that 72% of respondents are males and 28% are females. Meanwhile, most respondents, 31.5% are 1-5 years of period of service and 68.5% are having more than 5 years' service. It was found that mostly, 64.9% of respondents are those who had the highest educational level at SPM/ SKM only. Others were at STPM/ Diploma and Degree levels.

Reliability Test for Pilot Study and Actual Survey

Reliability is about how well the researcher could get the consistent feedback by using an instrument of questionnaire to measure something at one time and more. On the other hand, reliability means whether or not the research method is able to yield strong and consistent results (Gorondustse & Haim, 2013). Therefore, this study assessed the consistency levels of the variables data which was famously used by the past researchers for the instrument reliability test. As usual, the Cronbach's alpha coefficient value was utilized to confirm the acceptable inter-item consistency (Sekaran & Bougie, 2020). From the reliability analysis, the results show the values from 0.791 to 0.810 that prove the high values of Cronbach Alpha coefficient (See in the Table 1).

Interestingly, referring to the reliability levels guideline provided by the famous scholar above, this study confirmed the acceptable reliability of the constructs and for conducting further descriptive and inferential analyses in completing the findings of this study. Furthermore, the instruments used in this study are significant to be referred for future studies in the area of service quality and customer satisfaction.

Table 1: Reliability Test Results

Constructs	Cronbach's Alpha (Pilot Study)	Cronbach's Alpha (Actual Survey)
Work- Life balance	0.840	0.791
Career development	0.734	0.791
Recognition	0.877	0.810
Job satisfaction	0.802	0.851

Pearson Correlation Analysis

Pearson Correlation Analysis was carried out to provide the basic ideas to research about the pattern of the inter-correlations of the study variables. Table 2 is a summary of the results from Pearson Correlation Analysis.

Table 2: Correlation Analysis Results

	JS	W-lB	CD	REC
Job satisfaction	1	.839**	.889**	.797**
Work-life balance	.839**	1		
Career development	.889**		1	
Recognition	.797**			1

From Table 2 it can be confirmed that correlation between independent variables and dependent variable such as work-life balance (r = 0.839, p < 0.01), career development (r = 0.889, p < 0.01) and recognition (r = 0.797, p < 0.01) are positively correlated with job satisfaction.

Multiple Regression Analysis

The results in Table 3 indicate that work-life balance and career development and are significant (significant at < 0.005). They are also positively correlated and predicted to job satisfaction variable (β = .198 and β = .746). However, impact of recognition on job satisfaction is not significant (significant level 0.559). There is a fact to understand that work-life balance and career development may explain why there are associations between these antecedents and job satisfaction perceived by the employees. In this survey, job satisfaction would be enhanced if the management really emphasize on the work life balance and career development. The result also illustrates that 79.7% of the variance of job satisfaction are explained by those two predictors; work-life balance and career development. On the other hand, 20.3% of the variance are explained by other potential factors that to be considered by future studies.

Table 3: Regression Analysis Results

IVs	DV: Job Satisfaction Beta Coefficients	t	Sig
Work-life balance	0.198	2.918	0.004
Career development	0.746	8.760	0.000
Recognition	-0.039	0.585	0.559

R^2 = 0.797

Hypothesis Test

Multiple Regression Analysis was conducted to examine the hypotheses in this study. The results of hypotheses test were explained as followed:

H1: There is a positive and significant effect of work-life balance on job satisfaction - Supported
H2: Impact of career development on job satisfaction is positive and significant - Supported
H3: Recognition positively and significantly affect job satisfaction - Rejected

Discussion

It focuses a solution and discussion to the existing issues that relate to this research. Moreover, it can also be supported to the expansion prospects of the research and the further reference in related studies. Determination of the findings of a relationship and an impact of work-life balance, career development and recognition on job satisfaction were the fundamental of achieving main objective of this study. The study measured the variables to allow a better understanding of the relationships and the effect of those three predictors on studied criterion. The study carried out measurements on the variables in pursuit of achieving the research objectives. The main objective of the research is discussed based the findings of the study.

Main Objective: To Examine the Impact of Work-Life Balance, Career Development and Recognition on Job Satisfaction.

Work-life balance, career development and recognition and job satisfaction create a sense of success and effectiveness of human resource management practices and employee perspective in the organization. Job satisfaction allows employees to perceive in a pleasant manner that indicates high performance of human resource practices of the organization. It was found from this study that work-life balance and career development have a significant effect on job satisfaction. Effective human resource management practices performed by the companies will normally have a high effectiveness of programs and activities provided to the employees, thus make them satisfied on their jobs.

In addition, trusted human resources practices performed by the companies in terms of work-life balance and career development play a significant role in predicting employees' job satisfaction. On the other hand, the research established that human resources management practice did act as a predictor as well on job satisfaction as perceived by the employees of this company. The respondents claimed that there will be a bad job satisfaction if the human resource management neglects to focus on such as work-life balance and career development for them. Acceptable work –life balance and career development would be fighting the tendency of low job satisfaction among the employees. Highly sensitive to the employee's needs are the significant implications of human resource management practices that lead to high company's authentic management performance and manage the best to the employees. Thus, this contributes to the high employees' job satisfaction solutions. The results of the relationship were supported by the previous study by Silaban & Margaretha (2021), Shantha (2019) and Pich & Fendy (2021). While, other finding by Aruldoss et al. (2021), Rahayu et al. (2018) and Mohyi (2020) had proven that human resource management practices (work-life balance and career development) influenced job satisfaction as well.

In contrast, employees perceived recognitions by the superiors were not the significant factor to promote their job satisfaction. This can be assumed that majority of the respondents who were very senior in service and for them work-life balance was more preferred and really needed for their job satisfaction. Apart of that, majority of the respondents were lower level workers who really perceived career development for their future success as a main determinant for their job satisfaction.

Contributions and Recommendations

The study shares some new idea in the field of employees' job satisfaction in the context of manufacturing industry. Therefore, it would be significant for future study and manufacturing companies to take the consideration from the following discussions. Future researchers should further conduct the study to use more relevant respondents to improve consistency of the results. In terms of theoretical implication, this study had proven the effect of work-life balance and career development on customer satisfaction. The employees will be more comfortable if the human resource management strongly consider for employees' work-life balance at workplace and apply career development activities for their future job expansions and promotions. These are the most influential determinants in this research which have revealed that the job satisfaction is successfully yielded. The study also recommends strategies for improving job satisfaction for manufacturing companies. Such strategies are for the management teams which they need to emphasize the employees needs and satisfaction factor through the creation of work-life balance. Besides the management also should focus on providing opportunities for the employees to participate in the career training and promotional programmes for their career enhancements. It is important because this is the antecedent basis for having motivated employees who are benefited from the career development initiative and finally disclose high satisfaction among them. Apart of that, the results of this study may be meaningful as a guideline to other related parties such as the employees of the company in giving fully support to the company's work-life balance policy and career development programme as initiated by the management of the company.

Conclusion

This study has achieved its main objectives. The findings revealed that work-life balance and career development initiated by the plastic manufacturing company have positive and significant impacts on job satisfaction. The study proposes that further consideration should be given to the employees for having balance workload and daily life activities as well as providing accomplished career development. This will yield the quality of management that is able to be performed to the employees. Employees are likely to feel satisfied with their job when there are closed interactions and proper human resource management functions provided (work-life balance and career development) to them. In principle, those who are involved in manufacturing managerial activity should be motivated of their jobs and sensitive to the needs of their employees. When these happened, they will put a solid response for the greatness of the roles given. Finally, there will be a result of job satisfaction.

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NEW TAX RELIEF, NEW TAX MEASUREMENT OF EXISTING TAX RELIEF AND THE MALAYSIAN ECONOMIC STIMULUS PACKAGE TO COMBAT COVID-19: A STUDY ON THE PERCEPTION OF MALAYSIAN INDIVIDUAL TAXPAYERS AND THE INFLUENCES DRIVERS

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Abstract: *The outbreak of Covid 19 had resulting to the worst ever economic crisis to the Malaysian economy. The economic recession has not only impacted the GDP, but also led to an increase in unemployment rate. As an effort to recover from the economic downturn, government of Malaysia took a proactive plan by issuing economic stimulus packages of Prihatin, Penjana and Permai. The study investigates perception of Malaysian individual taxpayers on the new tax reliefs and the new measurement on existing tax reliefs in the economic stimulus package of Prihatin, Penjana and Permai as well as the influences drivers for the perceptions. Data collected through questionnaire distributed to 150 sample of individual taxpayers around Selangor and Kuala Lumpur is analyzed by using statistical analysis of multiple regression. Findings of the study reveals that taxpayers have a favorable perception towards the new tax relief and the new measurement on existing tax relief in the economic stimulus package. Result of multiple regression analysis indicates that factors of peer influence, tax awareness and tax education are significant in influencing perception of Malaysian taxpayers upon the new tax reliefs and the new measurement of existing tax reliefs under these three economic stimulus packages. The study provides significant contribution towards knowledge on taxation issues in the context of Malaysia as an emerging economic country in the world.*

Keywords: *Tax Relief, Tax Measurement, Economic Stimulus Package, Covid-19, Taxpayers*

Introduction

The first case of Coronavirus desease (COVID 19) in the world is reported on 17 November 2020 in Wuhan, China (Davidson, 2020). COVID-19 is a combination of Middle East respiratory syndrome coronaviruses and the deadly severe acute respiratory syndrome (Wang, Tang and Wei, 2020). The symptom is flu-like symptoms, fever, cough and breathing difficulty. On 25 January 2020, there were a total of 1975 confirmed and 2684 suspected cases worldwide. On 30 January 2020, the World Health Organization (WHO) announced Covid-19 as a pandemic owing to first illness caused by coronavirus.

Malaysia was among the first few countries that affected by this fatal disease including Thailand and Singapore. According to the Malaysia's Minister of Health (2020), Covid-19 in

Malaysia consists of three waves. The first wave started on 24 January 2020 with 22 cases from infected people coming from China. This was followed by the second wave started on 27 February and the third wave on 8 October. Due to the fast growth in active cases of Covid-19 in the second wave, the Government of Malaysia announced an action plan known as a Movement Control Order (MCO) on 18 March 2020 to halt the spread of COVID-19. Under MCO, only essential services such as healthcare, logistics, the food supply chain, and banking are allowed to be operated (Nadzir, Ooi, Alhasa, Bakar, Mohtar, Nor and Anuar, 2020). People are afraid to go out and they are working from home to follow the rules of MCO to flatten the curve of COVID-19.

Due to the spread of Covid-19 and MCO, Malaysia is facing the worst ever economic crisis just as other developed nations in the world. The recession has not only impacted the GDP, but also led to increase in unemployment rate (Landau, 2020). In the two weeks of the MCO, the economic activity declined from 2% to 0.5%. Within five weeks of the implementation of MCO, GDP of Malaysia decreased from 3 to 4 per cent. The International Monetary Fund (IMF) seen this economic crisis as worse than the mortgage crisis and need a long time to recover at a normal state. At this time, it was very difficult to boost the economy like before (Hasanat, Hoque, Shikha, Anwar, Hamid and Tat, 2020).

Government of Malaysia took a proactive plan to recover the economy by issuing the economic stimulus package of Prihatin on 27 March 2020, followed by Penjana on 5 June 2020 and Permai on 18 January 2021. The package of Prihatin's goal is to safeguard the public's welfare, assist companies and develop the economy. As for Penjana, the goal is to empower citizens, revive businesses and boost the economy. Whereas Permai's goal is to fight COVID-19 outbreak, assure public's welfare and assist business.

The economic package if Prihatin assist business cashflow by enabling small and medium enterprises (SMEs) to defer income tax instalment payments for three months commencing 1 April 2020. This is in addition to the previously announced the deferment of tax instalment payments for tourisme businesses for six months period commencing 1 April 2020. Other affected industries may also modify the amount of income tax due in the third, sixth and ninth instalments. To stimulate tourisme sector, government granted the personal tax relief up to RM 1,000 to resident individuals for the domestic travel expenses incurred between 1 March 2020 to 31 August 2020 which include accommodation expenses at hotel registered with the Ministry of Tourism, Arts and Culture Malaysia and entrance fees (RSM International Association, 2020).

Under the economic package of Penjana, government provides special individual income tax relief of up to RM 2,500 on the purchase of a smartphone, notebook and tablet to facilitate work from home arrangements and to assist individuals during the COVID-19 crisis effective on 1st June 2020. Due to pandemic, all kindergartens, public and private schools have been closed to avoid the virus spreading. Thus, to assist working parents throughout the MCO period, government offers childcare subsidies by raising the income tax relief of parents on childcare services cost from RM 2,000 to RM 3,000 for the year of assessment 2020 and 2021. Penjana is mainly focus on businesses to recover from the impact of COVID-19 (Deloitte, 2020). Under the package, companies are eligible for tax reduction on COVID-19-related expenditures. The goal is to assist companies in adhering to new standards and operating according to SOPs. COVID-19-related expenditures include COVID-19 testing and the procurement of personal protective equipment and thermal scanners. According to the Tourism

Malaysia Corporate Website (2020), Due to the pandemic, there is a decrease of almost 70 percent in the visitor spending in Malaysia from RM 41.6 billion in 2019 to RM12.5 billion in 2020 (Tourism Malaysia Corporate Website, 2020). Therefore, through Penjana package, government provides tax advantage to the tourism industry by extending the time period for income tax deductions of up to RM1000 for tourism expenditures until 31st December 2021. As for the package of Permai, the scope of the medical check-up relief of RM 1,000 is expanded to include COVID-19 screening tests for the year of assessmentv2021. Also, tax relief up to RM2,500 on the purchase of a smartphone, notebook and tablet that is introduced under package of Penjana is extended to 31 December 2021.

Tax relief is often assessed as exception to taxation rules (Bikas and Jurevičiūtė, 2016). Tax relief has been defined by Bikas and Jureviciute (2016) in two ways. First, government is suffering income loss and second, taxpayers reduced their liabilities. The primary justification for tax relief is to reduce taxpayers' financial loads. Tax reliefs help to minimize chargeable income, thus assist taxpayers to lessen significant amount of taxes. However, in applying the tax relief, taxpayers must have sufficient tax knowledge to assure that they do not miss out any benefits that they actually deserve (Ghani, Abdul hamid, Sanusi and Shamsuddin, 2020).

In general, the package of Prihatin, Penjana and Permai is introduced with the aim to help Malaysian taxpayers in lessen the financial burden. The objective of this study is to investigate perception of Malaysian taxpayers on the new tax relief and new measurement of existing tax reliefs in these economic packages and the factors influencing the perception.

Literature Review

Tax relief is one of government initiative aimed at lowering the amount of taxes paid by people and companies. Gbadago (2017) states that tax relief is intended to alleviate burdens associated with the enforcement of tax laws and to ensure an equitable distribution of tax burdens. To accomplish this, effective tax systems provide individual personal income taxpayer with reductions in their taxable income through personal income tax reliefs schemes. Tax reliefs are often seen as exceptions to taxation laws (Bikas and Jureviciute, 2016). These exceptions are made to accomplish certain goals or to encourage or limit particular behaviours in the context of social or economic policy. Tax reliefs are a critical structural component of taxes that are validated by national legislation and international agreements. Bikas and Jurevičiūtė (2016) defined the tax reliefs in two ways, which are government losses revenue and taxpayers reduced their liabilities. Tax reliefs benefit enterprises, increase resident earnings, and lowers social exclusion. Yet, tax reliefs increase tax expenses which led to negative impact on public finances.

Individuals' perceptions may influence their attitudes upon new tax relief and new assessment of current tax relief. Ahmad, Ismail and Halim (2016) conducted a study on the level of understanding of GST among taxpayers in Malaysia upon 256 secondary school teachers in the area Kuala Kangsar, Perak. Findings revealed that favourable attitude of citizens toward tax system is critical for them take responsibility for the country's growth.

Palil, Mohd Rusyidi and Wan Fadillah (2013) examine the impact of religion on tax awareness and tax compliance of 70 graduates of Malaysian public university. Study found that taxpayers' perceptions are related to knowledge and experience, which explains why those with knowledge about taxes have better tax compliance. Taxpayers with tax knowledge and experience are able to respond differently to the new tax relief and new measurement on existing tax relief.

Methodology

The study is conducted by using quantitative method. Questionnaire is distributed to 150 sample of individual Malaysian taxpayers in the area of Kuala Lumpur and Selangor. The Questionnaire is divided into different section. Section A is for background of respondent, section B is for taxpayers' perception upon new tax relief and new measurement on existing tax relief and section C is for factors that influence the perception of taxpayers on the new tax relief and new measurement on existing tax relief. Data is analysed by using descriptive and regression statistical analysis.

Findings

The descriptive analysis of the mean value for taxpayers' perception on the new tax relief and new measurement on existing tax relief in Malaysia is conducted based on the 17 questions. 134 respondents strongly agree that the new measurement tax relief of childcare subsidy of RM 3,000 under Penjana package really help parents to reduce the tax burden, while 133 respondents strongly agree that scope of the medical check-up relief of RM 1,000 expanded to include COVID-19 screening tests under PERMAI package for Year of Assessment (YA) 2021 really encourage taxpayers to go for COVID-19 screening tests. The mean score of the response for both questions is the highest which is 5.82. In addition, the lowest mean score is 1.33 with 130 respondents strongly disagree on the statement of 'I think the new tax relief and new measurement on existing tax relief should not be introduced by government'

Based on multiple regression analysis, findings of the study reveal that factors of peer influence, tax awareness and tax education are positively and statistically significant at p 0.05. This shows that taxpayers with higher tax awareness and tax knowledge will results to better perception upon new tax relief and new measurement on existing tax relief in Prihatin, Penjana and Permai. In addition, peer influence play significant role in influencing the perception of taxpayers upon the economic stimulus package.

The value of adjusted R^2 is 0.592, thus indicates that the regression model is able to explain nearly 60 percent of the associations between the perception upon new tax relief and new measurement on existing tax relief in Prihatin, Penjana and Permai and its determinant. Based on the results, the equation of the regression model is specified as follows:

$$\gamma = 1.357 + 0.126X1 + 0.238X2 + 0.400X3 + \varepsilon$$

Annotation:
γ: Perception of Taxpayers
X1: Peer Influence
X2: Tax Awareness
X3: Tax Education
ε: Error

Conclusion

Results of this study is fruitful in better understanding the perception of Malaysian taxpayers upon the new tax relief and new measurement on existing tax relief in Prihtain, Penjana and

Permai as well as the influencing factors of the perception. As the study found that peer influence, tax awareness and tax knowledge have a positive significant relationship with the perception of Malaysian taxpayers upon the new tax relief and new measurement on existing tax relief in Prihatin, Penjana and Permai, the results suggest that individual taxpayers with better tax awareness and tax knowledge will have better perception upon the new tax relief and new measurement on existing tax relief in Prihatin, Penjana and Permai. Peer influence also play a significant role in influencing those perception.

However, there might be other potential stimulus factor that might influence the perception of the new tax relief and new measurement on existing tax relief in Prihatin, Penjana and Permai, but are not included in this study. Therefore, it is valuable for future research to consider the possibility of other stimulus factor. Also, the inclusion of other stimulus factors is worthwhile to obtain a stronger predictive model of this matter.

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6th LIMC 2023

6th Langkawi International Multidisciplinary Conference 2023 (6th LIMC 2023)
eISSN 2976-3223
9th – 10th September 2023
Bayview Hotel, Langkawi, Malaysia

EXPLORING THE IMPACT OF ORGANIZATIONAL COMMITMENT AND EMPLOYEE GREEN BEHAVIOUR ON GREEN HUMAN RESOURCE MANAGEMENT: INSIGHTS FROM CONSTRUCTION COMPANIES

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Abstract: *In response to globalization, Indonesia is also taking part in efforts to meet the 2030 sustainable development goals, which call for Indonesia to contribute to the ongoing development of the SDGs. Green human resource management is the best response to human resource management strategies that emphasize environmentally friendly and sustainable organizational practices. This study uses quantitative research techniques to determine the effect of organizational commitment and employee green behavior on green human resource management. The object of research is one of the state-owned enterprises (SOEs) in the field of construction, namely PT Wijaya Karya Bangunan Gedung Tbk. The number of respondents was 100 employees in the SOEs. This study's results show an influence on organizational commitment to green human resource management. Employee green behavior has a moderate effect on green human resource management. Organizational commitment and employee green behavior influence green human resource management.*

Keywords: *Green Human Resource Management, Organizational Commitment, Employee Green Behavior*

Introduction

The importance of environmental protection has been recognized in the era of globalization, and organizations worldwide are now prioritizing ecological challenges. Indonesia is taking part in preparing the sustainable development goals (SDGs) for 2030, which require Indonesia to contribute to creating adjustments and improvements. The United Nations (UN) released 17 SDGs, commonly known as the sustainable development goals, in September 2015. In 2015-2030, these goals aim to eradicate poverty, protect the environment, and achieve universal prosperity. The millennium development goals (MDGs), which were in effect from 2000 to 2015, have been replaced by the Sustainable Development Goals. The sustainable development goals, which cover social, economic, and environmental aspects, serve as a more inclusive and comprehensive framework for sustainable development (Wang et al., 2019). As a result, companies in Indonesia are becoming more aware of their social and environmental responsibilities alongside their concentration on financial returns. A human resource management strategy emphasizing environmentally friendly and sustainable organizational practices is green human resource management (GRHM). GHRM can be vital in the overall business strategy to build a sustainable company. Companies' use of GRHM can be essential in building a sustainable business. Companies can reduce their adverse impact on the environment and drive growth by implementing green practices, including carbon emission reduction, waste management, and energy efficiency. Organizations can better use resources by leveraging GRHM. Human resource management can encourage saving energy, using less paper, and managing water effectively in these situations. It helps preserve the earth's limited natural resources while lowering operational costs (Sumiati, 2023).

The leading construction company in Indonesia, PT Wijaya Karya Gedung, has set out to implement socially and environmentally conscious business practices. However, in designing and analyzing its human resources, PT Wijaya Karya Gedung must fully integrate ecologically friendly human resource management. However, there is also a second dimension, namely green human resource management, that the company can apply. This dimension includes environmental management activities/programs based on ISO 14001 (Labella-Fernández & J. Martinez, 2020). PT Wijaya Karya Gedung has certainly used ISO 14001 as a guideline, as well as one of the main priorities of K3 and environmental management, which is undoubtedly under ISO 14001.

According to the kompas.com article that found 305 companies in Indonesia violate environmental laws still and are still far from meeting ISO 14001 product standards which harm the environment in the country. According to PT Wijaya Karya Gedung's 2022 sustainability report, the company made a difference as one of the businesses that care deeply about environmental sustainability by building green buildings and presenting the green building concept for the WIKA group. PT Wijaya Karya Gedung has received more than nine green transportation apartment awards from housing estate magazine due to WIKA Gedung's overall green ship-level gold construction. Qualified human resources support PT Wijaya Karya Gedung and have obtained green building certification.

According to Labella-Fernández and J. Martinez (2019), if a company provides environmental education and training to its employees, can be achieved all aspects to the maximum. When implementing GRHM, it is crucial to consider organizational commitment (OC) and employee green behavior (EGB). Jevon Jeciniah (2022) shows that green human resource management has a positive impact on employee commitment, and green human resource management has a beneficial impact on employee green behavior. It implies that green human resource management can positively increase employee green behavior.

Employee green behavior (EGB) refers to individual actions taken by employees to maintain and preserve the environment in the workplace. In comparison, organizational commitment refers to the level of loyalty and dedication of employees to the organization where they work. Employee green behavior is essential in green human resource management, as environmentally friendly employees will help reduce the organization's negative environmental impact. In addition, several factors can be used to measure how much employees care about the company's internal environment; of all the EGB dimensions, "savings" is the most relevant (Bashirun, 2019).

According to Statiska.com, 42% of Indonesia's electricity is consumed by the industrial sector, and the country still relies on coal for 49% of its energy needs, despite coal mining, processing, and use being one of the most environmentally damaging activities. Coal production methods also pollute water, soil, and air by cutting down trees and excavating mines (source: kompas.com). However, in this case, regarding the use of electrical energy at PT Wijaya Karya Gedung, Tbk, there is an increase in the use of electrical power every year from 2020 to 2022; the use of electrical energy in 2020 amounted to 231,286 kWh. There was an increase 2021 of 5,981 kWh, which means PT Wijaya Karya Gedung used 237,261 electrical power that year.

There was another increase in 2022 of 9,817 kWh, used as 247,084 kWh in 2022. Based on the calculation of energy consumption intensity (IKE), Regulation of the Minister of Energy and mineral resources No. 13 of 2012, the use of electrical energy by PT Wijaya Karya Gedung in 2022 is included in the "highly efficient" category; this category is achieved if IKE is below 120 kWh/m2/year. The purpose of this study is to examine the effect of organizational commitment (OC) and employee green behavior (EGB) on green human resource management (GRHM).

Literature Review

According to Hasibuan (2019), human resource management is the study of relationships that function as an effective and efficient workforce supporting organizational, employee, and community goals. HR management is a strategic approach to skills, motivation, development, and administration of organizing resources (Hamali, 2018). In addition, Human Resource Management is a science or method of managing the relationship and role of resources (labor) owned by individuals efficiently and effectively. It can be used optimally so that (goals) with companies, employees, and society are maximized (Ricardianto, 2018). Hamali (2018) states that human resource management has four objectives as follows societal objectives, organizational objectives, functional objectives, and individual objectives.

Green Human Resource Management

The company's "Green Human Resource Management" (GHRM) policy aims to manage human resources sustainably by incorporating environmental concerns to protect the environment in business operations. GHRM is necessary to mitigate this situation amid the growing problem of environmental damage caused by corporate processes. Utilizing, developing, and researching existing human resources (HR) and natural resources is the goal of human resource management (HRM) to manage them successfully and efficiently (Amrutha & Geetha, 2020).

According to Paillé (2022), GHRM aims to give employees the tools to incorporate environmental concerns into all aspects of their work, from the simple to the complex. In other words, GHRM can be seen as a means to an end by achieving SDG 9 (i.e., build resilient infrastructure, foster equitable and sustainable industries, and support innovation). GHRM can be considered a tool in the fight against climate change. It allows companies to incorporate and implement policies intended to remediate environmental damage caused by industrial activities and halt ecological degradation.

Organizational Commitment

The desire to remain part of the organization is called employee organizational commitment. Employee retention (retention) and turnover (workers who leave the organization to find a new job) are influenced by organizational commitment. as a sequence of steps taken by workers to avoid problems at work which ultimately result in termination of employment from the company (Colquitt et al., 2020). According to Wardhana et al. (2021), organizational commitment is a state of mind that is considered a desire for employees to stay with the company and have a sense of enthusiasm to carry out their duties and obligations to achieve company goals. Continuance commitment, affective commitment, and normative commitment are some aspects of organizational commitment.

According to Darman Syarif (2018), organizational commitment is evident that the idea of organizational commitment was centered initially on commitment itself. It is because it is based on an attitudinal approach, which emphasizes problems and loyalty. In the language of Porter et al. (2018), the attitudinal process is the psychological relationship or affective commitment that an employee develops in connection with the issue and his devotion to the company. The extraordinary couple who became the symbol of commitment specifically defined organizational commitment as "loyalty to the organization" as the intention to stay in it, identifying oneself with the values and goals of the organization.

Employee Green Behaviour

According to Ones & Dilchert (2019), employee green behavior is measurable actions and behaviors that relate to, contribute to, or reduce environmental sustainability. This definition suggests that by addressing global issues such as pollution and climate change through employee behaviors, organizations can help the environment and their efforts to become sustainable. According to Manika et al. (2018), Gkorezis & Petridou (2019), and Dumont et al. (2018), Organizational support, organizational identification and environmentally friendly human resource management techniques are all related to EGB.

Employees' willingness to go the extra mile has been identified as a critical component of effective organizational performance. EGB is commonly referred to as beyond-the-call-of-duty behavior and is defined as a collection of discretionary workplace actions that go beyond one's essential job obligations. EGB is a work behavior in which an individual takes on additional responsibilities and commitments and develops greater independence and resourcefulness, which can benefit the organization. Altruism, courtesy, sportsmanship, conscientiousness, and civic virtue are five characteristics that often appear in EGB. Numerous studies have examined the relationship between employee initiative, volunteerism, and organizational environmental performance. According to research, there is a relationship between EGB and employee performance. (Bashirun, 2019).

Hypotesis Development

The relationship between organizational commitment to green human resource

Employees dedicated to the company are in a position to own, defend and fight with all their energy, time, and thoughts for the organization's progress in achieving goals without ignoring aspects of natural sustainability (Colquitt et al., 2019). According to Allen and Shannock (2012), almost all companies are very interested in commitment because commitment is a critical element that can directly influence workers' attitudes, behaviors, and mindsets to ensure that they always give their best efforts while thinking positively about the environment. Mercurio (2018), Meyer et al. (2018), and Tjahjono et al. (2018) noted that, in contrast to continuance and normative commitment, affective commitment has the most influence on employee behavior. This is based on research that has been conducted. Employees with a strong attitude of commitment will voluntarily act in the company's best interests. They will perform under company and government policies, such as being environmentally responsible (Morrow, 2021).

Relationship between employee green behavior to green human resource

According to Chan et al. (2019), knowledge is a crucial predictor of employee character development, representing green behavior. The commitment to realizing the importance of green behavior also grows along with the increasing awareness of its importance. Green behavior is developed from a deep belief in its significance, not just from company management requirements.

According to Wang et al. (2019), environmental commitment is one of the most significant predictors of environmentally friendly employee behavior. Individuals' commitment to ecological responsibility will influence their current and future behavior. It suggests that employees' environmentally friendly behavior will also increase as environmental responsibility grows within the company.

Nachmias (2019: 133) defines a *hypothesis* as a temporary answer to a research problem. The correlation between the independent and dependent variables describes that answer. The previously described conceptual framework will be used in this study to validate the hypothesis. The following is a description of the theory used by the author.

H1: Employee green behavior influences green human resource management of employees.
H2: Organizational commitment influences the green human resource management of employees.
H3: There is an influence of employee green behavior and organizational commitment on employees' green human resource management.

Based on the explanation above, the conceptual framework of this research is as follows (see Figure 1).

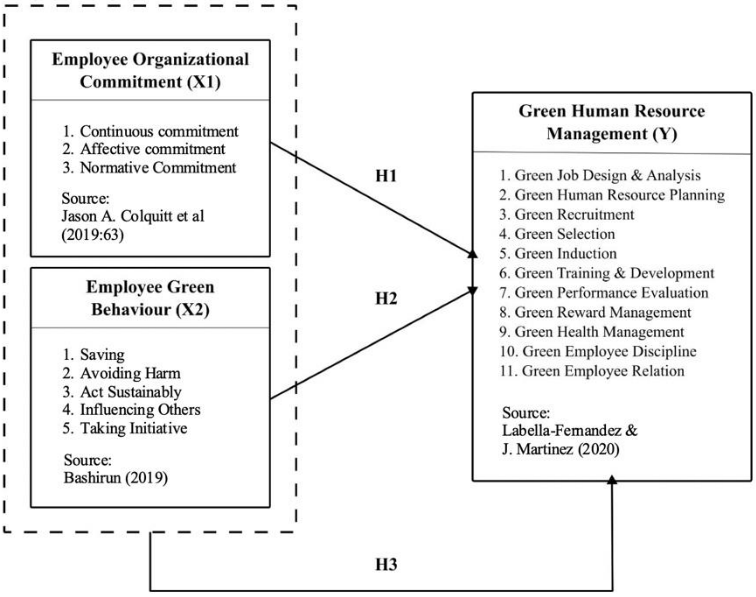

Figure 1. Research Framework

Methods

This research technique uses a quantitative approach and descriptive-causal research type. Independent research variables include employee green behavior and organizational commitment. In comparison, green human resource management is the study's dependent variable. All employees of PT Wijaya Karya Gedung, Tbk, located in East Jakarta, became the research population. One hundred respondents were selected as samples using nonprobability and purposive sampling techniques. The data collection techniques used are observation, questionnaires and interviews. The authors used IBM SPSS Statistic Version 26 For Mac software in this study. Validity and reliability tests are used in the data testing approach.

Techniques for analyzing data are descriptive analysis, classical assumption test, and hypothesis testing.

Result

Validity Test

The authors used IBM SPSS Statistic Version 26 For Mac software in this study. To test and ensure the validity of each statement or question in the questionnaire, before the researcher distributes the questionnaire to respondents, the researcher conducts a pre-survey questionnaire to 30 respondents to determine whether the questionnaire to be distributed is valid or not. Based on the validity test results, each variable's validity value is > 0.361 (r-table). It can be concluded that all variables are valid.

Reliability Test

Based on the reliability test results, it shows that the reliability value of each variable is >0.60. It can be concluded that all variables are reliable. The results are shown in Figures 2, 3 and 4.

Reliability Statistics

Cronbach's Alpha	N of Items
.858	4

Figure 2. Reliability of OC

Reliability Statistics

Cronbach's Alpha	N of Items
.816	6

Figure 3. Reliability of EGB

Reliability Statistics

Cronbach's Alpha	N of Items
.758	11

Figure 4. Reliability of GHRM

Descriptive Analysis

The organizational commitment variable has a percentage of 79.07%, which, if placed on a continuum line, is in the Good group, according to the results of descriptive analysis. If placed on a continuum line, the employee green behavior variable has a percentage of 77.67% in the Good group. When examined on a continuum line, the Green human resource management variable has a portion of 79.93% in the good group. In conclusion, PT Wijaya Karya Gedung Tbk has shown organizational commitment, implemented environmentally friendly human resource management practices, and encouraged environmentally responsible employee behavior.

Classical Assumption Test

The test findings show that the factors influencing purchasing decisions have passed the normality test and are typically distributed. Figure 5 shows a bell-shaped pattern (symmetrical).

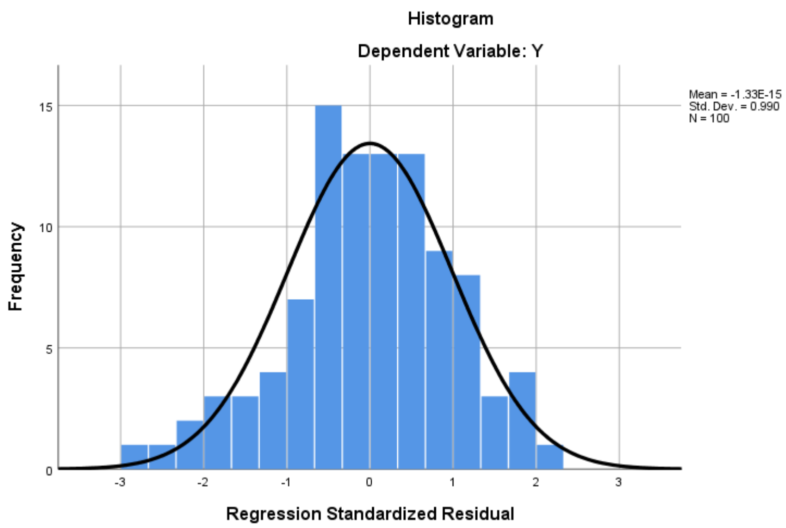

Figure 5. Histogram Chart

The Kolmogorov-Smirnov test can also check normality, with a significant threshold (a) = 0.05. Data is regularly distributed if the considerable value is > 0.05. The results are shown in Figure 6.

One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual
N		100
Normal Parameters[a,b]	Mean	.0000000
	Std. Deviation	5.80249624
Most Extreme Differences	Absolute	.067
	Positive	.037
	Negative	-.067
Test Statistic		.067
Asymp. Sig. (2-tailed)		.200[c,d]

a. Test distribution is Normal.

b. Calculated from data.

c. Lilliefors Significance Correction.

d. This is a lower bound of the true significance.

Figure 6. One-Sample Kolmogorov-Smirnof Result

Based on the data above, the data is distributed because the significant value of the data is more excellent than alpha (0.200>0.05). Based on the test results, the VIF value is 2,850, which indicates the absence of multicollinearity problems. In addition, the tolerance value is 0.351 > 0.1, proving that this study does not have multicollinearity problems. The results are shown in Table 1.

Table 1. Multicollinearity Test Results

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)	13.417	4.182		3.208	.002		
	ORGANIZATIONAL COMMITMENT	.360	.130	.244	2.767	.007	.351	2.850
	EMPLOYEE GREEN BEHAVIOR	.846	.115	.649	7.373	.000	.351	2.850

a. Dependent Variable: GREEN HUMAN RESOURCE MANAGEMENT

Based on the test results, the points on the Y-axis spread and do not form a particular pattern above or below 0. Thus, it means that there is no heteroscedasticity. The results are shown in Figure 7.

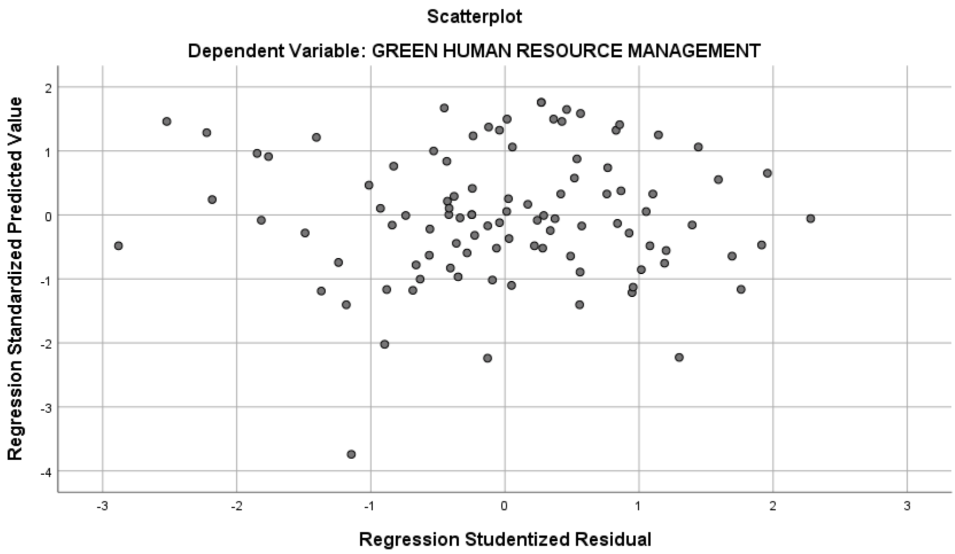

Figure 7. Heteroscedacity Result

Based on Table 1, the constant value of 13.417 states that if there is no organizational commitment and employee green behavior, the consistent value of green human resource management is 13.417. The regression coefficient value of organizational commitment is positive, namely 0.360, which means that variable organizational commitment correlates with green human resource management, and each addition of one unit of organizational commitment can affect green human resource management by 36%. The employee green behavior regression coefficient value is positive at 0.846, which means that the employee green behavior variable correlates with green human resource management, and each addition of one unit of employee green behavior can affect green human resource management by 84.6%.

Hypothesis Test

The test results using SPSS show that for the organizational commitment, the t count is 2.767> 1.984 with a significance value of 0.007 <0.050. So it concludes that H0 is rejected and H1 is accepted, which means there is a correlation between organizational commitment partially and significantly to green human resource management at PT Wijaya Karya Gedung. Meanwhile, for the employee green behavior, the t count is 7.373> 1.984 with a significance value of 0.000 <0.050. thus, concluding that H0 is rejected and H1 is approved. It shows that at PT Wijaya

Karya Gedung Tbk, employee green behavior greatly and partially influences green human resource management. Results are shown in Table 2.

Table 2. T-Test Results

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	13.417	4.182		3.208	.002		
	ORGANIZATIONAL COMMITMENT	.360	.130	.244	2.767	.007	.351	2.850
	EMPLOYEE GREEN BEHAVIOR	.846	.115	.649	7.373	.000	.351	2.850

a. Dependent Variable: GREEN HUMAN RESOURCE MANAGEMENT

Based on the F-test, it shows that the calculated F value is 135.243 with a significance level of 0.000. So, it concludes that F count> F table or 135.243> 3.19 and a significance level of 0.000 <0.050. It means H0 is rejected and H1 is accepted, proving that organizational commitment and employee green behavior impact the green human resource management of PT Wijaya Karya Gedung Tbk. These findings are shown in Table 3.

Table 3. F-test results

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9294.773	2	4647.386	135.243	.000[b]
	Residual	3333.227	97	34.363		
	Total	12628.000	99			

a. Dependent Variable: GREEN HUMAN RESOURCE MANAGEMENT

b. Predictors: (Constant), EMPLOYEE GREEN BEHAVIOR , ORGANIZATIONAL COMMITMENT

Based on the coefficient of determination test, the results show that the value is 73.6%. It shows that at PT Wijaya Karya Gedung, organizational commitment and employee green behavior combined influence green human resource management of 73.6%, with other factors affecting the remaining 26.4% (see Table 4).

Table 4. Coefficient of Determination Test Result

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.858[a]	.736	.731	5.86201

a. Predictors: (Constant), EMPLOYEE GREEN BEHAVIOR , ORGANIZATIONAL COMMITMENT

b. Dependent Variable: GREEN HUMAN RESOURCE MANAGEMENT

Discussion

According to Paillé (2022), one of the objectives of GHRM is to help staff members incorporate environmental concerns into all aspects of their work practices. In other words, GHRM can be seen as a means to an end by achieving SDG 9 (i.e., build resilient infrastructure, support equitable and sustainable industrialization, and foster innovation). In other words, GHRM can be considered a tool in the fight against climate change as it allows companies to incorporate and implement policies intended to remediate environmental damage caused by industrial activities and halt ecological degradation.

Based on the results of the descriptive analysis with 100 respondents and 21 statements, the company's statement with the highest percentage includes an estimate of the number and characteristics of employees that need to be implemented, getting a value of 87.20%. In contrast, the statement with the lowest percentage is that the company asks questions about environmental management during interviews with prospective employees, getting a value of 67.20%. Thus, according to respondents, PT Wijaya Karya Gedung has good environmentally friendly human resource management.

Organizational commitment, according to Wardhana et al. (2021), is a state of mind that is described as a strong desire always to be part of a particular organization, the desire to work hard for the achievement of organizational goals, and the belief and awareness to accept organizational values and goals. Based on the results of the descriptive analysis with 100 respondents and 15 statements, the statement with the highest percentage is "I use reusable bags rather than plastic bags" (87.20%), while the statement with the lowest percentage is "I separate organic and non-organic waste" (67.20%), so PT Wijaya Karya Gedung has a strong organizational commitment, according to respondents.

Employees' willingness to go the extra mile has been identified as a critical component of effective organizational performance. EGB is commonly referred to as beyond-the-call-of-duty behavior and is defined as a collection of discretionary workplace actions that go beyond one's essential job obligations. EGB is a work behavior in which an individual takes on additional responsibilities and commitments and develops greater independence and resourcefulness, which can benefit the organization. Altruism, courtesy, sportsmanship, conscientiousness, and civic virtue are five characteristics that often appear in EGB. Numerous studies have examined the relationship between employee initiative, volunteerism, and organizational environmental performance. According to research, EGB and employee performance are positively correlated (Bashirun, 2019).

Organizational commitment can have an impact on employees' green behavior. Employees who have a high commitment to the organization also tend to be more concerned with sustainability and environmental initiatives carried out by the company. Green employee behavior refers to individual actions or behaviors in the work environment that support sustainable and environmentally friendly practices. Examples of green employee behavior include saving energy, recycling, using eco-friendly products, or participating in sustainability initiatives undertaken by companies. Employees' high level of green behavior can reflect their awareness and commitment to the environment and sustainability values.

GHRM refers to a human resource management approach that integrates sustainable and environmentally friendly practices into employee recruitment, training, development, and management. This includes policies and practices that focus on reducing the company's negative impact on the environment and encouraging green behavior from employees. Implementing GHRM can include environmental awareness training programs, environmentally friendly technology, or incentives for employees who support the company's sustainability initiatives.

As an industry that has a major impact on the environment, construction companies are responsible for implementing sustainable and environmentally friendly practices. The concept of green in this context refers to a company's efforts to reduce its environmental footprint by using environmentally friendly materials, energy efficiency, good waste management, and sustainable development practices.

There is a positive relationship between organizational commitment, the green behavior of employees, and the implementation of Green HRM in construction companies that apply the concept of sustainability. A high organizational commitment to sustainability values can increase employee participation in green behavior. Green HRM can increase employee awareness and support the company's sustainability initiatives.

The construction industry significantly impacts the environment by using natural resources, waste, and carbon emissions. Therefore, implementing the concepts of sustainability and green human resource management is becoming increasingly important to reduce its negative impact and promote more environmentally friendly practices.

The influence of an organization's commitment to green employee behavior can be significant. Employees strongly committed to the company tend to be more motivated to participate in sustainability and eco-friendly initiatives. Strong commitment can also increase employee loyalty to the company and encourage them to more actively contribute to achieving organizational sustainability goals.

The green behavior of employees can be a key factor in the success of a company's sustainability efforts. When most employees actively participate in green behavior, companies can reduce their negative impact on the environment and strengthen their reputation as a company that cares about sustainability. Green employee behavior can also influence other employees to participate in sustainability efforts, creating a positive domino effect.

Companies can create a work environment that supports and encourages employees' green behavior through environmentally friendly human resource management policies and practices. GHRM can also increase employees' awareness and understanding of environmental issues, change their attitudes toward sustainability, and increase participation in environmental programs.

As one of the sectors that has a major impact on the environment, implementing environmentally friendly construction practices is the company's main responsibility. The concept of green in the construction industry involves applying more sustainable technologies and materials, optimizing the use of natural resources, and reducing waste. Thus, construction companies that implement the green concept can reduce their negative impact on the environment significantly.

Conclusion

Partially and simultaneously organizational commitment and employee green behavior influences green human resource management.

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THE IMPACT OF LEADERSHIP ON ESPORT TEAM PERFORMANCE

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Abstract: *This study explores the impact of leadership on team performance in competitive game situations. The purpose of the study is to understand the importance of effective leadership strategies to maximise team performance and team success. The study uses a combination of literature review and use SMARTPLS as measuring tools. Research results show that effective leadership has a positive impact on team performance in esports. The study concludes that leadership has a significant impact on esports team performance. An effective leadership style that focuses on psychological factors and the role of the coach contributes to better team cohesion, better communication, and better execution of strategy. This paper highlights the importance of customised leadership strategies that consider the unique challenges and characteristics of the esports industry.*

Keywords: *Leadership, Esport, Team Performance*

Introduction

Managing an esports team has become a critical factor in today's rapidly growing esports industry. In an ever-changing competitive environment, effective leadership is essential to team success. Effective team performance is significantly influenced by good leadership in addition to individual success. The problems associated with running a sports team are closely related to team management. Esports team managers must understand and be able to manage industry-specific challenges such as the pace of technological change, cultural differences, diverse team dynamics, and intense competitive pressures. In this context, it is important for educators, researchers, and practitioners to understand existing problems and find appropriate solutions to improve the management of sports teams. One of the biggest challenges in running a sports team is building and maintaining strong relationships between managers and team members. Leaders must be able to inspire, motivate, and guide team members to achieve common goals. In a competitive and stressful environment, it is important for managers to create a healthy work atmosphere and look after the mental and emotional health of their team members. Effective leadership also includes the ability to manage internal conflicts among team members. Esports are team sports involving players from diverse cultural, linguistic and experiential backgrounds. Conflicts between team members can affect teamwork and overall team performance. Leaders must therefore be able to identify the sources of conflict, foster constructive dialogue, and create an environment in which differences are respected and wisely managed. Sports team management must face technical and strategic issues in addition to interpersonal challenges. A team manager needs a deep understanding of game dynamics, team strategy, metagame shifts, and the evolution of his esports tech. In this context, effective management requires the ability to make quick and accurate decisions, manage resources, and adapt quickly to changes in the competitive environment.

2. Literature Review

2.1 Definition of Esport

According to Hamari and Sjoblom (2017), esports is the term used to describe competitive video gaming at both the professional and amateur levels that is structured and organized through online platforms and offline competitions. Its distinct feature from general video game play lies in the competitive aspect, where individuals compete against each other (Pizzo et al., 2022). Esports combines aspects of sport, culture, and entertainment by utilizing internet technology (Sjoblom et al., 2020). According to several studies (Cranmer et al., 2021; Hong, 2022; Macey and Hamari, 2022; Seo et al., 2019), esports are significant beyond entertainment because they draw the interest of a youthful digital audience inside developing communities. This helps to highlight the societal effects of technology progress. Insights into the customs and dynamics of gaming communities are also provided (Scaraboto et al., 2020). However, there is still disagreement about the validity of esports, particularly in relation to whether or not it should be considered a conventional sport (Funk et al., 2018). Questions like legitimacy, governance, and institutionalization are becoming more important as esports grow more prevalent in global youth culture, sometimes surpassing conventional sports (Kelly et al., 2022; Witkowski, 2023).

Esports is currently transforming into a rapidly growing industry throughout the world, and Indonesia is no exception. As the esports industry grows, it is important for sports managers and coaches to understand the many factors that affect team performance. One of them is leadership. Effective leadership can have a positive impact on team performance, while poor leadership can lead to poor morale and performance. Therefore, the purpose of this study is to examine the influence of leadership on eSports team performance.

Effective leadership is one of the most crucial elements for determining team goals. Leadership plays a key role in an Esport team's performance by setting clear objectives for the group and inspiring team members to collaborate for the sake of accomplishing those objectives (hamari and sjoblom, 2017).

In sports, leaders and coaches may use different leadership styles to influence and motivate teams. A popular leadership theory that can be applied. in eSports, is a theory of transformational leadership that emphasizes a leader's ability to inspire and motivate their team members to reach their full potential. Another theory that prevails in sports is situation management theory, which states that the effectiveness of a leadership style depends on the situation. This theory suggests that leaders must adapt their leadership style to the level of competence and commitment of their team members (Hersey & Blanchard, 1969). Overall, effective leadership is critical to the success of a sports team. Managers and coaches must consider the situation and use the appropriate leadership style to motivate and inspire their team members to do their best.

Furthermore, effective leadership can positively impact team performance in a number of ways, such as creating a supportive and positive team environment, setting clear expectations for team members, facilitating communication and collaboration among team members, and motivating team members to achieve their goals. In contrast, poor leadership can lead to low morale, decreased motivation, and decreased team performance.

Therefore, this study seeks to provide valuable insights into the impact of leadership on team performance in esports, with a focus on gamers community teams that located in Bandung, by understanding the importance of leadership and its impact on team performance, esports managers and coaches can develop effective leadership strategies that can help their teams achieve success in the competitive esports industry

Esports, or electronic sports, is a form of competitive video gaming that has become increasingly popular over the past decade. Esports tournaments and leagues offer substantial prize pools and attract millions of viewers from around the world. In Indonesia, esports has gained significant traction in recent years, with the industry projected to grow at a rapid pace in the coming years. Esports requires teams to have high levels of coordination, communication, and cooperation among team members, as well as effective leadership. Therefore, understanding the impact of leadership on team performance in esports is critical for the success of esports teams and organisations.

Esports, also known as electronic sports, is a form of competitive video gaming that has gained widespread popularity in recent years. In this sport, professional players compete against each other in various video games, often in organized tournaments or leagues. Esports has gained significant recognition and is now considered a legitimate sport by many people worldwide. Esports involves various genres of video games, including first-person shooters, multiplayer online battle arenas, and real-time strategy games. These games require a high level of skill, strategic thinking, and hand-eye coordination. Players often form teams and participate in tournaments or leagues, which can have significant prize pools and attract millions of viewers worldwide.

The popularity of esports has been growing rapidly in recent years, with millions of people tuning in to watch professional players compete. This has led to the formation of various esports organizations and teams that provide training, support, and resources to players. Esports has also attracted the attention of traditional sports teams, such as the Philadelphia 76ers and the Miami Heat, who have formed their esports teams. One of the significant advantages of esports is that it provides opportunities for players from all over the world to compete against each other. The internet has made it possible for players to connect and compete from different parts of the world, breaking down barriers and promoting cultural exchange. Esports has also provided an avenue for individuals who may not have had the opportunity to participate in traditional sports due to physical limitations.

Esports has also had a significant impact on the video gaming industry. The popularity of esports has led to the development of new games specifically designed for competitive play. Game developers have also been working to make games more accessible and user-friendly for players, resulting in an increase in the number of people who play video games. The rise of esports has also opened up new career opportunities for people interested in the video game industry. Esports organizations require professionals in various fields, such as marketing, event management, and content creation. The growth of esports has led to the creation of new jobs, and the industry is expected to continue expanding.

There are a variety of indigenous and non-indigenous stakeholders in the eSports ecosystem. Professional teams, players, game creators, and tournament organizers are a few of those that have already been highlighted. However, further research is required to create a deeper knowledge of the entire ecosystem.

Figure 1: Esports Ecosystem (Dynamic Capabilities in Professional eSports Teams by Lisa Völkel)

The numerous entities that make up the eSports ecosystem (seen in figure 1) may be divided into major and secondary stakeholders. All parties involved are inescapably interdependent. For instance, in order to put up events, the tournament organizers rely on professional teams and video games (Scholz, 2019). The viability of the overall ecosystem ultimately depends on how well the stakeholders exploit their interdependencies (Jalonen, 2019). According to McCauley et al. (2020, p. 33), the main stakeholders are those who "directly contribute to the value chain and interact directly with the audience". The audience is the primary stakeholder who is the focus of everyone else's attention, as this definition suggests. The audience that actively engages in the ecosystem is targeted for monetization, particularly by the key stakeholders (professional teams, professional players, tournament organizers, and game developers) (Scholz, 2019). Through a variety of means, the audience generates income for the stakeholders, mostly through purchasing goods, participating in live events, or making donations (Besombes, 2019).

2.2 Leadership

A leader's actions used to persuade others is referred to as their leadership style. There are four different path-goal leadership philosophies, including prescriptive, supporting, participatory, and task-oriented leadership. A manager may influence and encourage employees to increase their performance at work by utilizing a variety of leadership philosophies. Esports industry has grown rapidly over the past five years, particularly in Indonesia. In many aspects, this growth is reflected in market size, the amount of money circulating, game variations, and supporting demographics. Various parties are racing to invest in this sector, especially after realizing the huge potential that continues to grow. Specifically, the last five years have been a significant period, as total global sports investment alone reached over $4.5 billion in that year alone. The number is remarkable, but there is actually something more important than the amount. The momentum of esports investment over the last five years shows that this sector is here to stay. Esports has the power to endure and become a mature industry, not just a passing trend that will burst and then disappear.

Leadership is an essential component of success in any industry, and esports is no exception. With the growth of the esports industry in recent years, the role of leadership has become increasingly important. In this essay, we will explore the importance of leadership in the esports industry, the qualities of effective esports leaders, and how leadership is evolving in this dynamic industry. The esports industry is highly competitive, with millions of players around the world competing for prizes and recognition. Effective leadership is crucial in this environment, as it can help to create a positive team culture, foster teamwork and communication, and provide guidance and direction to players.

Effective esports leaders possess several key qualities. One of the most important qualities is the ability to communicate effectively. Esports teams are often remote, with players from different countries and cultures. Leaders who can communicate clearly and effectively through digital channels can help to build a sense of team cohesion and trust. Another important quality of effective esports leaders is a deep understanding of the game and the industry. Leaders who understand the nuances of the game, the mechanics of the esports industry, and the psychology of players can provide valuable guidance and direction to their teams.

In addition, effective esports leaders are strategic thinkers who can develop long-term plans for their teams. They understand the importance of setting goals, developing strategies, and adapting to changing circumstances. Leadership in the esports industry is evolving rapidly. As the industry grows, new challenges arise, and effective leaders must adapt to these challenges. One of the most significant challenges facing esports leaders today is the need to balance the demands of competition with the well-being of players.

Many esports players are young and inexperienced, and effective leaders must take a proactive approach to ensure that their players are not overworked or burned out. This may involve providing mental health support, scheduling regular breaks, and encouraging players to engage in healthy habits such as exercise and proper nutrition.

Another challenge facing esports leaders is the need to navigate the complex legal and financial landscape of the industry. Effective leaders must be familiar with the regulations governing esports, negotiate contracts, and manage finances. leadership is a crucial component of success in the esports industry. Effective leaders can create a positive team culture, foster teamwork and communication, and provide guidance and direction to players. Effective esports leaders possess several key qualities, including effective communication skills, a deep understanding of the game and the industry, and strategic thinking. As the esports industry evolves, effective leaders must adapt to new challenges and balance the demands of competition with the well-being of players.

2.3 Performance

According to the data from the game, team performance is strongly linked to how familiar team members are with their assigned roles, and that this relationship is particularly strong when team members' roles are well-matched. Meanwhile, for individual performance, it correlated with the likelihood of players choosing roles that complement their team versus roles they are better at. (Reitman, J. G., et al. 2020). Individual player performance may also be attained and maintained by consistently training to optimize their skills and talents. (Nagorsky E & Wiemeyer J. 2020). Other variables related to game performance in esports that are seen as better are kill/death ratios and scores obtained in practice during the lead-up to competition. (Pluss, M. A. et al. 2021). E-Sports games require fast and accurate responses to complex visual stimuli for optimal performance. (Dykstra, R. et al. 2021). Participants recognized that proper nutrition, adequate sleep, and regular physical activity are essential for optimal health and exercise performance. (Baumann, A. et al. 2022). Membership competencies, member relationships, and member knowledge sharing have a significant impact on the innovation performance of esports industry knowledge alliances. (Yue, L. et al. 2022).

Esports Team Formation and Coordination requires players to adapt to their positions and increase their compatibility with others. A stable, compatible, and high-performing online team was the result of such a combination. (Freeman, G., & Wohn, D. Y. 2017). Social congruence, mutual trust, and shared objectives are the main elements that promote knowledge sharing and team effectiveness in virtual teams. (Zhang, W. et al. 2022). The player is the first component, followed by the budget, which is primarily derived from personal funds. It is also necessary to have funding that enables Esport athletes to thrive in all areas on a par with players at the highest international levels. Additionally, the marketing component depends on being one of the primary methods for letting people know about Esport. (Noriya, W., et al. 2021). In eSport, cooperation takes place in a virtual setting that is highly competitive. Its effective operation depends on covert collaboration and quick team decision-making. (Ye, J. N., et al. 2021). Performance is built on consumption that is competitive and esports-focused. The desire to interact with people is the second motivator. (Kovacs, J., M. et al. 2022).The significance of cognitive capacity for the performance of a comprehensive esports team can increase the cognitive abilities of players to gain an advantage. (Toth, A. J. et al. 2020). One of the elements that esports players believe can enhance performance is being physically fit, coupled with eating a healthy diet and getting enough sleep. (Pekel, A. et al. 2022). Coordination in a team is a process of interaction that unifies a group of interconnected activities, behaviours, and information and enables people to actualize a group's performance and accomplish goals. (Freeman, G. et al. 2018).

A good leadership style can have a positive impact on the esport team's performance. Innovation, information sharing, and transformative leadership all had a favorable direct influence. Additionally, it was shown that information exchange acted as a bridge between transformative leadership and creativity. (Yue, L. et al. 2022). Working in teams, whether in person or virtually, requires strong leadership. Therefore, when a team is made up of members with different backgrounds, leadership can be difficult to use his skills. (Nuangjumnong, T. 2015). Satisfaction and viability, two components of leadership function and team effectiveness, are the behavioural processes of surveillance and protection that play a mediating role in this relationship, and the overall mediation is coordinated by the involvement of teamwork. (Zanin, N. 2018). Also popular in esports is the democratic leadership style, in which the leader collaborates with his or her teammates in some way, whether it be to devise strategies or provide and receive feedback, with the goal of strengthening the team's cohesiveness and increasing their chances of success. (Szilágyi, G. J. 2022).

An Esports organization's performance suffers as a result of bad leadership, weak player motivation, and weak communication. A leader's lack of charisma prevents followers from having faith in them to solve problems, which is more precisely what is meant by the "bad leadership style" mentioned above. (Syahar, I. 2021). Motivation can be initially defined as the propensity of individuals to act in pursuit of a goal. Players that compete professionally in esports are motivated by a variety of motives, including the desire to win, the thrill of a new

eISSN 2976-3223

challenge, the camaraderie of their teammates, and the opportunity to better themselves. (Ramirez, F. G. et al. 2022).

3. Research Method

In collecting data in the field, the appropriate and accountable method and technique of data collection are those that are accurate, targeted, and in line with the research needs. The data collection technique used in this research is through the use of questionnaires or surveys, and a closed questionnaire is used to gather information on each variable to determine the influence. This research employs the simple linear regression method, which aims to determine the influence of one variable on another. In regression analysis, the independent variable is also called the explanatory variable or the predictor variable, while the dependent variable is referred to as the response variable. The data will be processed using the SmartPLS program.

4. Result and Discussion

There are 1.823 gamers (Gamers community) and several Esport team in Bandung - West Java. By the data given, researcher using Slovin formula to calculate the minimum sample size. This research using structural equation modelling (SEM) to analyse the results, by using 5% margin of error, the minimum sample size was 328. In the process researcher have collected 463 samples.

The Slovin formula is :
n = N / (1 + N * e^2)
Where : n = minimum sample size
N = population size
e = margin of error (in decimal form)
n = 1,823 / (1 + 1,823 * 0.05^2)
n = 1,823 / (1 + 1,823 * 0.0025)
n = 1,823 / (1 + 4.5575)
n = 1,823 / 5.5575 n ≈ 328.04

Table 1: Value of The Loading Factor

	Average Variance Extracted (AVE)
Performance	0.756
Leadership	0.608

This study based on relationship assessment model, that Leadership has correlation of Performance. This quantitative study using SEM to analyse the results

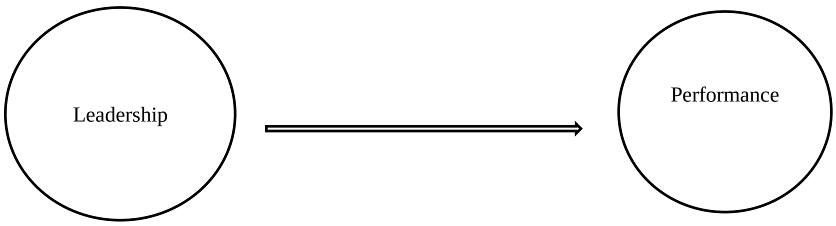


Table 2: Cross Loading

	Performance	Leadership
K1	0.909	0.605
K2	0.896	0.604
K3	0.809	0.630
K4	0.858	0.632
K5	0.872	0.595
L1	0.482	0.752
L2	0.576	0.816
L3	0.542	0.772
L4	0.642	0.834
L5	0.480	0.814

The cross-loading value for every construct given on Table 2, found that there is no issue appeared. Results for this test indicate that all variables/ construct are valid, because all the value are greater than 0.7 and every item on the construct has a bigger value than its cross-loading.

Table 3: Composite Reliability Value

	Composite Reliability
Performance	0.919
Leadership	0.845

The composite reliability must be measured in order to complete the outer model test. For a value to be considered dependable, it must be at least 0.8. According to the data in Table 3, no variable has a composite reliability < 0.8. Performance scores 0.919, whereas Leadership have values of 0.845. According to the aforementioned results, the study was valid.

Table 4: Cronbach's Alpha

	Cronbach's Alpha
Performance	0.919
Leadership	0.837

The Cronbach's Alpha values for Performance 0.92, whereas Leadership has a score that is somewhat lower than the latter (0.83). According to those findings, all of the variables employed are reliable.

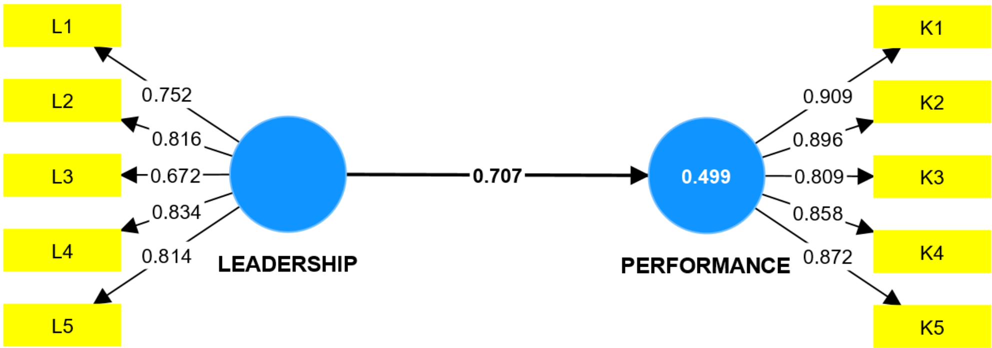
Table 5: R-Square

	R-Square
Performance	0.499

As mention on table 5, According to R-Square above, 49% of performance is impacted by leadership. On the other hand, this study excluded 51% of the factors that may have influenced the results.

5. Conclusion

This study trying to analyse the correlation of Leadership to Performance on Esport Team. Then based on the findings, the researcher has some conclusion



1) There is a positive correlation between Leadership to Performance. It means that increasing the leadership role will have a significant impact on the performance of an Esport team

2) There are many other factors that can affect the performance of an Esport team that were not investigated by the author.

From the results of this study it can be said that leadership has a very important role in developing the performance of an esport team. managers or trainers in an esport team need to understand that with good leadership, effective communication, coordination between team members can make the goals in the esport team well achieved. The Esport industry is currently experiencing rapid progress, many competitions are being held at both national and international levels, making professional team management expected to be able to increase the team's participation in various competition events. Furthermore, from the results of this study, effective leadership can significantly improve the performance of an esport team.

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6th Langkawi International Multidisciplinary Conference 2023 (6th LIMC 2023)
eISSN 2976-3223
9th – 10th September 2023
Bayview Hotel, Langkawi, Malaysia

INSUFFICIENCY OF SOFT SKILLS AMONG GRADUATES WITHIN THE SERVICES AND MANUFACTURING INDUSTRIES

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Abstract: *The unemployment rate in Malaysia is at 3.5% as of February 2023. The competition for employment is tougher due to the rising number of graduates. Employers today consider graduates' Hard and Soft Skills in addition to their academic accomplishments. It was reported that the graduates are not able to secure jobs because they lack of critical thinking and Soft Skills yet we do not exactly what skills are they lacking. The goals of this study are to identify the Soft Skills that the workforce requires, investigate the Soft Skills that companies provide, and identify the graduates' Soft Skills by employers. The samples are employers from the services and manufacturing sectors that were obtained from the Federation of Manufacturing Malaysia. A questionnaire is used and made available online for one month in the form of a Google Form. Using SPPS version 25.0, both descriptive and inferential analyses are performed on the data. Employers stated that problem-solving and critical thinking abilities are the most important Soft Skills for their organisations and teamwork skills are among the Soft Skills that employers may impart to graduates. The organisations recognise that the graduates who joined their companies have the capacity to learn. According to the results of the inferential analysis, there is a substantial positive correlation between the importance of Soft Skills in organisations and the Soft Skills that can be acquired at the organisations (ρ: .515). There is no connection between graduates' Soft Skills and the importance of Soft Skills in organisations (ρ: .105), and the graduates' Soft Skills and the Soft Skills learned at the organisations show a moderately good association (ρ: .372). According to the findings, organisations provide learning opportunities for employees that are relevant to their organisations. The findings also support the claim made by the employers that graduates lack Soft Skills. This study focuses on the Soft Skills needed for employment in the services and manufacturing sectors and is significant because it encourages additional collaborations between educational institutions and industries to provide students with the practical experiences they need for future employment.*

Keywords: *Graduates, Employability, Soft Skills, Critical thinking*

Introduction

The unemployment rate in Malaysia is at 3.5% as of February 2023 (Department of Statistics Malaysia, 2023). The competition for employment is tougher due to the rising number of graduates. Employers today consider graduates' Hard and Soft Skills in addition to their academic accomplishments. Soft Skills are important to assist employees to thrive by fostering a good and productive work environment, whereas Hard skills are concentrated on carrying out technical-related tasks in a profession.

The issue of many unemployed graduates in Malaysia is not new (Abdul Wahab, 2022); (D'Silva, 2020); (Abd Rahman, Ismail, Ridzuan, & Abd Samad, 2020). It is said that most graduates have strong educational backgrounds, but when it comes to expressing themselves on the job, they lack the necessary Soft Skills (Nazron, Lim, & Nga, 2017). Fifty percent of employers who have been surveyed globally stated that employees that are often with a skills gap or lack Soft Skills (Hurrell, 2016). This is rather concerning as the number of graduates increases every year, resulting in an increasing unemployment rate when graduates struggle to find employment after they graduate (Md Razak, Mohd Yusof, Syazana, Jaafar, & Talib, 2014). While it is common for employers to state those graduates lack Soft Skills, what do the organisations themselves provide to fill these Soft Skills voids after they have accepted the graduates for employment? There are numerous important soft skills that can be used in the workplace (Vasanthakumari, 2019). Hence, it is important to acknowledge the Soft Skills prioritised in the organisations and whether they implement those skills in new employees. Lack of Soft Skills is a very general statement to graduates' unemployment, thus, in a way, there are some Soft Skills that graduates possessed but either they do not suit the organisations' needs or other graduates have the upper hand on their Soft Skills. It is imperative that this study is conducted, plainly to know what Soft Skills are lacking in graduates in the services and manufacturing industries. Below are the research objectives and research questions for this study.

Research Objectives

This study focuses on Soft Skills for employability through these three (3) objectives:

RO1: To identify the Soft Skills that are required by organisations.
RO2: To investigate the Soft Skills that are provided by organisations.
RO3: To identify graduates' Soft Skills from employers' perspectives.

Research Question

RQ1: What are the Soft Skills required by the organisations?
RQ2: What are the Soft Skills provided by the organisations to their employees?
RQ3: What are the Soft Skills possessed by graduates from employers' perspectives?

Literature Review

Soft Skills for Employability

Soft skills are considered a subset of Critical Thinking (Norshima, Nur Syafiqah, & Belinda, 2022). Soft skills are most closely tied to Critical Thinking (CT) Affective domain because they entail feelings, emotions, and attitudes. This domain includes how we emotionally connect with things and is further separated into five (5) subdomains: receiving, responding, valuing organisation, and characterization (Krathwohl, Bloom, & Masia, 1964). Although most people think of learning as an intellectual or mental function (only the cognitive domain can be taught), we may also learn attitudes and actions (affective), or Soft Skills. The Malaysian Government has identified seven (7) Soft Skills that are vital to the employability of new graduates as shown in Figure 2. CT is seen as an umbrella which encompasses of all the learning domains in a human being. Additionally, if all three domains were given equal attention, this produces balanced individuals which is the ultimate aim of Malaysia's National Education Philosophy (NEP).

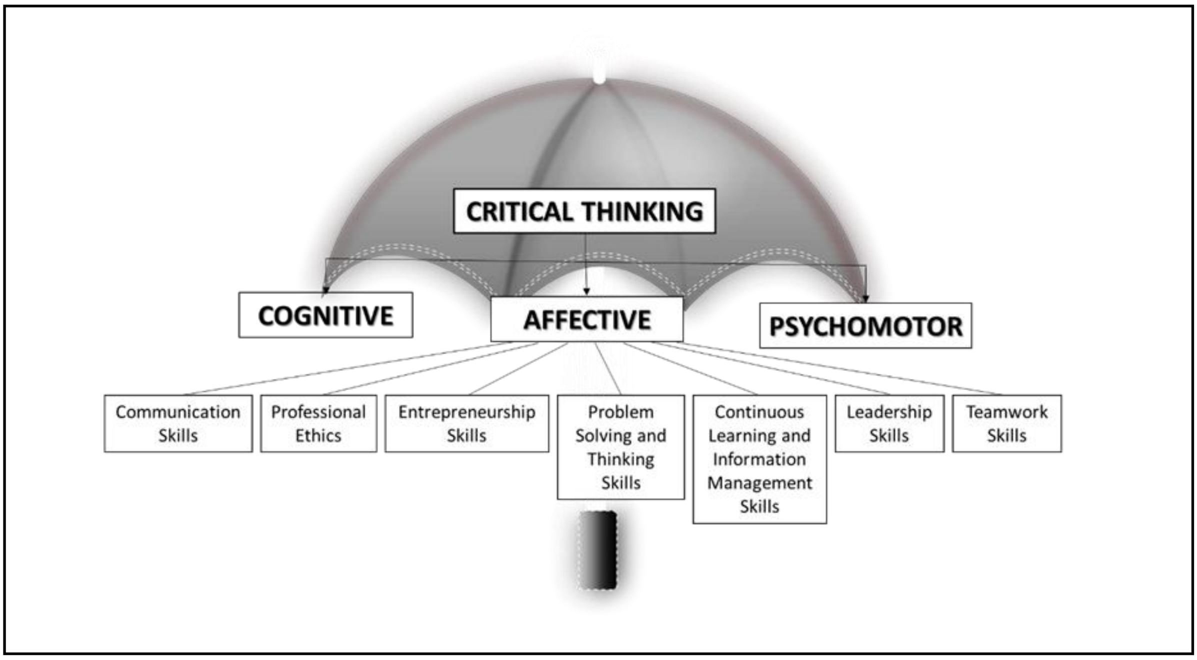

Figure 1: Soft Skills (Affective Domain) in Critical Thinking

The seven (7) Soft Skills as outlined by the Malaysian Government through the Ministry of Higher Education (MOHE), are being used in the research instrument to assess graduates' skills.

Theoretical Framework

According to Dewey's Philosophy of Progressive Education, educational strategies employed by institutions of higher learning cannot be detached from reality or be abstract. Instead, it serves as a little town that educates students for careers in broader society. According to Dewey's Philosophy, which was developed in the early 1930s, schools or universities are not just places where students received a traditional education, but also organisations that worked to create a social framework before students encountered the outside world. Dewey viewed the aesthetic experience as it pertains to the creation of art and culture, and he contended that this experience can enhance our quality of life while assisting us in discovering our purpose and realising our potential (Lee & Oh, 2019); (Dewey, 1956). As seen in Figure 2, Dewey posited that an individual's interactions with their environment shape both their instrumental intelligence and the values that guide those interactions. This then generates education through real-world encounters.

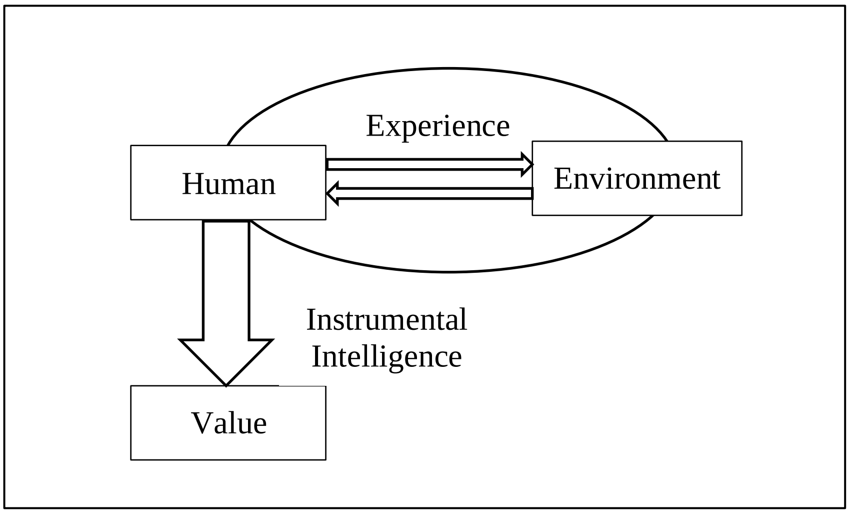

Figure 2: Theoretical Framework, Theory of Progressive Education

In other words, students must be taught how to use what they have learned in order to become excellent performers with a variety of job alternatives. Ideally, based on this paradigm, students should be taught Soft Skills and given opportunities to practice them before entering the workforce. In connection to the issue of graduate unemployment, this theory proposes that colleges have close ties with the sectors in which they operate to establish a "social framework" to familiarise and prepare graduates for the working world. Below is a Conceptual Framework for this study where the research objectives and research questions are constructed based on the framework.

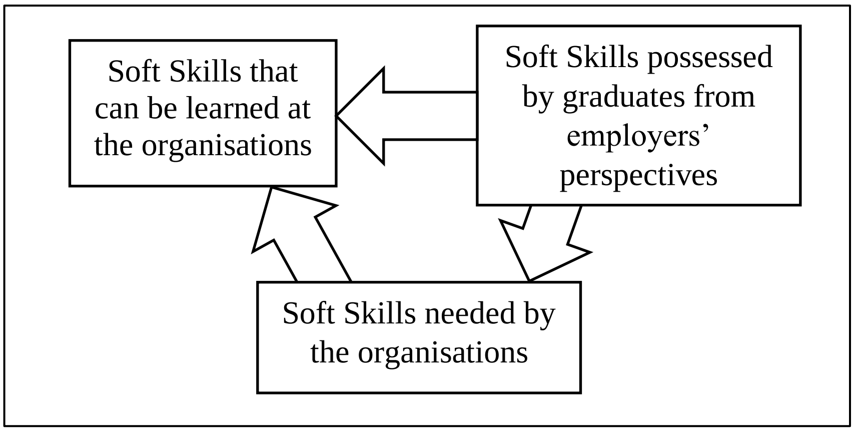

Figure 3: Conceptual Framework for this study

Hypotheses
There are three (3) null hypotheses that were generated based on the Conceptual Framework:

H01: There is no significant relationship between the Soft Skills needed by the organisations and the Soft Skills that can be learned by the graduates at the organisations.

H02: There is no significant relationship between the Soft Skills owned by the graduates from employers' perspective and the Soft Skills that can be learned by the graduates at the organisations.

H03: There is no significant relationship between the Soft Skills possessed by the graduates from employers' perspective and Soft Skills deemed important by employers for their organisations.

Methodology

Research Design

Quantitative analysis was applied to acquire data for this study. The method used was the form of an online survey through Google Forms. The questionnaire is a closed-ended questionnaire. The questionnaire used in this study is an adaptation of one titled "The Role of Personal Core Skills in the Working Life Competency of Graduates" from the Trans-European Framework for Core Personal Skills. The seven Soft Skills promoted by the Ministry of Higher Education (MOHE) in place of the original questionnaire's skillset included communication skills, teamwork skills, leadership skills, problem-solving and critical thinking skills, continuous learning and information management skills, professional ethics, and entrepreneurship skills.

Population and Sampling

The population for this study is employers in Malaysia. The samples are employers from the services and manufacturing sectors as it was recorded in the Department of Statistics Malaysia (DOSM) as the two highest employed sectors. Their contact information was obtained from the Federation of Manufacturing Malaysia (FMM). The questionnaire was distributed through a convenient random sampling technique. As it was made available for a month, a total of 35 employers completed the questionnaires.

Data Collection

Data and information from this study were collected based on the questionnaires that were distributed to respondents. The questionnaire has also been altered as it was verified by three (3) experts to better accommodate the research objectives.

Data Analysis

Using SPPS version 25.0, both descriptive and inferential analyses were performed on the data. Frequency, percentage, mean score, and normality test are all included in the descriptive analysis, while Spearman correlation was used for the inferential analysis.

Descriptive Analysis

In the absence of experimental manipulation, the descriptive analysis entails the direct observation of the target behaviour in natural (or naturalistic) circumstances to obtain information on subsequent and potentially significant environmental occurrences (Sloman, 2010). The information focused only on the target group.

The five-point Likert scale was used as it is numerical and measurable thus following five levels of the mean score used to measure the mean acquired from the analysis. The levels of the mean score are presented below:

Table 1: Mean Score and Level

Mean Score	Level (Frequency/Agreement)
1.00 – 1.80	Very Low (Never/Strongly Disagree)
1.81 – 2.60	Low (Rarely/Disagree)
2.61 – 3.20	Medium (Sometimes/Neutral)
3.21 – 4.20	High (Often/Agree)
4.21 – 5.00	Very High (Always/Strongly Agree)

Source: (Moidunny, 2009)

Reliability Analysis

In this study, a five-point Likert scale was utilised to evaluate the association between the variables using a quantitative approach to assess the link between the variables. The Cronbach's Alpha coefficient is used in this study to examine the relationship between the variables. Under some very severe conditions, Cronbach's alpha can be a valuable indicator of reliability when conceptualised as item consistency (Komperda, Pentecost, & Barbera, 2018). The following table shows the rule of thumb of the Alpha coefficient range of Cronbach:

Table 2: The Range of Cronbach's Alpha Coefficient

Cronbach's Alpha	Internal Consistency
$\alpha \geq 0.90$	Excellent
$0.90 > \alpha \geq 0.80$	Good
$0.80 > \alpha \geq 0.70$	Acceptable
$0.70 > \alpha \geq 0.60$	Questionable
$0.60 > \alpha \geq 0.50$	Poor
$0.50 > \alpha$	Unacceptable

Source: (Cronbach, 1951)

Inferential Analysis

Inferential analysis is a sort of analysis that uses the data definition to produce conclusive findings. Inferential statistical techniques were used to analyse the hypotheses, and the results were used to decide whether they should be accepted or rejected. Making conclusions based on inferential analysis is the process of generalising a study group's findings to the overall population. As the data was not regularly distributed, Spearman rho, ρ, is used to analyse the provided hypotheses and to determine the strength of the correlation between the two variables in order to explain how well the independent variables and dependent variable of the sample interact with each other. The interpretation for the Spearman correlation analysis is shown in the table below:

Table 3: Interpretation Table of Spearman Rank-Order Correlation Coefficients

Spearman, ρ	Correlation
≥ 0.70	Very Strong Relationship
0.40 – 0.69	Strong Relationship
0.30 – 0.39	Moderate Relationship
0.20 – 0.29	Weak Relationship
0.01 – 0.19	No or Negligible Relationship

Source: (Dancey & Reidy, 2004)

Findings

Demographic Data

The demographic profile survey consists of six (6) questions on the characteristics of the respondents which include gender, age, years of service, education level, industry they worked in, and the region they are from. Question 1 asked for the respondents' gender which respectively consists of 68.6% (n = 24) female and 31.4% (n = 11) male. Question 2 focuses on the age range of respondents where 34.3% (n = 12) of respondents are from the age 21 to 30 years old, another 34.3% (n = 12) are from the age 31 to 40 years old, 20.0% (n = 7) from the respondents aged 41 to 50 years old, and the last 11.4% (n = 4) respondents are from the age 51 to 60 years old. Question 3 looks into respondents' years of service in the industry. There are 8.6% (n = 3) of respondents who work for less than a year, 42.9% (n = 15) of respondents work between one to five years, 17.1% (n = 6) work for six to ten years, another 11.4% (n = 4) of respondents work for 10 to 15 years, and the rest 20.0% (n = 7) respondents work for more than 15 years in their respective industries.

Question 4 of the questionnaire asked the respondents to choose their educational level. The results showed that 2.9% (n = 1) of the respondents hold *Sijil Pelajaran Malaysia* (SPM) as its highest educational level, 8.6% (n = 3) of the respondents hold a diploma, 68.6% (n = 24) of them acquired a bachelor's degree, 17.1% (n = 6) has a master's degree, and only 2.9% (n = 1) of the respondents is a Ph.D. holder. For Question 5, the respondents were asked to choose the industry they worked in. As the study only focuses on manufacturing and services industries, 60.0% (n = 21) of the respondents chose manufacturing, while the rest 40.0% (n = 14) chose services. To ensure that this study covers these two industries in Malaysia, Question 6 was added to acknowledge whether all regions took part in this study. From the northern region; Perlis, Kedah, Penang, and Perak, only 8.6% (n = 3) of people took part. The respondents from the central region; Selangor, Negeri Sembilan, and Melaka, took the most part in this study with the percentage of 60.0% (n = 21). 11.4% (n = 4) of the respondents from this study were contributed by the eastern region; Kelantan, Terengganu, and Pahang. The respondents from the southern region; Johor, and Sarawak contribute 8.6% (n = 3) each, while there is only 2.9% (n = 1) respondent from Sabah.

Descriptive Analysis

Descriptive analysis is mainly used to answer the research questions. As the first research question focuses on the Soft Skills required by organisations, Question 7 was generated to figure out the most significant Soft Skills for organisations. The results for Question 7, where the mean scores are concerned, are presented in Table 4 below.

Table 4: Descriptive Statistics for Question 7

	N	Min	Max	Mean	Std. Dev
b7cs	35	2	5	4.29	0.789
b7ts	35	1	5	4.49	0.853
b7ls	35	3	5	4.40	0.651
b7psct	35	3	5	4.51	0.658
b7clim	35	3	5	4.46	0.611
b7pe	35	3	5	4.31	0.631
b7es	35	1	5	3.51	1.040

Legend
b7: Section B, Question 7
cs: Communication Skills
ts: Teamwork Skills
ls: Leadership Skills
psct: Problem Solving and Thinking Skills
clim: Continuous Learning and Information Management Skills
pe: Professional Ethics
es: Entrepreneurship Skills
: Highest Mean Score
: Lowest Mean Score

Based on Table 4, employers stated that "problem-solving and critical thinking" skills are their organisations' most important Soft Skills ($\bar{x}$ = 4.51). These Soft Skills acknowledged as the most significant by employers indicate that these are required in organisations. "Entrepreneurship skills" is the least important Soft Skill ($\bar{x}$ = 3.51). Employers considered indicators like problem-solving skills and critical thinking skills to be very important and have a significant impact on the sector (Rasul, Abd. Rauf, & Mansor, 2013). High problem-solving aptitude combined with critical thinking will enhance the standard of labour, service, and product as well as each person's sense of worth and wellbeing.

The second research questions aim to answer whether organisations provide Soft Skills training to their employees. To provide the answer to this question, refer to Table 5 as Question 8 focuses on the Soft Skills that can be learned in organisations. As the question was answered by employers, these are the Soft Skills that are offered in most organisations involved:

Table 5: Descriptive Statistics for Question 8

	N	Min	Max	Mean	Std. Dev
b8cs	35	2	5	4.29	0.667
b8ts	35	2	5	4.37	0.646
b8ls	35	2	5	4.17	0.707
b8psct	35	2	5	4.23	0.770
b8clim	35	2	5	4.29	0.622
b8pe	35	2	5	4.29	0.667
b8es	35	1	5	3.29	1.100

Legend
b8: Section B, Question 8
cs: Communication Skills
ts: Teamwork Skills
ls: Leadership Skills
psct: Problem Solving and Thinking Skills
clim: Continuous Learning and Information Management Skills
pe: Professional Ethics
es: Entrepreneurship Skills
: Highest Mean Score
: Lowest Mean Score

"Teamwork skills" is among the Soft Skills that employers may impart to graduates ($\bar{x}$ = 4.37), but they give the least for "entrepreneurship skills" ($\bar{x}$ = 3.29). The ability to work together as a team in order to accomplish a job or reach a shared objective is known as Teamwork Skills

(Vasanthakumari, 2019). People of either gender, from various age groups, qualifications, and skill sets collaborate to complete the assignment as a team. The necessity for improved employee skills in the fiercely competitive workplace is acknowledged by organisational employers (Batalla-Busquets & Pacheco-Bernal, 2013). For competitiveness and to solve the skills gap, more training opportunities are needed. Therefore, teamwork avoids singling out a person for training whenever possible as this could create the impression to other workers that the worker is in need (Dean & East, 2019).

The final research question was to identify the Soft Skills possessed by graduates from employers' perspectives. Among the seven (7) Soft Skills listed by the Ministry of Higher Education (MOHE) back in 2006, employers had chosen a Soft Skill that they deemed graduates to have. Table 6 shows the list of mean scores for Question 9, which indicates the most and the least have Soft Skills graduates.

Table 6: Descriptive Statistics for Question 9

	N	Min	Max	Mean	Std. Dev
b8cs	35	2	5	3.60	0.812
b8ts	35	2	5	3.69	0.867
b8ls	35	1	5	3.20	0.933
b8psct	35	1	5	3.34	1.056
b8clim	35	2	5	3.74	0.886
b8pe	35	1	5	3.54	0.886
b8es	35	1	5	2.94	1.110

Legend
b9: Section B, Question 9
cs: Communication Skills
ts: Teamwork Skills
ls: Leadership Skills
psct: Problem Solving and Thinking Skills
clim: Continuous Learning and Information Management Skills
pe: Professional Ethics
es: Entrepreneurship Skills
: Highest Mean Score
: Lowest Mean Score

The organisations recognise that the graduates who join their companies have the capacity to learn continuously ($\bar{x}$ = 3.74) but lack the opportunity to pursue "entrepreneurship skills" ($\bar{x}$ = 2.94) from their organisations. For an organisation to be sustainable, there is a critical need for ongoing learning and knowledge management (Chiabrishvili & Zaim, 2018); (Menon & Menon, 1997). According to this perspective, knowledge management and organisational sustainability are closely intertwined (Demir, Budur, Omer, & Heshmati, 2021).

Reliability Analysis

Table 7: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardised Items	N of Items
0.861	0.864	21

The α for the questionnaire is 0.864. Since the coefficient alpha for all the variables used in the questionnaire is higher than 0.70, which is a good level of internal reliability, all the variables are reliable. All the variables could be verified as reliable, standard, and relevant because they all met the requirements of the reliability analysis.

Inferential Analysis

Normality tests consisting of Skewness, Kurtosis, Kolmogorov-Smirnov, and Shapiro-Wilk, were done on all the items in the questionnaire. In SPSS, the skewness and kurtosis statistic values should be less than ±1.0 to be considered normal (Leech, Barrett, & Morgan, 2005). As for Kolmogorov-Smirnov and Shapiro-Wilk, the data is considered not normal if the significance is less than 0.05 (Chua, 2008). Table 8 and Table 9 show the result of the normality tests done on the questionnaire.

Table 8: Skewness and Kurtosis

	Std. Dev		
	sumb7	**sumb8**	**sumb9**
Skewness	0.398	0.398	0.398
Kurtosis	0.778	0.778	0.778

Table 9: Kolmogorov-Smirnov and Shapiro-Wilk

	Sig.		
	sumb7	**sumb8**	**sumb9**
Kolmogorov-Smirnov	0.200	0.040	0.100
Shapiro-Wilk	0.094	0.001	0.335

Results showed that the data were not normally distributed, hence Spearman, ρ, was calculated to test correlation. The Spearman rank correlation coefficient is a nonparametric measurement correlation where it is used to establish the relationship that exists between two pieces of data (Dodge, 2008).

Table 10: Spearman's Correlation

			b7sum	**b8sum**	**b9sum**
Spearman's rho	**b7sum**	**Correlation Coefficient**	1.000	0.515**	0.105
		Sig. (2-tailed)		0.002	0.548
		N	35	35	35
	b8sum	**Correlation Coefficient**	0.515**	1.000	0.372*
		Sig. (2-tailed)	0.002		0.028
		N	35	35	35
	b9sum	**Correlation Coefficient**	0.105	0.372*	1.000
		Sig. (2-tailed)	0.548	0.028	
		N	35	35	35
*. Correlation is significant at the 0.05 level (2-tailed) **. Correlation is significant at the 0.01 level (2-tailed)					

The results of Spearman's correlation analysis revealed that there was a strong relationship between the significance of Soft Skills needed by the organisations and the Soft Skills that can be acquired at the organisations (ρ: 0.515). According to the results of the inferential analysis, there is a substantial positive correlation between the importance of Soft Skills in organisations and the Soft Skills that can be acquired at the organisations. This indicates that organisations offer to implement workplace skills that are relevant to their organisations. The success of an organisation depends on its individual training and development programmes (Khattak, Rehman, & Rehman, 2014). Thought to be person-specific, emotional intelligence training may potentially have effects on groups (Schutte, Malouff, & Thorsteinsson, 2013). Hence, the importance of internship is to impart more Soft Skills to students as they trained under the organisations for a certain period.

Next, there was a moderate relationship between graduates' Soft Skills and the Soft Skills that can be learned at the organisations ($\rho = 0.372$). The graduates' Soft Skills and the Soft Skills learned at the organisations show a moderately good association. The Soft Skills graduates bring to the workforce are relevant to the organisation where they are employed. This is supported by Tang (2019) who suggested that within six months of graduation, graduates are capable of securing entry-level positions at the graduate level. Cramer, Van Der Heijden, and Jonker (2006) asserted that these effects would rapidly diminish over time as graduates are able to find other employment requiring occupationally specialised knowledge and abilities in line with their areas of specialisation through on-the-job training and practical experience. Due to the lack of employability, the extended time of ongoing supply and demand imbalances in the job market will result in more than one transfer into other work.

Lastly, there was no or negligible relationship between the significance of Soft Skills at organisations and graduates' Soft Skills ($\rho = 0.105$). There is no connection between graduates' Soft Skills and the importance of Soft Skills in organisations. Although many university graduates in Malaysia are well-trained in their fields of study (Rahmah, Ishak, & Wei-Sieng, 2011), Hairi, Toee, and Razzaly (2011) pointed out that they actually lack soft skills competencies. Graduates do not have the Soft Skills needed by the manufacturing and services employers as per suggested by the results.

Conclusion

According to the findings of this questionnaire, organisations provide learning opportunities for employees that are relevant to their organisations. It also supports the claim made by employers that graduates lack Soft Skills. On the other hand, the skills that graduates bring to the workplace are applicable to the companies where they work, and this shows that universities do nurture Soft Skills in students. This study is significant because it encourages the creation of additional collaborations between educational institutions and industries in order to provide students with the practical experience they need for future employment.

Collaboration helps bridge the gap between academia and industry, ensuring that the academia is relevant where what is being taught is applicable to real-world problems. Collaboration provides opportunities for students and future employers to gain hands-on experience and develop practical skills. Graduates can apply their theoretical knowledge in real-world scenarios and develop a better understanding of industry needs. This enhances their employability and makes them better prepared for the workforce.

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6th Langkawi International Multidisciplinary Conference 2023 (6th LIMC 2023)
eISSN 2976-3223
9th – 10th September 2023
Bayview Hotel, Langkawi, Malaysia

CHALLENGES AND SUCCESS FACTORS ON THE IMPLEMENTATION OF IoT IN THE THIRD-PARTY LOGISTICS INDUSTRY

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Abstract: *Third-party logistics (3PL) are increasing in demand to provide professional support on logistics needs for the market. 3PL includes warehouse management, distribution, and technology support to manage the most effective and efficient supply chain. Therefore, there is a critical need to improve and enhance the efficiency of 3PL operators. Despite the Internet of Things (IoT) being able to enhance the competitiveness and sustainability of the industry, the market in general still maintains the traditional version of the warehouse management system. This study aims to examine the success factors of the implantation of IoT in third party logistics. The following are the research objectives: to determine the effect of IoT implementation on the organisation's performance, identify the factors that influence the IoT implementation in the organisation, and examine the main critical success factors in the IoT implementation. The research is conducted using a qualitative case study by conducting an in-depth interview using expert sampling at several logistics companies in Klang and Shah Alam areas. The sample selection focuses on the middle management directly involved from the proposal stage until system implementation. This research shows that most respondents agree that IoT would bring a relative advantage to warehouse performance, especially in reducing time and workforce and providing systematic storage and easy access. This paper identified the factors for the IoT implementation in the organisation: knowledge and exposure to IoT, financial aspects, and customer requirements. Management support, a collaboration between departments, the employee capabilities to utilise the IoT and security and privacy are considered critical success factors for IoT implementation. This study provides an insight into the company's challenges in implementing the IoT. This study is both necessary and timely for the development and sustainability of the 3PL operator in Malaysia.*

Keywords: *Internet of Things (IoT), Third-party logistics (3PL).*

Introduction

The logistics industry supports the supply chain, and it is recognised as a mechanism to stimulate trade, facilitate industry, and stimulate economic development. Sangka (2017) defines logistics as the physical movement of goods (consolidation, procurement, transportation, trans-shipment, storage, and packaging) and enabling this movement through document administering, participant coordination, activity monitoring, and transaction financing. Supply chain management incorporates logistics by connecting critical business processes from the end-user to the original providers of products, services, and information that add value to customers and other stakeholders.

Supply chain and logistics contribute significantly to company expenses, impacting and influencing other economic activities. Supply chain and logistics activities include demand planning and forecasting, inventory control and planning, warehousing, transportation planning and planning, sourcing, and logistics. A service provider in supply chain and logistics can reduce uncertainty, reduce operation cost, increase productivity, and eventually increase company revenue. Logistics and supply chain management have long been recognised as critical factors in determining a company's competitive advantage.

According to Min (2015), a warehouse is a critical component of a business's logistics system. It stores items such as parts/components, raw materials, work-in- process, and completed goods at and between their points of origin and consumption. Information from the warehouse is essential as it provides customer insight into the state, condition, and disposal. A warehouse's conventional functions include receiving, pre- packaging, putting away, cross-docking, and unitising. However, these traditional warehouse tasks have evolved faster than in any prior decade with the "value-added services" that go beyond the conventional warehousing functions. Today's warehouses face increasing pressure to improve inventory accuracy, on-time delivery, personalised order fulfilment, adaptability to value-added services, and response to customer requirements. To achieve these high-performance targets, the warehouse must identifyways to minimise waste, simplify procedures, and increase efficiency in all aspects of warehouse operations.

Implementing the Internet of Things (IoT) for warehouse management has progressed beyond a promising notion in recent decades. Businesses began adding sensors, Radio-frequency identification (RFID) tags, device-to-device communication, and other types of connections in the warehouse to improve stock traceability and the overall performance of their warehouse operation.

In addition, it provides a competitive advantage by enhancing customer connection through real-time communication. As the implementation of this technology has yet to be made a practice in most Third-Party Logistics (3PL) or Fourth Party Logistics (4PL) companies across Malaysia, thus this will give an edge advantage in approaching new customers prospects.

Scope of Study

This research aims to determine the challenges encountered by 3PL operators while adopting IoT technology and the success factors associated with IoT deployment. This study is in the form of exploratory research by using a qualitative case study approach to data gathering, analysis, and report writing. According to Krishnan et al. (2019), a qualitative case study employs a naturalistic method that searches for and investigates occurrences and happenings within a specific event and has a very narrow and well- defined scope. The researcher serves as the instrument of research in such a case study.

The qualitative case study uses interviews and observation to get insight into IoT development and the experience and challenge to deploy the IoT in the warehouse. The respondent was selected from several 3PL companies in Selangor located in Klang and Shah Alam. The company's primary business is providing Third Party Logistics to its customers, and they are presently implementing an IoT system in their warehouse operations. The respondents are from middle management positions. The researcher believes the participant is ideal for contributing to the study objective.

Significant of Study

This study aims to improve knowledge of 3PL operations, particularly in warehouse management, to ensure the success of future development, particularly in IoT deployment. By gaining a thorough grasp of the contemporary challenges confronting organisations, this study will advise practitioners and scholars as future adaption is anticipated to be more efficient due to the organisation's readiness to embark on digital development and investment in this technology. Additionally, the Malaysian government has launched several policies and regulations to advance the Malaysian logistics sector. Thus, understanding the challenges and success factors faced by industries today will serve as a recommendation to the government policymaker to create comprehensive future policies to tackle this challenge and advance the growth of the logistics industry in Malaysia.

Literature Review

Sekaran & Bougie (2009) describe literature review as a step-by-step procedure that entails finding published and unpublished work on a subject of interest from secondary data sources, assessing the work connected to the issue, and documenting thefinding. This literature review is essential in broadening knowledge on the research topic; researchers can also seek clarification and focus on the research problem. Moreover, theliterature review provides a construction analysis of other researchers' research methodologies and approaches. This chapter will discuss the methods and findings frompprevious studies conducted in or out of this study.

Evolution of IoT Development

The technologies that underpin the IoT have existed and been developed for decades. However, only a few years back, the concept of interconnected devices was primarily focused on research and development. The IoT is becoming more widely recognised for its potential to improve supply chain management by increasing inventory accuracy, reducing costs, and enhancing product tracking. Below is the history of the evolution of IoT and its supporting and associated technologies in chronological order.

Table 2.1: Historical development of IoT

Years	Development of the Internet of Things
1932	Jay B. Nash writes about machines that can support daily lives and increase people's leisure time.
1949	Norman Joseph Woodland designs the linear code bar. In 1952, the first patent for the code bar wasgranted.
1969	Advanced Research Project Agency Network (ARPANET) was designed to connect computers to general-purpose computer centres run by the US Defence Department and other organisations for academic and research purposes.
1973	Mario Cardullo obtains the first patent for a passive, read-write RFID tag. At the same time, Charles Walton acquired a patent for a passive transponder to open the door the same year remotely.

1974	A supermarket uses a Universal Product Code (UPC) label to track purchases for the first time.
1974	Embedded computing was another significant IoT technology. This system uses single board computers and microcontrollers and is part of a more extensive system.
1980	Industry use of RFID tags-utilised sensors and actuators communicating over a wireless sensor network (WSN) emerged for sensing, tracking, and monitoring things in healthcare and traffic control.
1984	A Coca-Cola machine was connected to the internet and sent information about the drink's temperature and availability.
1990	The precursor to IoT is the Auto-ID Centre at MIT's notion of linked gadgets.
1990	Increased internet use in business and consumer markets. However, the usage is constrained due to the network connectivity's performance.
1991	Mark Weiser introduced ubiquitous computing. A computer could be present in everything with modern embedded computing while remaining undetectable. Later, it was dubbed ubiquitous computing.
1995	Siemens establishes a special department inside its mobile phones business unit to develop and market the "M1" GSM data module for machine-to-machine (M2M) industrial applications. This module enables machines to connect through wireless networks.
The Mid 1990s	Sensor nodes were built to collect data from individually recognised embedded devices and share it easily, realising the IoT's fundamental concept.
1997	Kevin Ashton, the Centre's director, explored utilising radio frequency identification (RFID) tags to monitor items as they moved through Procter & Gamble's supply chain. RFID tags were used to scan and identify objects and then wirelessly broadcast the data via a network.
1999	The Auto-ID (for Automatic Identification) Centre at MIT is credited with coining the term "Internet of Things." The information is handled and intelligently recognised to all things using the RFID sensing device that is linked to the internet. A low-cost chip is being developed to store data and connect items to the internet. Sanjay Sarma, David Brock, and Kevin Ashton transformed RFID into a networking technology by linking objects to the internet through the RFID tag.
2000	Internet connection has become the de facto standard for various applications due to digitalisation. All companies and goods were required to have an online presence and offer information. However, these gadgets continue to be predominantly internet-connected objects that need more human intervention and monitoring through applications and interfaces. The increased need for quicker logistics necessitates RFID tags to aid in routing, inventory management, and loss prevention.

2010	Cost reductions result in widespread adoption of the second wave of applications, including surveillance, security, healthcare, transportation, food safety, and document management.
2015	Indoor equipment's capacity to detect geological signals. The term "ubiquitous positioning" refers to the technique of locating individuals and everyday items.
2020	The development focus is on miniaturisation, energy-efficient electronics, and accessible spectrum, as well as software agents and sophisticated sensor fusion. Physical-World Web development as a means of teleoperations and telepresence (Ability to monitor and control distant objects)

Source: Adapted from Ali, R, Jaafar, H. & Mohamad, S. (2008); Machado, H., & Lane, N. (2014) and Sharma et al. (2019)

IoT applications enable reliable and resilient device-to-device and human-to- device interactions by physically connecting devices and networks. IoT applications are primarily focused on the transportation and logistics industries in this context. Typical IoT communication designs allow IoT devices to communicate autonomously with one another by connecting to the internet's communication backbone via an infrastructure- based wireless network paradigm.

Haddud et al. (2017) Supply chain integration is essential in improving business performance. This supply chain integration can reduce cost, improve responsiveness, increase service level, and facilitate decision-making. Information sharing, collaboration, and agility are critical characteristics of supply chain integration. Supply chains that adapt and react to the rapid rise of the IoT will realise more benefits and competitive advantages in the new business environment.

IoT can have a significant impact on enhancing the SCM's different functionalities. Warehouses play a critical role in fulfilling consumers' needs in today's corporate environment. Hamdy et al. (2018). Warehouses may hold thousands of items, so they should be used efficiently to guarantee accurate and timely performance across all activities to fulfil client needs. Applying IoT to warehousing can have a substantial effect since it can be used to monitor several operations in real-time and remove human intervention. Warehouses can be improved in various ways, from speed and precision picking process, the effectiveness of management, and the reduction of nonvalue-added services. Another area of interest is integrating information to monitor inventory levels, monitor products, and handle orders. Warehouses may hold thousands of goods; thus, it is essential to have effective management across all business functions to satisfy customer expectations. Tsang et al. (2017) IoT implementation is expected to increase warehouse effectiveness, and customer satisfaction will continue to increase because of the improved services.

The IoT applications can be used for various purposes, including location sensing and sharing, environmental sensing, remote control, ad hoc networking, and secure communication. Applications such as GPS, CELL ID, and RFID can monitor mobile assets, fleets, and traffic information systems. Environment sensing helps detect changes in the physical or chemical features of the surrounding environment (Chen et al., 2014).

Review of the Success factors of IoT implementation

According to Fernando et al. (2018), there are 21 success factors in IoT implementation in a single organisation: efficiency, integration, cost, effectiveness, transparency, communication, quality, ability, timeliness, accuracy, completeness, performance, coordination, automation, flexibility, responsiveness, real-time, trust, speed, relationships, and suitability. This factor is a success factor generated from the supply chain's use of information technology. This study provides insight into all businesses considering using IoT in their supply chain. IoT has a beneficial effect on allsupply chain operations, improving internal processes ranging from raw material procurement to manufacturing processes, logistics, and customer support. All of this enables a business to compete internationally with others.

Hariharan et al. (2019) identify ten critical success factors for Supply Chain Management implementation in SMEs, including information sharing, the use of sophisticated technologies, top management involvement, collaboration with supply chain partners, a less rigid production system, an increase in competitive priorities, long-term goals, product differentiation, and innovation, as well as inventory management.

According to Lin et al. (2016), in the study of the adoption of IoT technology in the agricultural supply chain in China, the technical variables such as complexity, compatibility, perceived benefit, and cost have a significant influence on the technologyadoption of IoT in agriculture. In addition, organisational factors of the scale of the enterprise, executive support, trust among the businesses in the supply chain, technical knowledge, and environmental factors, either from external pressure or government support, all have positive relationships with IoT adoption. Bayo (2019), the reason for the delay in implementation of the IoT include technological readiness, compatibility, complexity, senior management support, business size, regulatory support, security concerns, cost savings, compatibility, and relative advantage, as well as the goal to utilisethe IoT.

The recent paper by Hakim, Singgih, & Gunarta (2021) identified the implementation of the IoT in the automotive industry. Thirty-four critical success factors(CSFs) are grouped into eight dimensions; marketing, regulations, people and management, operations, technology, finance, invocation and ideas, and resource. However, there is no validation testing to test the relationship between critical success factors (CSFs) and their dimensions in determining the success of IoT implementation, especially in the automotive industry. The author proposes a thorough validation testingusing statistical methods to test the relationship between critical success factors (CSFs) and their dimensions.

From the previous study, researchers shall focus on the main contribution of the critical success factors for the IoT implementation as top management commitment, security, privacy, trust, employee expertise and competitive pressure. According to Sharma et al. (2019), as the internet environment evolves at a breakneck rate, the whole globe is migrating toward IoT, profoundly affecting our lives in the coming years. Now, many smart gadgets will be linked to the internet and one another. Some analysts refer to it as the 'Next Digital Revolution,' while others refer to itas the 'Next Generation of the Internet.' IoT demonstrates its breadth by providing organisations with a unique chance to transform data into insights. Numerous reasons contribute to the adoption of IoT, including enhanced sensors, device connectivity, and lifestyle and mobility progression. Businesses will embrace IoT solutions at a somewhathigher pace than other sectors since IoT have the potential to enhance productivity and reduce operational costs.

Theories and Models
Based on the gap and theory from previous studies, this research concluded and outlinedthe theoretical framework for this study in Figure 1.

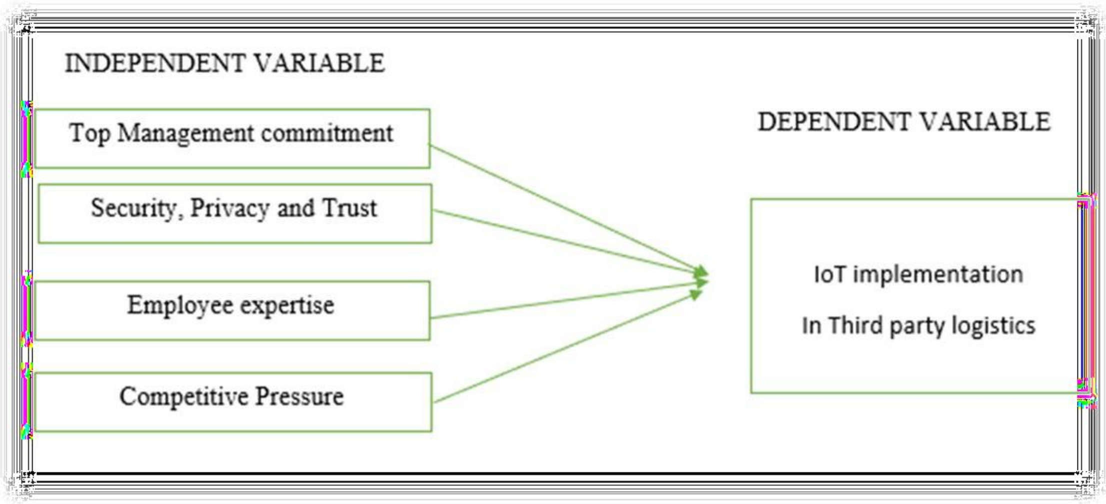

Figure 1: Conceptual Framework

Based on Figure 1 show the theoretical framework of this study that consists of four independent variables (IVs) Top management commitment (IV 1), security, privacy, andtrust (IV 2), employee expertise (IV 3), competitive pressure (IV 4) and IoT implementation in third party logistics as the dependent variable.

The IoT is a critical component of Industry 4.0, the fourth industrial revolution. The IoTis generally regarded as one of the most promising technologies for controlling and optimising supply chains; warehouses are critical components of every industrial organisation's supply chain. As a result, new technologies attract considerable interest from various businesses seeking to enhance their performance reputation, attract new clients, and increase profits: this paper is an approach to understanding the underlying IoT adoption in terms of challenge and success factors. By adopting IoT technologies, organisation or warehouse performance is expected to increase due to inefficiency. Thisefficiency will be reflected primarily in inventory shortage and counterfeiting, increasingorganisational profit.

The IoT has fundamentally altered how people live, communicate, play, and work, but its full potential has yet to be realised. The tremendous power of this digital behemoth will be fully realised when technology begins to touch people's lives daily. It will alter how people perceive technology usage, and the resulting ripple effect will domesticate IoT. Corporate actors manufacture devices, businesses develop new applications, technologists create new technologies and protocols, and customers consume IoT solutions and services. Despite the amount of work that has been accomplished, the IoT paradigm will take longer to develop since the technology and associated ideas are still in their infancy. More robust implementation techniques must be designed to exploit IoT prospects and global exposure.

Methodology
The purpose of the presented qualitative exploratory case study was to examine the challenge and success factors of the implantation of IoT in third-party logistics. This qualitative

exploratory case study used semi-structured interviews conducted in a one- on-one manner to produce detailed responses from the respondent on the success factorsof the implantation of IoT in third-party logistics.

The qualitative exploratory case study results may generate details that will be beneficial to the stakeholders of the 3PL operator, especially in Malaysia. This chapter includes the research method and the study design appropriateness, the population description, the geographic location, procedures for data collection, and the principles for informing the research subjects regarding the guidelines for confidentiality about study participation.

This study aims to examine IoT applications in warehouse operations at Third- Party Logistics (3PL) companies using an interview-based method with a sample selectedfrom the industry of 3PL operators. Thus, new empirical facts and insights are generatedto confirm, expand, and supplement the IoT proof-of-concept.

Contribution of the Study

The interdisciplinary study of emerging technology in supply chain managementby supply chain management and information systems provides critical insights to academics and practitioners on various dimensions of IoT adoption and use. This finding could assist in advancing supply network digitization, especially during and after the COVID-19 pandemic. The current theory concentrates on the dimension of success factor before the IoT implementation; less research focuses on the challenge and issues faced by the organisation during or after the IoT implementation. The finding of this research is deemed to be a guidance for future research to review the implementation process andthe support available after the technology implementation.

In terms of contribution to the policymaker, by understanding the major constraint in the organisation, the policymaker can organise a program that can cater to the industries' needs. A collaboration or consultation program, especially for the company seeking the IoT implementation, appears ideal as most companies have no experience, knowledge, or resources to implement the large-scale project in the organisation. Having a professional third party that provides the guidance will support the small and medium logistics companies to grow their business further. These initiatives will transform Malaysia's logistics industry into a more integrated and movingtoward industry 4.0.

Industry 4.0 is projected to boost the supply chain and logistics industries significantly. This development is focused on the significant influence on long-term performance. While increased IoT adoption is anticipated to result in staff reductions, new workers will be required to configure and monitor the equipment. Additionally, theoutcomes of this study may motivate the workforce to develop alternative skills togetherwith development for Industry 4.0.

The Implication of Research and Recommendation to the Organisation

Based on the conducted research, the researcher managed to understand the issueand challenges faced by the organisation before the IoT implementation and the benefit gained from the IoT in the organisation's performance. The critical factor affecting the success of the project implementation was also explored to have a better insight into eachdimension before and post-project execution.

The project manager will be able to foresee issues and problems in the organisation by understanding throughout the process. The proposal and countermeasurecan be outlined first to overcome this issue. For example, employee readiness may be lacking. Thus, a proper introduction and training program to have all the employees be engaged in the engaging new system will benefit the success of the IoT implementation. The support after technology implementation will guarantee that the employee fully utilizes the company's assets and investments.

Recommendation for Future Research

The propositions generated in this study can be used as a basis for future research and tested in framework-based survey research. Furthermore, the present discovery is restricted to the 3PL logistics organisation. The inclusion of vertical collaborators in the study will most likely improve the understanding of IoT utilisation in supply chain management. Future research may reveal significant findings, particularly between 3PL operators and other stakeholders. As technology advances, the study should not be limited to IoT implementation in an organisation but should also include IoT integrationthroughout the supply chain.

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6th Langkawi International Multidisciplinary Conference 2023 (6th LIMC 2023)
eISSN 2976-3223
9th – 10th September 2023
Bayview Hotel, Langkawi, Malaysia

FROM SOCIAL MEDIA USE TO WILLINGNESS FOR BARIATRIC SURGERY IN CHINESE INDIVIDUALS: UNRAVELING THE PSYCHOLOGICAL MECHANISM

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Abstract: *This paper aims to investigate the underlying mechanism of the influence of social media use on the Chinese people's willingness to bariatric surgery. As body ideals continue to shape beauty standards in Chinese society, social media has emerged as a significant platform that reinforces these norms. Bariatric surgery, commonly referred to as weight-loss surgery, involves operative modifications to the digestive system, resulting in substantial weight reduction. Despite the increasing trend of bariatric surgery adoption among Chinese individuals, this domain remains underexplored by researchers. And there is a pressing need to dispel some stereotypes surrounding bariatric surgery due a lack of knowledge among the public. This research employs a blend of social learning theory and social comparison theory, offering new insights into the psychological and sociocultural factors influencing Chinese people's choices regarding bariatric surgery. The research adopt quantitative method, conducting a cross-sectional survey research, which targets at Chinese individuals worrying about their body image. This paper is the first to use multiple measurements to measure social media engagement. The findings not only contribute to theoretical advancements but also hold practical implications for hospitals, healthcare practitioners, and education organizations aiming to provide comprehensive support to individuals considering bariatric surgery*.

Keywords: *Social Media Use, Bariatric Surgery, Chinese Individuals, Social Comparison, Internalization*

Introduction

Contemporarily, social media has evolved into a pivotal tool for global communication and information exchange, boasting billions of active users across diverse platforms (Farsi, 2021). Beyond its social connectivity role, social media significantly reinforces societal norms and expectations, creating pressures for individuals to conform to narrowly defined standards of appearance (Ahadzadeh et al., 2022). This amplification of conformity is exemplified in the work of Brady et al. (2020), where social media communication intensifies deindividuation, compelling individuals to align with societal norms for a favorable image. This positive image could be linked to either ethical virtue or physical attractiveness (Bulatova, 2016). In this context, the emphasis on appearance in social media content is more pronounced compared to traditional media, often leading to the sharing of selectively attractive photos (Saiphoo & Vahedi, 2019). Celebrities, as prominent figures on social media, have also played a role in establishing cultural body ideals, further pressuring women to adhere to these standards (Brown & Tiggemann, 2022).

The realm of social media has prompted investigations into novel variables to assess usage, particularly related to appearance-related preoccupation and photo-based activities (Fioravanti et al., 2023; Ozimek et al., 2023). Online platforms have cultivated an environment where individuals are preoccupied with their appearance, fostering contemplation of their image in photos, which can cause negative outcomes such as depression, body anxiety, and sensitivity to appearance criticism (Hawes et al., 2020). Photo-related activities, including capturing, editing, sharing, and comparing images, deepen appearance fixation and contribute to body dissatisfaction (McLean et al., 2015). The consumption of images depicting beauty and fashion standards on social media, particularly from celebrities, is linked to body dissatisfaction and desires to achieve the idealized body (Brown & Tiggemann, 2022).

Body ideals represent culturally constructed beauty standards that dictate attractive physical appearances within a given society (Jong & Drummond, 2020). These ideals encompass various aspects such as body size, shape, weight, and physical features (Mills et al., 2017). Motivated by body ideals, individuals pursue various means to attain these standards, including dietary changes, exercise, and even surgical interventions like bariatric surgery (Bianciardi et al., 2019). Bariatric surgery, in particular, has gained popularity as it alters dietary and metabolic habits, resulting in significant weight loss and improved well-being (Li et al., 2021).

With the growing popularity of bariatric surgery in China, it is rather crucial to dispel stereotypes surrounding this procedure due to lack of knowledge in public (Crozet et al., 2023). People's concern about risks and potential failures hinder individuals from considering bariatric surgery (Zhu et al., 2021). In addition, limited research has examined the sociocultural and psychological factors influencing the acceptance of bariatric surgery in China. Furthermore, this study pioneers an extensive assessment of social media engagement.

The study aims to investigate the underlying mechanism through which social media influences Chinese individuals' acceptance of bariatric surgery. The study adopts two key theoretical frameworks: social learning theory and social comparison theory. Social learning theory emphasizes how individuals learn behaviors through observation, modeling, and reinforcement, and it will guide the examination of media influence and modeling behaviors. Social comparison theory, on the other hand, will be used to explore how upward social comparison on social media contributes to body image concerns and bariatric surgery acceptance.

Literature Review

Weight Concerns and Bariatric Surgery

Obesity (a body mass index [BMI] of 25–29.9 kg/m2) and overweight (a BMI of 30 kg/m2 and above) have become global health challenges, with over one billion people being obese according to the World Health Organization (2022). In China, over 50% of adults are overweight, leading to increased prevalence of chronic diseases (Bing, 2022). Obesity not only impacts physical health but also has serious mental health implications, often associated with eating disorders and body dysmorphic disorders (Bjornsson et al., 2022).

As the obese population grows, various weight loss methods have emerged, including lifestyle changes, weight-loss drugs, traditional Chinese medicine, liposuction, and bariatric surgery (Wen et al., 2022; Bagatin et al., 2021). Bariatric surgery, a highly effective treatment for obesity, provides sustainable weight loss and improved quality of life. It has evolved significantly since its inception in the 1960s, with laparoscopic techniques enhancing safety and recovery (Faria, 2017). Common types of bariatric surgery include Sleeve Gastrectomy (SG), Roux-en-Y Gastric Bypass (RYGB), and Adjustable Gastric Band (AGB) (Clapp et al., 2022). The mechanism of SG is performed by removing approximately 80% of the stomach. RYGB means the stomach after surgery "in the shape of Y". AGB is placing a device around the top part of stomach, controlling the fullness. Though many people may worry about the postoperative adverse complications, the actual complication rates of bariatric surgery are lower than common operations. Nguyen & Varela (2017) said, the mortality of the surgery is only three in 1,000 patients.

China is in infancy, but also witnesses an explosive growth. Researchers found that a total of 7,779 bariatric procedures were reported from 2001 to 2015 (Du et al., 2016). In 2023, a study summarized the statistics from the Greater China Metabolic and Bariatric Surgery Database, where 53 centers reported 6,807 surgeries (Tian et al., 2023). The study also found some differences of domestic patients compared to abroad - Chinese patients had a younger age and a lower BMI, and more chose to undergo SG.

Social Media Use Intensity and The Willingness for Bariatric Surgery of Chinese People with Overweight Concern

Mascherini and Nivakoski (2022) defined intensity of social media use and the time spent on social media. In this study, social media use intensity encompasses both the frequency and duration of social media usage. An international study indicated that social media use intensity could influence one’s well-being (Boer, Van Den Eijnden, et al., 2020). Some study indicated that social media use intensity could cause poor equality of sleep (Permatasari et al., 2023). The reduced physical activities, insufficient sleep, and circadian misalignment caused by intense social media use could increase the risks of obesity (Chaput et al., 2023). Another cross-sectional study illustrated that sedentary time had a more significant effect on metabolic health than physical activities in obese adolescents (Julian et al., 2022).

Most studies investigated about the intense use of western popular social media platforms (Miguel et al., 2023). Existing research primarily suggests that the frequency of social networking site (SNS) use can indirectly predict adolescents' inclination towards desiring cosmetic surgery by fostering increased investment in appearance (de Vries et al., 2014). Therefore, the hypothesis is developed:

Hypothesis 1a: Social media use intensity is positively associated with the willingness of Chinese people with obesity concern to take bariatric surgery.

Appearance Related Social Media Preoccupation and The Willingness for Bariatric Surgery of Chinese People with Overweight Concern

The time or frequency of social media usage fails to account for nuanced differences, such as diverse motivations, content, and activities (Widman et al., 2022). Researchers have identified various aspects of appearance-related engagement on social media, including motivated use for appearance or connection and conversations focused on appearance (Jarman et al., 2023). Appearance includes a wide range of characters, such as height, weight, body parts (breast, waist, hips, and legs), facial features (i.e. eye, nose, and lips), color, age and clothing (French, 2002). Appearance-related preoccupation on social media could lead to behaviors like body surveillance, comparing oneself to others, and ultimately result in low self-esteem and even depression (Choukas-Bradley et al., 2019). A longitudinal study also found this preoccupation eventually played a role in the development of body dissatisfaction and eating disorders (Jarman et al., 2023).

Associations between appearance related social media activities and people’s willingness to take cosmetic surgery have been confirmed in previous studies. Research specifically examining the potential effect of appearance related preoccupation on interest in bariatric surgery is lacking, and their association in the context of Chinese social media platforms is vacant. Thus, the following hypothesis is developed to investigate these gaps:

Hypothesis 1b: Appearance related social media preoccupation could have a positive relationship with the acceptance of bariatric surgery in Chinese people with weight concern.

Photo-Based Social Media Activities and The Willingness for Bariatric Surgery of Chinese People with Overweight Concern

Photo-based activities helped to construct the self-presentation and self-identity. When entering social media, individuals constructed the identity of oneself through name, profile photo, gender, religion, which would represent how they would socialize in the cyberspace (Candrasari, 2016). In a study on self-impression management in WeChat, it was found that requent modifications of the WeChat homepage, such as changing profile photos, were used to create impressions; and people selectively controlled the visibility of photo-based updates to specific individuals to protect their desired impression (Liu et al., 2022). The study also highlighted that f Scholars have noted that individuals who dedicate their time primarily to photo-based activities on Facebook, such as browsing, visiting, checking, liking, messaging, or commenting on other users' profiles, may experience heightened internalization of body ideals, and increased concern about weight (Ahadzadeh et al., 2017).

In the present study, photo-based social media activities will be instigated in the context of Chinese social media platforms. Besides, previous studies suggested that photo-based social media activities were related to people's acceptance of cosmetic surgeries. A study suggested that young women aged between 18 to 29 who were exposed to digital photos depicting the beautiful changes brought about by cosmetic surgery expressed stronger desires to undergo the same procedures (Candice et al., 2021). Chen et al. (2019) also suggested that alternations of lighting and modification of body parts in photos might have effects on cosmetic surgery attitudes. Although there is no existing study directly about association between exposure to photos and people's willingness to take bariatric surgery, based on previous studies, the hypothesis can be developed:

Hypothesis 1c: Photo-based social media activities is positively associated with the willingness of Chinese people with weight concern to take bariatric surgery.

Social Comparison and the Willingness for Bariatric Surgery of People with Overweight Concern

Social Comparison Theory suggested that people had a drive to evaluate their own opinions and abilities through comparison with others (Festinger, 1954). There are two categories of social comparison: upward social comparison and downward social comparison. Suls et al. (2020) noted that downward social comparison takes place when people compare themselves to people who are worse off. Upward social comparison refers to people compare themselves to someone better than them, and can simultaneously lower self-evaluation and raise motivation for attainable targets.

Due to the rise of social media use, social comparison is happening at "an unprecedented rate and scale" (Verduyn et al., 2020). A study discussing about male Instagram users suggested that self-improvement and perceived model attractiveness caused by upward social comparison can contribute to men's fitspiration (Peng et al., 2019). A study found that the comparison based on appearance between the models and women themselves was average upward, and comparison based on intelligence was average downward (Tiggemann & Polivy, 2010). Since previous studies suggested a positive correlation between upward social comparison and self-improvement, such as practices for ideal body image, this journal will mainly discuss about upward social comparison.

There are some existing studies proving the association between upward social comparison and bariatric surgery. In the study of Coleman et al. (2020), participants said social comparison was one of the motivator for them to undergo bariatric surgery. A qualitative study of body image in patients undergoing bariatric surgery said that social comparisons presented both in the use of social media and everyday social environment takes up 6.17% of the presurgical elicitations (Butt et al., 2021). The study also showed that a small percentage of presurgical patients identified positive social comparison as a motivation to change as well as empathy for others struggling with weight. A study provided interesting insights into the equity perception and on satisfaction of bariatric surgery, where downward social comparison is needed to increase patients' well-being (Gaudrat et al., 2021). The following hypothesis is developed:

Hypothesis 2: Upward social comparison is positively related to people's willingness to take bariatric surgery.

Determinants of Upward Social Comparison: Intensity of Social Media Use, Appearance Related Social Media Use, and Photo-Based Social Media Activities

A study conducted in Asian context indicated that the intensity of Instagram use could predict upward social comparison and eating disorders (Teo & Collinson, 2019). Social media users tend to present themselves in overly attractive ways, passive social media use means being exposed to unrealistically editing or flattering photos from others. This exposure may cause feelings of jealousy or upward social comparison (Verduyn et al., 2017). Another study suggested that intensity of social media use could cause more negative body image in young women with the mediating mechanism of social comparison and internalization (Jung et al., 2022). The study of Uusberg et al. (2018) found that women with preoccupation about body size might engage in upward social comparison. The tendencies to social comparison about physical appearance mediated the relationships between photo-based activities and body dissatisfaction and weight loss practices (Fardouly et al., 2018). The appearance related social media use and importance of likes and comments are directly related to upward social comparison (Seekis et al., 2020). The number of "likes" of Instagram photos resulted in appearance related upward social comparison and more body dissatisfaction (Tiggemann et al., 2018). Therefore, the following three hypotheses are developed:

Hypothesis 3a: Intensity of social media use will positively predict social comparison.
Hypothesis 3b: Appearance related social media use has a positive influence on social comparison.
Hypothesis 3c: Photo-based social media activities has a positive relationship with social comparison.

Body Dissatisfaction, Body Ideals Internalization, and Self-Esteem as Predictors of The Willingness for Bariatric Surgery of People with Overweight Concern

Body Dissatisfaction

Body dissatisfaction refers to the negative subjective evaluation of one's own body and is the effect caused by perceived discrepancy between actual body image and the desired ideal state of the body (Gruszka et al., 2022). More recent evidence shows body dissatisfaction occurs across gender, but might have different body ideals: the thin ideal and muscular/athletic ideal (Wagner et al., 2022). A meta-analysis study found body dissatisfaction is strongly related to internalization of body ideals (Paterna et al., 2021).

Many studies have examined the relationship between body dissatisfaction and bariatric surgery. In addition to concerns about physical health, it has been observed that patients often experience significant body dissatisfaction and a strong desire to alter the appearance of specific body parts, which resulted in decisions to undergo bariatric surgery (Pearl et al., 2019). A study gave focus on the application of cognitive behavior therapy in the bariatric surgery, but failed to assess the effectiveness of cognitive behavior interventions to reduce body dissatisfaction and increase self-esteem (Cheroutre et al., 2020). Evidence has accumulated that body dissatisfaction has a positive relationship with the willingness to undergo bariatric surgery of whom are concerned about their weight. Therefore, the following hypothesis is developed:

Hypothesis 4a: Body satisfaction has a positive relationship with overweight people's willingness to undergo bariatric surgery.

Body Ideals Internalization

Body ideals internalization refers to the active endorsement of the socially accepted beauty as personal beliefs and goals (Cafri et al., 2005). The body ideals can be mainly categorized as thin ideal and muscular/athlete ideal (Roberts et al., 2022). Many journals generally suggested that internalization mediated the social media use and body dissatisfaction (Jung et al., 2022). Social media can be viewed as the place to promote beauty ideals, of which the standards is even unattainable (Seekis & Barker, 2022). Some studies found that the editing of photo and selfie into ideal appearance could result in body ideal internalization (Kwon, 2023). Western social platforms, such as TikTok, Snapchat, and Instagram, influence how people internalize the skinny or fit body ideals (Butt et al., 2022). Scholars Wang et al. (2019) said that Chinese Internet celebrities' selfies on SNS had common features like "big eyes, a pointy chin, a high-bridged nose, and fair skin" and conveyed idealized facial beauty; and in return, the extent of people internalized the ideal increased as they saw these edited selfies.

There are few proofs showing that internalization is related to the willingness to take bariatric surgery. However, many studies have discovered the body ideals internalization is associated with people's choice for cosmetic surgery. A research found that beauty-ideal internalization was a positive predictor for Chinese women's attitudes towards cosmetic surgery, and partly attributed it to the collectivistic culture in China where women strived to meet and internalize the social standard (Alleva et al., 2022). A study illustrating the association between social media use and internalized weight stigma suggested that bariatric patients internalized the idea that a smaller body type is perfect, and would like to confirm these beliefs (Butt et al., 2022). Therefore, the hypothesis is developed according to current related literatures:

Hypothesis 4b: Body ideals internalization is a positive predictor for people's willingness to undergo bariatric surgery.

Self-Esteem

Self-esteem refers to a person's subjective evaluation of self-worth, involving self-verification, self-acceptance and self-respect (Blascovich et al., 1991). In the research of Saiphoo et al. (2020), under the social networking sites usage background, self-esteem can be a buffer against harmful content to ensure one's overall well-being. In Maslow's theory (1987), one needs both acknowledgment from other people and self-acceptance from inner self to build esteem. In this article, self-esteem will mainly focus on the inner self evaluation.

Low self-esteem appeared common in bariatric surgery candidates (Cella et al., 2019). Some pre-bariatric surgery patients had a poor health-related quality of life due to weight bias internalization and low self-esteem (Zhang et al., 2022). Abilés et al. (2010) learnt the psychological characters of obese candidates for bariatric surgery who had higher levels of stress and eating disorder symptoms, and lower levels of self-esteem. Beside profound weight loss, there is evidence showing that self-esteem was enhanced after the bariatric surgery, which patients were most satisfied with (Proczko et al., 2022). Thus, the following hypothesis is developed:

Hypothesis 4c: Low self-esteem is positively related to people with overweight concern and seeking for bariatric surgery.

Upward Social Comparison as the Determinant of Body Dissatisfaction, Body Ideals Internalization and Low Self-Esteem

A wide range of studies have found social comparison is related to body dissatisfaction, body ideals internalization, and low self-esteem. The frequency of social comparison of physical appearance to whom people followed on social media could also predict body dissatisfaction and drive for thinness (Jiotsa et al., 2021). Liu (2022) said in her study that the unconscious process of upward social comparison on social media would cause Chinese women's negative body image and promote the ideal body in an objection way, where women are viewed as objects that serve as visual entertainment. Another study suggested that intensity of social media use can cause more negative body image in young women with the mediating mechanism of social comparison and internalization (Jung et al., 2022). Betz et al. (2019) found that exposure to thin, curvy and athletic body ideals all can lead to increased social comparison, and this social comparison can result in increased self-surveillance, decreased body appreciation, and decreased body esteem. Therefore, the following hypotheses is developed:

Hypothesis 5a: Upward social comparison is positively related to body dissatisfaction.
Hypothesis 5b: Upward social comparison is positively related to body ideals internalization.
Hypothesis 5c: Upward social comparison is a positive predictor for low self-esteem.

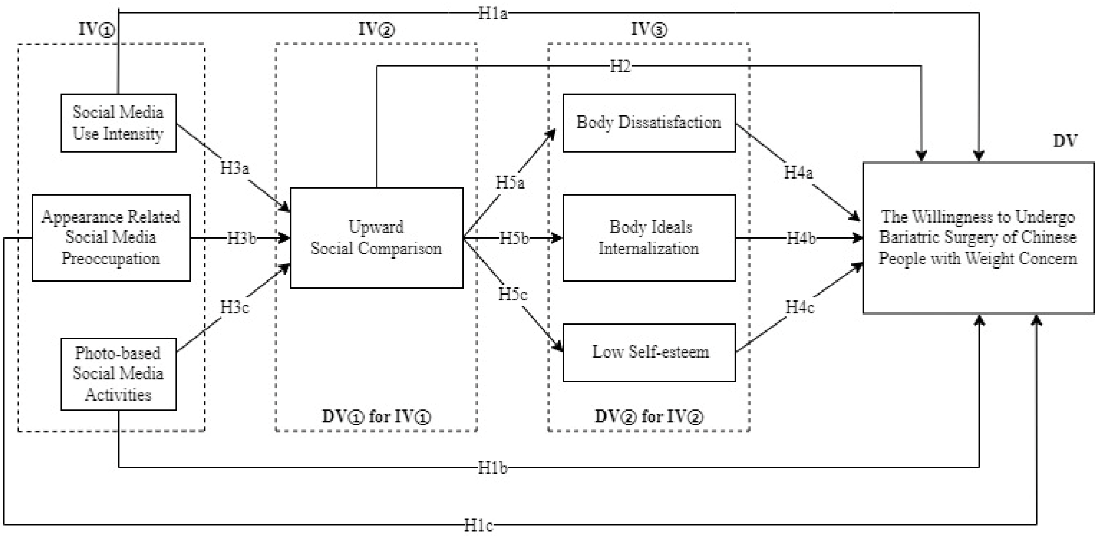

Figure 1: Research Framework

Note:
Based on the social learning theory and social comparison theory, the present study develops a model consisting of social media use, upward social comparison, negative emotions, and the willingness to undergo bariatric surgery of Chinese people with weight concern. To be more specific, social media use will be measured in three dimensions - social media use intensity, appearance-related social media preoccupation, and photo-based social media activities. The negative emotions will be elaborated from body dissatisfaction, body ideals internalization, and low self-esteem respectively.

Social media use intensity, appearance related social media preoccupation, and photo-based social media activities are independent variables (IV) ① for the dependent variable (DV). Upward social comparison is IV② for DV. Body dissatisfaction, body ideals internalization, and low self-esteem are IV③ for DV. DV is the willingness to undergo bariatric surgery of Chinse people with weight concern. Upward social comparison is DV① for IV①. Body dissatisfaction, body ideals internalization, and low self-esteem are DV② for IV②. The willingness to undergo bariatric surgery of Chinse people with weight concern is DV for IV③.

Methodology

Measurements

Dependent Variable

Acceptance of Cosmetic Surgery Scale (ACSS)

The ACSS is a 15-item scale covering three dimensions: Intrapersonal (5 items), Social (5 items) and Consider (5 items) (Henderson-King & Henderson-King, 2005). All these items in this research will be rated on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). Scholars usually calculate the Cronbach’s α value to study the internal consistency of scale to check reliability, and $\alpha > 0.70$ is considered acceptable (Ary et al., 2018). The researchers had examined ACSS had high internal consistency, with Intrapersonal Cronbach’s α = 0.88-0.91, Social α = 0.84-0.88, and Consider α = 0.86-0.92 (Henderson-King & Henderson-King, 2005). Researchers translated the ACSS to Chinese version which showed excellent internal consistency with all Cronbach’s alphas >.90 (Alleva et al., 2020). Since there is no any scale about the acceptance of bariatric surgery, the researcher will adapt the ACSS to measure the dependent variable of this study. To some extent, cosmetic surgery and bariatric surgery both fulfill people's need to become the socially accepted ideal beauty, thus the ACSS can be a guideline for measuring people's acceptance of bariatric surgery. The researcher will replace the "cosmetic surgery" with "bariatric surgery".

Independent Variables

Time Spent on Social Media

Previous studies measuring time of social media use by asking the time on weekdays and weekends respectively (You et al., 2023). Therefore, in the questionnaire, there will be two items asking about time on weekdays and weekends. The response options will range from 1 to 5 (1= less than 1 hour, 2 = 1-2 hours, 3 = 2-3 hours, 4 = 3-4 hours, 5 = more than 4 hours). Respondents will be given background information: "Social media consists of all user-driven platforms where people upload content, send messages in diverse forms, and connect to others (Aichner et al., 2021). In present study, social media include Chinese social platforms like WeChat, QQ, Douyin, Xiaohongshu, Weibo, Zhihu, and etc." Hawes et al. (2020) examined the correlation of social media use on weekday and weekend day, which showed high correlation ($r = .78$, $p < .001$). All analyses will use the average scores of the two items, which represent individuals' time spent on social media.

Intensity of Social Media Use

Two items from the study of Boer, Stevens, et al. (2020) will be used to measure intensity of social media use, of which the Cronbach's α ranged from .84 to .86. Questions cover the frequency of social media use and sending out instant messages. Participated will be asked to answer: "How many times a day do you make response to (i.e. 'like', comment, and share) messages, photos, videos from others on social media?", and "How times a day do you send a message, photo, or video via your electronic communication devices through social media?" Participants will respond on a 5-point scale, with 1 = less than once a day, 2 = 1 – 10 times a day, 3 = 11 – 20 times a day, 4 = 21 – 30 times a day, and 5 = more than 30 times a day. Apart from frequency of social media use, two items will also ask about people's emotional connectedness to social media. Hawes et al. (2020) has selected some items from Facebook Intensity Scale (Ellison et al., 2007) and slightly modified the items to more general subject - "social media use" rather than just "Facebook".

The Social Media Appearance Preoccupation Scale (SMAPS)

The SMAPS is a valid and reliable measurement developed by Zimmer-Gembeck et al. (2021). The researchers conducted exploratory factor analysis (Study 1) and confirmation factor analysis (Study 2). After two studies, researchers retained 18 items from 21 items. Items of the SMAPS mainly focus on three aspects - online self-presentation, appearance-related activity online, and appearance comparison. The variables showed significant correlations. In Study 1, online self-presentation Cronbach's α = .91, appearance activity α = .87, and appearance comparison α = .93. In Study 2, online self-presentation Cronbach's α = .91, appearance activity α = .85, and appearance comparison α = .94. In the study of , 5 items were used to measure social media preoccupation and showed Cronbach's α = .93. The present survey chooses 6 items out of the total 18 items.

Photo-Based Social Media Activities

Photo-based social media activities will be measured by the photo subscale of The Facebook Questionnaire (FBQ) of Meier and Gray (2014) and the editing behaviors measurement of Othman et al. (2020). The Cronbach's α for the whole FBQ scale (24 items) was .874 and for photo subscale (8 items) was .817. The study measured people's photo editing behaviors by collecting information about which editing applications they use, how often they use the applications, why they use them, and the impacts of these applications on their decision to take cosmetic procedures. Researchers test the statistical significance was $P < 0.05$. In present questionnaire, photo-editing applications refer to Meitu and Xingtu, which are popular in China.

Sociocultural Attitudes Towards Appearance Questionnaire-4 (SATAQ-4)

The SATAQ-4 is an evaluation of internalization of appearance ideals and appearance pressures to achieve the societal ideal (Schaefer et al., 2017). It measures 22 items on a 5-point Likert-type. In the latest study about the Mandarin Chinese version of SATAQ-4, found highly consistencies of each subscale with Thin $\omega = 0.79$-0.85, Muscular $\omega = 0.86$, Family/Peers = 0.87-0.91, and Media $\omega = 0.94$-0.95. Scholars tested each subscale of the Spanish version of SATAQ-4 and found they had good reliability with Internalization: Thin $\alpha=0.93$, Internalization: Muscular $\alpha=0.89$, Pressure from Family $\alpha=0.88$, Pressure from Peers $\alpha=0.94$, Pressure from Media $\alpha=0.97$ (Beltrán-Garrayo et al., 2023).

The Iowa–Netherlands Comparison Orientation Measure (INCOM)

The INCOM (Gibbons & Buunk, 1999) included 11 items to measure a person's tendency to make social comparisons. A study using the Chinese version of a short version of INCOM showed good internal reliability with .88 and .86 at two times respectively (Fu et al., 2018). Bai et al. (2013) also used the Chinese version of INCOM in their studies, which showed Cronbach's $\alpha = .78$ for the whole scale and $\alpha = .75$ for upward social comparison items.

Figure Rating Scale (FRS)

The FRS developed by Stunkard et al. (1983) is a pictorial measurement of body dissatisfaction. Mutale et al. (2016) developed the FRS by using DAZ Studio 4 software to create 3D version of body figure, depicted at a 25-degree angle, which enabled more realistic visual of body shape than simply front view bodies. Nine bodies were created in total which range from extremely thin to obese. Different body figures represent different levels of BMI: bodies 1-3 are underweight, bodies 4-6 are in the normal range and bodies 7-9 are overweight/obese. Participants need select their actual body figure and the ideal body figure. The discrepancy between the number of actual body figure and ideal body figure can display the extent of their body dissatisfaction. The bigger the difference in numbers is, the higher level of body dissatisfaction participants have.

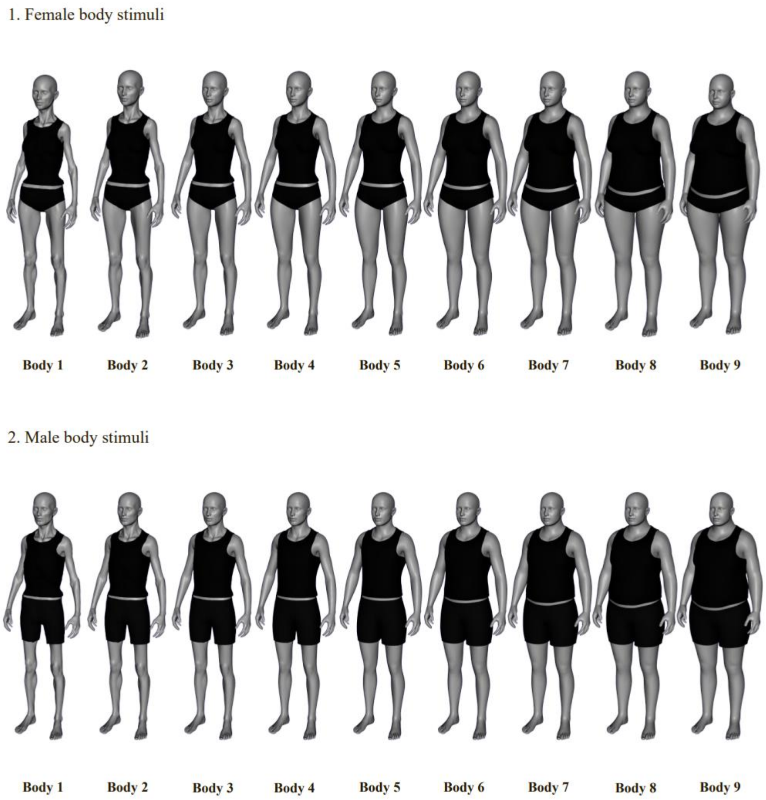

Figure 2: Models of Figure Rating Scales

Source: (Mutale et al., 2016)

Rosenberg Self-Esteem Scale (RSES)

The RSES developed by Rosenberg (1965) measure general feelings of self-esteem. The RSES has 10 items on a 4-point Guttman scale. The test-retest reliability over 2 weeks reveals correlations of $\alpha = 0.85$-0.88 in Spanish version, which indicates high stability (Beltrán-Garrayo et al., 2023). The scale also showed unidimensionality, internal consistency (.77 to .88), test–retest reliability (.82 to .85), and convergent and discriminant validity in some studies (Alexias et al., 2016). In the study of Chien et al. (2020) which used Chinese version of RSES, the Cronbach's α was .89. In a recent study, researchers observed the Chinese version of RSES with $\omega = 0.86$ for women and $\omega = 0.78$ for men (Ma et al., 2023).

Translation of Questionnaire

The investigator will adopt Chinese version of some measurements whose validity and reliability had already been tested in previous studies, include the ACSS, SATAQ-4, INCOM, and RSES. For the remaining parts, the translation follows the strongly recommended method back-translation, which is translating the target language back to the original source (Brislin, 1970). Since the mother language of all participants will be Chinese (i.e. target language), the researcher needs to translate the original English scales into Chinese version for respondents' convenience and better understanding. The researcher will compare the difference between the original measurements and the back-translated version item by item. Discrepancies will be spotted, and revision will be made if necessary.

Ethical Considerations

The researcher will be careful with the privacy, anonymity, and confidentiality of participants, the authenticity and credibility of research, and data collection and storage (Creswell & Creswell, 2018). In the first section of the questionnaire, participants will be asked to sign an informed consent form, which include elements like identification of the researcher, identification of the anonymous involvement of participants, guarantee of confidentiality of participants, and assurance that participants can withdraw any time without penalty. The questionnaire of this research will not include sensitive, illegal, or confidential answers, yet any information of personal identification should also be stripped from the dataset. For research purposes, the dataset will be uploaded onto OneDrive, to which only the researcher will have access. As Sieber & Tolich (2013) suggested, after 5-10 years, the researcher will discard the data from the computer and online data base so that the data won't be misappropriated by others.

Assessment of Standard Method Biases

Common method biases may arise due to people's social desirability, mood states and inclinations to respond moderately or extremely (Jordan & Troth, 2020). To address them, several methods will be taken to mitigate common method variance (CMV) in the research design. For questionnaire, the following methods suggested by Rodríguez-Ardura and Meseguer-Artola (2020) will be implemented:

(1) The researcher will give a randomize order of questions about predictors and theoretical framework.
(2) Respondents will be promised to keep the anonymity and confidentiality of responses.
(3) The researcher will emphasize there is no right or wrong answer, encouraging participants to answer honestly.

Statistically, the investigator will employ the Correlation Matrix Procedure suggested by Bagozzi et al. (1991) to assess the impact of CMV by examining the correlations among latent variables. If a substantial correlation ($r > 0.9$) is found among the main constructs, it will indicate the presence of common method bias. However, if the correlation among constructs is below 0.9, CMV will not be an issue in the study (Tehseen et al., 2017)).

Data collection

Pilot Study

Pilot study is a small-scale version of the full-scale study, which can pre-test the research instrument of the major study (i.e. questionnaire) (Ary et al., 2018). In general, the required sample size for pilot study is 10% of the full-scale study (Hertzog, 2008). Johanson and Brooks (2010) had studied the non-liner relationship between precision and pilot study sample size, and suggested minimum 30 representative participants from the population of interest.

Actual Study

The investigator distributes 200-300 questionnaires and collect the responses. After removing some possible outliers (i.e. participants who did not meet the sample inclusion criteria), 153 participants will be eventually included in the analysis which meets the required sample size calculated by G*Power. It takes the researcher around a month from August 2023 to September 2023 for data collection.

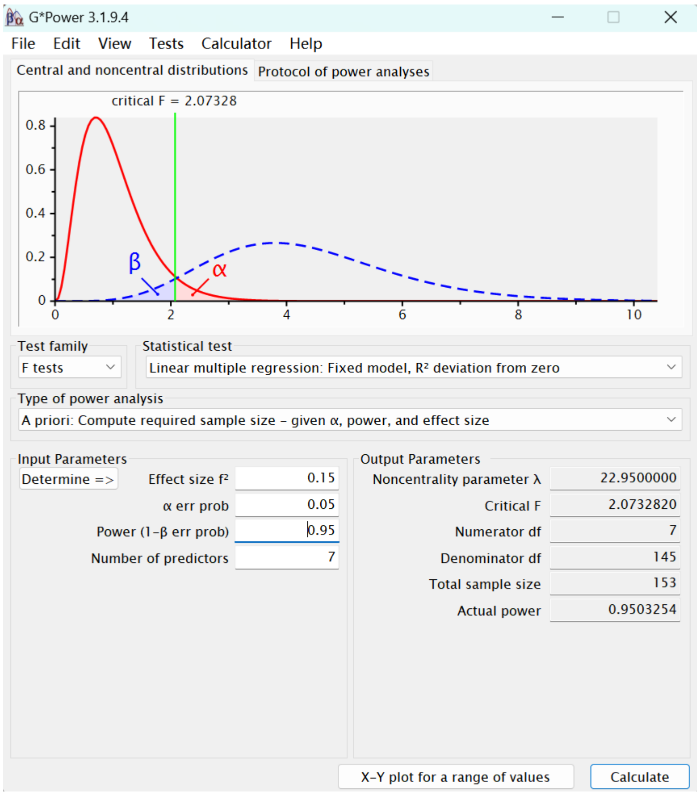

Figure 3: G*Power Calculation of Sample Size

Data Analysis

Partial least squares structural equation modeling (PLS-SEM) is a widely used multivariate data analysis in social science and health science studies (Fan et al., 2016; Memon et al., 2021). With the help of PLS-SEM, the researcher can do the confirmatory factor analysis to test the 7 main independent variables in this study, and the path analysis which quantifies the relationships between multiple variables (Wright, 1921). Data analysis will be performed with SmartPLS 4, which is a graphical user interface software based on Java programming (Ringle et al., 2022). SmartPLS 4 is good for latent variable modeling, which provide results in well-organized tables and graphical models (Leguina, 2015). The researcher will export the results in Excel and present the results in the graphical modeling window of SmartPLS.

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FROM TRADITION TO EXCLUSION: ANALYSING THE SURGE OF GATED COMMUNITIES IN JORDAN AND THEIR SOCIETAL CONSEQUENCES

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Abstract: *The wide spread of gated communities has urged many scholars and planners to investigate this type of residential development and its impacts on the surrounding as they effectuate segregation and urban fragmentation. With the emergence of gated communities in Jordan, this article aims to study the motives behind their formation on the one hand, then will investigate the social and spatial impacts of such developments on the surrounding neighbourhoods to examine if these developments cause segregation and fragmentation. This will be explored in the context of urban design theory, such as the Segregation theory developed by the Chicago school of thought. In conclusion, this paper emphasises the detrimental impact of gated communities on Amman's physical infrastructure and social cohesion. It strongly recommends that the local planning authorities take immediate action to address these negative consequences and explore alternative urban development models.*

Keywords: *Gated Communities, Social and Spatial Impacts, Urban Fragmentation*

Introduction

Tourism Arabian cities used to consist of distinct settlements encompassed by walls and gates, resulting in a city plan reflected in the social structure of neighbourhoods and homes. However, in the 1950s, new planning regulations were implemented in many Arabian cities, leading to contemporary urban developments, including gated communities. This design was initially embraced in the United States and Europe in the 1950s and 1960s, then spread to other regions such as South America, South Africa, the Middle East, Asia, and the Far East, including Jordan. The wide spread of gated communities has urged many scholars and planners to investigate this type of residential development and its impacts on the surrounding as they effectuate segregation and urban fragmentation.

As noted by Bianca (2000, p. 38-39), religious life and social institutions profoundly impacted Arabian cities. These institutions were integrated into the city's urban fabric and shaped the architecture and function of Arabian cities. The sense of sacredness extended to residential areas, where houses were often enclosed by walls or built inward. Figures 1 and 2 depict typical house forms in old Arabian cities. Clusters and closed neighbourhoods, like those shown in Figure 3 (Al-Hemaidi, 2001), were commonly seen in Riyadh until 1985.

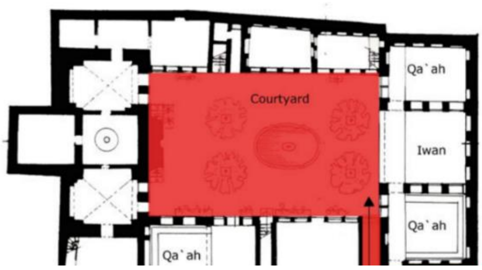

Figure 1 Typical Guestroom design.
Source: Amro and Bahauddin 2015

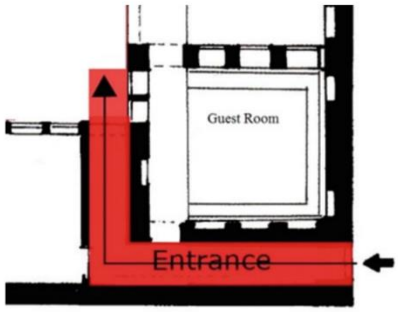

Figure 2 Typical courtyard house design.
Source: Amro and Bahauddin 2015

Historical Inquiry

As houses were protected from the main roads and outsiders by walls and gates; then, a manifest hierarchy formation was created to segregate visitors from private rooms when entering the house visually (Bianca 2000). Such designs and separation have led to the formation of "Quarters" as they are considered a continuation of the private space and a self-protective neighbourhood (Pallister-Wilkins 2015). The idea of separation and privacy prevailed in a way that controlled cities' urban planning. Nonetheless, robust connectivity and interaction between residents and neighbours were identified in the planning of Arabian cities through a fully integrated network of roads and streets which interconnected neighbourhoods together from one side and between people and public and social activities (such as mosques and markets) from the other side (Al-Hemaidi 2001). This robust relationship between residential dwellings and the mosque in a neighbourhood has formed the city fabric and the movement of people.

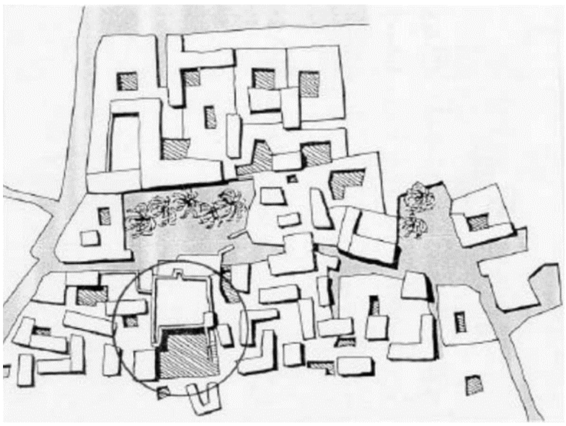

Figure 1: Typical neighbourhood in Riyadh, Saudi Arabia, 1985 (Al Hemaidi, 2001)

With the gradual disappearance of walls and quarters in the Arabian peninsula and Bilad al-Sham [1] with the advent of several colonialisms starting from the Romans, Egyptians, and Ottomans dynasties in 1516 -1918 CE (Omar, Bahrom, and de Mello 2015) to the European and British imperialism across the Middle (Pallister-Wilkins 2015), and the same was observed in Jordan since it was part of Bilad al-Sham. In 1880, the city of Amman had narrow streets and closed alleyways and was fortified with gates and walls to safeguard the people and their

[1] Bilad Al Sham: referred as Syria or West Arabia which contains four countries (Jordan, Lebanon, Syria, and Palestine). (www.wikepedia.com)

trades from intruders. This is demonstrated in Figure 4. However, a linear planning approach was adopted with the introduction of the main train line in 1903. This resulted in wider roads and streets, replacing the previous organic pattern, as mentioned in a study by (Omar et al. 2015). Figure 5 displays a photo of the city of Amman during the Ottoman dynasty.

Figure 4 As-Salt city castle in 1880. Picture from Al Madena newspaper, archives.
Source: almadenahnews.com/article/339945

Figure 5 Amman in the Ottoman dynasty. Picture from (Alzyoud and Hammad 2020). Source: Al Madena newspaper,
Source: almadenahnews.com/article/339945

Amman Gated communities are a luxurious haven, offering top-notch amenities, safety, and privacy for the affluent few (Al Omari & Al Omari, 2015). The increasing need for social status and seclusion among the wealthy has fuelled the inception of new paradigms in the housing sector, resulting in the proliferation of gated communities in Amman since 2018.

Literature Review – Contextualising

Separation and seclusion have been evident in Arabian cities' neighbourhoods and social groups. This socio-spatial fragmentation distinguishes Arabian cities from other liveable cities. These characteristics stem from the importance of sacredness and privacy, extending to houses and residential areas (Bianca, 2000, p.35). The planning of Arabian cities is based on a multifunctional core structure that includes numerous individual buildings. As a result, there is no conventional grid of streets or plazas, creating homogeneity and coherence between neighbourhoods and allowing for social harmony (Bianca, 2000).

As this article is attempting to investigate the impact of gated communities on the surrounding neighbourhoods in Jordan, the literature review will be divided into three sections: Section 1 will present a theoretical discussion of gated communities from an urban design viewpoint through a broader review of the historical background of gated neighbourhoods in the old Arabian cities including the city of Amman to:

- Understand the main characteristics of the old Arabian gated neighbourhoods.
- Investigate if there are any social, spatial, and economic impacts from the Arabian gated neighbourhoods on the surroundings.
- Examine the relationship between modern gated communities and historical gated neighbourhoods.

Section 2 will analyse the instigation of modern gated communities in the Middle East, focusing on Jordan, as the selected case study is considered the first gated community developed in the city of Amman (Al-Homoud and Al Aswad 2018). Section 3 will review the spatial, social, and economic impact of modern gated communities on the surrounding neighbourhoods and will examine how literature has defined the impact of gated communities, especially from social, spatial, and economic aspects.

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Section 1 - Neighbourhoods in Arabian Cities

Historically, Arabian cities were heavily influenced by religious and social institutions, which played a crucial role in shaping the community's urban fabric. The integration of religious elements into the architecture of Arabian cities has had a lasting impact on their form and function. Scholars have noted that the planning of old cities in the Arab world influenced the development of gated communities. Glasze (2006) identified two primary reasons for social segregation in the Arab world: the use of courtyards as an extension of private and sacred spaces, and their function as a first line of defence, with access limited to a single gate that could be seized at any time (Abu-Lughod, 1987). The formation of courtyards has created neighbourhoods within walls and gates, protecting the city from intruders. Furthermore, Glasze (2006) argued that the introduction of contemporary gated communities in the Arab world, especially in Saudi Arabia, resulted from the integration between the Arab traditions of privacy and sacredness and the Western types of gated communities. However, Touman (2005) counter-argued that gated communities in Saudi Arabia could not be considered an urban solution, and they were found primarily to serve a specific layer of residents on a temporary basis. Furthermore, Giddings et al. (2023) argued that gated communities in GCC (Gulf Corporation Council) are new housing concepts imported from the U.S. and had greatly contradicted traditional houses.

Following that, Alkan Bala (2018) suggested an argument by comparing the concept of cul-de-sac to gated communities in the Turkish Urban Culture. A comparative methodology with case studies in Turkey was utilised to examine the privatisation of public space benefits on gated communities in relation to the original notion of cul-de-sacs. Alkan Bala (2018) argued that gated communities are labelled as a different type of cul-de-sacs; however, gated communities have created segregation. The study's outcome has recommended investigating the neighbourhood's human behaviours and perceptions and how it has changed from traditional to modern, namely from a cul-de-sac to a gated community.

Section 2 - Gated Communities in the Middle East and Jordan

Amman had an organic planning pattern with narrow streets and closed alleyways that functioned similarly to the courtyard (Omar et al. 2015). Also, Amman was surrounded by gates and walls to protect people and trades from intruders (Alzyoud and Hammad 2020) in 1880. Nevertheless, as Al Omari and Al Omari (2015) argued, gated communities were introduced in Jordan in response to the desires of the middle and upper-middle classes, who sought to live a luxurious and secluded lifestyle similar to that found in Western gated communities. Their study examined the impact of gated communities on the residents who live both within and outside their boundaries.

Furthermore, Al Shawish (2016) conducted a study to examine the effects of gated communities in Doha, Qatar, which is part of the GCC (Gulf Cooperation Council). The researcher argued that these communities should integrate more seamlessly into the city's urban landscape. The study used case study analyses and interviews to identify Doha's current urban and social integration level. The researcher suggested that the city should work towards creating a more cohesive and integrated urban environment.

Similarly, Al-Homoud and Al Aswad (2018) conducted a questionnaire study in Jordan, showcased that gated communities are preferred due to regulations, feasibility, security, and lifestyle. However, the study also highlighted the inequality that arises between those living inside the walls and the surrounding neighbourhoods. The research solely focused on the residents' motives within the walls and did not delve into the effects of such developments on the adjacent areas.

Section 3 - Social, Spatial, and Economic Impact

Several researchers have argued different social, economic, and spatial impacts associated with developing gated communities. On the one hand, Roitman et al. (2010) argued that developing gated communities for the rich in a poor area will have an economic integration between both, as these communities may offer job opportunities for the poor people living outside the walls. However, Rafiemanzelat (2016) counter-argued this outcome and suggested that the key issues related to social features of gated communities are: segregation and fragmentation, exclusion and a sense of community. Rafiemanzelat (2016) found that gated communities have several impacts on the surrounding neighbourhoods, such as access limitation and social inequality. This may be further examined through a historical review of the Arabian City's key features, successful integration, and coherence to legislate design guidelines for the future gated communities, which will examine both hypotheses.

According to Wang et al. (2018), privatising urban areas could lead to a division of neighbourhoods and a separation of communities. In order to maintain balance, the public and private sectors need to work together to provide public amenities without forcing gated communities to open up. The study examined the perspectives of residents living in gated communities. However, it did not provide any suggestions for integrating them into their surroundings or compensating those who invested in living in a gated community.

In addition, Salim (2021) has argued that gated communities in Bahrain have impacted the city and created “double segregation”, as he suggested. His illustration was related to the segregation created between gated communities and the city and between two neighbouring gated communities, as location did not create socio-economic uniformity. Gated communities in the GCC (Gulf Corporation Council) differ from the international phenomenon since they cater to a specific segment of society: the professional expatriates working and residing in the GCC. These communities have created isolated islands within the city, providing a temporary housing solution. However, due to lack of demographic data, his study had limitations in assessing the impact of gated communities on a larger scale.

As it is clear from the literature review, some researchers have attempted to associate modern gated communities with the historical Arabian cities’ neighbourhoods, as highlighted by Glasze (2006), or by comparing gated communities with the cul-de-sacs concept seen in the Arabian courtyards as argued by Alkan Bala (2018). However, such studies were either limited to a specific geographical location or did not thoroughly compare the historical characteristics of old Arabian cities with modern gated communities. Henceforth, this article seeks to extract deep-rooted social and spatial interconnections from the old Arabian cities and compare them with modern gated communities to recommend thriving integrated gated communities with less social and spatial impact. Furthermore, several researchers emphasised on the social, economic, and spatial impact of gated communities by arguing significant impacts such as segregation, fragmentation, and exclusion. However, further studies are required to interpret how historical architectural trends can inspire the urban form of cities. (Salim 2021)

Method of Investigation

The literature review revealed the link between gated communities, social and spatial segregation, and their influence on nearby neighbourhoods. To better understand this connection, two types of investigations were conducted. Firstly, a historical inquiry examined gated neighbourhoods' cultural and social context in old Arabian cities. Secondly, a conceptual framework was developed to investigate segregation and separation in gated communities.

The method investigated the historical notion of gates, walls, and neighbourhoods in Arabian cities, their coherence and integration, and lessons learned from such developments. To understand the epistemological element of the research paradigm, it is imperative to investigate the knowledge of gated communities through understanding the history of old Arabian cities and their relationship with the surrounding, including history, social dynamics of the community, and their culture. (Kivunja and Kuyini 2017).

Furthermore, the conceptual framework has reviewed the segregation theory developed at the Chicago school (Goist 1971), focusing on the spatial distribution of different racial and ethnic groups within a city. This theory sought to explain why certain groups of people tend to live in specific neighbourhoods and how patterns of residential segregation emerge. Main key points and concepts extracted from the segregation theory:

- Ecological Perspective: The Chicago School embraced an ecological viewpoint, viewing the city as an ecosystem where various neighbourhoods fill specific ecological roles. According to their beliefs, neighbourhoods undergo growth, stability, and decline cycles, resulting in population shifts and alterations in social makeup.
- Concentric Zone Model: The concentric zone model, developed by the Chicago School, is a highly significant model. It effectively portrays the city as a collection of concentric circles, each representing a distinct land use and socio-economic status. Over time, these circles expand outward, leading to urban succession.
- Invasion and Succession: This theory proposes that neighbourhoods undergo a process of invasion and succession, whereby incoming groups "invade" and potentially displace prior residents. This leads to the spatial separation and segregation of various racial and ethnic groups.
- Social Disorganization: As explored by the Chicago School, the concept of social disorganisation highlights the breakdown of social ties and the weakening of communal bonds. According to their research, this phenomenon can lead to increased crime rates and other societal problems that can contribute to the decline of a neighbourhood.
- Segregation as a Result: Segregation patterns can arise due to ecological and social processes that tend to corral people of certain racial and ethnic groups into specific neighbourhoods. This can lead to geographic isolation, where different groups are separated.

It is essential to recognise that while the Chicago School theory served as a foundation for understanding urban segregation and dynamics, more recent research and scholarship have expanded and enhanced these theories. Present-day theories of segregation take into account factors such as institutional racism, economic inequalities, housing policies, and complex social interactions.

In Addition, the article has implemented inclusion and exclusion criteria for evaluating studies related to the social, economic, and spatial impact of gated communities on the surrounding neighbourhoods in the selected additional three cases (Saudi Arabi, Qatar, and Bahrain):
Inclusion criteria:

- Studies that focus on gated communities and their impact on the surrounding.
- Studies that analyse both social and spatial impact which will include a) social segregation and exclusion of non-gated community residents, b) changes in the social cohesion and community identity, c) perception of safety and security among residents, d) changes in the availability and accessibility of public spaces, e) impact on the property values and housing affordability in the surrounding neighbourhoods.
- Studies that consider the perspectives and experiences of both residents and non-residents of gated communities.

Exclusion criteria:

- Studies that do not focus specifically on social and spatial impacts on the surrounding neighbourhoods.
- Studies that only consider the perspective and experiences of residents of gated communities without considering the views of non-residents in the surrounding neighbourhoods.

Studies that only examine the impact of gated communities on a narrow range of outcomes, such as property value, without considering other social and spatial impacts.

Gated Communities' Impact

The development of gated communities has received academic attention among researchers, designers, and urban planners with contradicting viewpoints over their impact on Spatial, Economic, and social fabric. From their Spatial impact, negative and positive arguments were discussed among researchers. The availability of compatible infrastructure and services within those communities had a positive and influential impact, attracting people to prefer them among primary governmental offerings (Salcedo and Torres 2004). However, this positive spatial impact was within the gated community, reinforcing the lack of adequate infrastructure and services for people living outside the gates and fragmenting the surrounding urban space (Low 2001).

From the economic impact, this argument has always been on the developers' side since these developments create jobs for the poor and unskilled society surrounding the gated community (Salcedo and Torres 2004). Also, their significant impact on the prices of the surrounding plots is considered a positive economic impact; however, the increase in property value might lead to the displacement of existing residents as these areas will not be affordable anymore.

Gated communities and their social impact have been the subject of intense debate among researchers, who have conducted extensive case studies to understand their effects. While some studies have found that such communities can foster positive social relationships among residents and their surrounding environment (AlQahtany, 2022), others have countered this argument by providing evidence of the lack of community and equality within these communities (Roitman, 2010). Furthermore, those living outside of gated communities may perceive a sense of danger towards those inside, hindering interaction between the two communities. (Low, 2001)

Conclusion

In conclusion, the article highlights the significance of grasping the historical context of Arabian cities' neighbourhoods, where both separation and coherence were defining traits. It acknowledges the complex interplay between the attributes of old Arabian cities and the emergence of contemporary gated communities, suggesting opportunities for integration. Examining the multi-dimensional impacts of gated communities on surrounding neighbourhoods reveals noteworthy insights. To systematically address these impacts, the study employs a rigorous methodology. It initiates an extensive historical investigation into gated neighbourhoods in ancient Arabian cities, scrutinising their socio-cultural dynamics and coherence. This historical analysis establishes a foundation for understanding the relationship between traditional urban forms and modern gated enclaves. Additionally, the article incorporates a robust conceptual framework, drawing from the Chicago School's segregation theory. This framework guides exploring how spatial patterns manifest within the context of gated communities. The study also features a comparative study, analysing the rise of contemporary gated communities in Jordan, focusing on Amman. Through case study analysis, it explores the motivations and consequences of Jordan's first gated community. Rigorous inclusion and exclusion criteria ensure a thorough understanding of these impacts. In sum, this article contributes to bridging a crucial knowledge gap by shedding light on the emergence and implications of gated communities in Amman and their intricate interactions with surrounding neighbourhoods. By synthesising historical insights, urban theories, and meticulous analysis, the study aims to offer valuable recommendations for urban development models that harmoniously balance traditional coherence with modern urban dynamics.

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6th Langkawi International Multidisciplinary Conference 2023 (6th LIMC 2023)
eISSN 2976-3223
9th – 10th September 2023
Bayview Hotel, Langkawi, Malaysia

SUSTAINABLE TOURISM SOUVENIRS: FOSTERING CULTURAL HERITAGE PRESERVATION THROUGH LOCAL HANDICRAFT PRODUCT

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Abstract: *Study aims to investigate the relationship between cultural tourism and traditional handicraft experiences on local handicrafts product namely souvenir. It explores the significance of souvenir product through sustainable tourism practices and preserving cultural heritage. Qualitative approach used to analyse the tourism souvenir in the market and proposes a new recommendation to meet the demands. Literature review, interviews, and case studies are employed to explore a strategy for enhancing the commercial value of tourism souvenir. Interviews with master craftsmen, practitioners, and consumers provided insights the resource development, product innovation, production organization, and market positioning. It also obtained a good understanding of customer experiences related to local handicraft product for effective marketing strategies based on customer experiences. Finding indicates that the sustainability of tourism souvenirs plays crucial role in cultural heritage preservation, supporting the local economy, and enhancing overall tourism experiences for tourists as well as promoting traditional handicrafts, safeguarding indigenous knowledge, and facilitating cultural exchange between tourists and local artisans.*

Keywords: *New Product Development, Cultural Tourism, Handicraft Souvenirs, Cultural Heritage, And Design Innovation and Creativity*

1. Introduction

As global tourism continues to flourish, the significance of souvenirs and the preservation of cultural heritage has become crucial for the tourism industry. Handicrafts, cultural tourism, and souvenirs are integral components of the global tourism landscape, intertwined to offer enriching experiences for tourists while empowering local communities economically and culturally. Handicrafts represent valuable artifacts reflecting regional traditions and artistic expressions handed down through generations. However, with the rise of tourism, the function and form of traditional craft products have evolved, prompting artisans to adapt their crafts to cater to tourists' expectations for souvenirs (Torabian & Arai, 2016). Integrating these authentic and unique products into the tourism experience fosters deeper connections with local cultures. Cultural tourism has shifted the cultural object of tourism, with tourists seeking "authentic" elements of local culture and willingly paying a premium for these experiences (Richards, 2018).

Tourism souvenirs require a thoughtful presentation of cultural elements that align with market themes and local culture, effectively conveying their inherent value to tourists. Handicraft souvenir and cultural tourism development engage in a longstanding debate on the true nature of souvenirs as tangible cultural products or mere inexpensive, mass-produced objects. However, the role of souvenirs in the sustainable development of cultural tourism is garnering increasing attention (Paraskevaidis & Andriotis, 2015; Peach, 2007; Torabian & Arai, 2016; Tosun et al., 2007; Yu & Xu, 2019). As traditional handicraft products, souvenirs require protection and innovation to preserve cultural heritage, while tourism development necessitates the adaptation of cultural resources to meet market demands (Chen et al., 2022). Yet, the challenge of innovating from a cultural heritage perspective and effectively transforming traditional handicrafts into commercially valuable and marketable souvenirs often remains overlooked in academic discussions.

Handicrafts play a pivotal role in transforming cultural resources and contributing to the local economic development in tourist destinations. Limitation of creativity and a non-focused on demand for handicraft souvenir development has been become an issue due to less marketability. Hence, the objective of the study is to examine the relationship among handicrafts, cultural tourism, and souvenir development, with specific attention on the sustainability impact on cultural heritage conservation, cultural innovation, and commercial value.

2. Background of Study

2.1 Description of Cultural Tourism

Cultural tourism has long been acknowledged for its dual benefits, supporting culture while creating attractions for tourism. The definitional scope of cultural tourism remains a subject of debate, given the diverse and interpretable nature of both culture and tourism. This has led to various definitional approaches without achieving a consensus (Vergori & Arima, 2020). Nevertheless, it is widely accepted that cultural tourism serves as a seasonal resource and attracts tourists with higher daily spending, particularly on authentic local goods. The United Nations World Tourism Organisation (UNWTO) defined cultural tourism in 2017 as an activity in which travellers are primarily motivated to learn (Richards, 2018), discover, experience, and consume tangible and intangible cultural attractions and products of the destination (Wu & Lin, 2022). Approximately 39 percent of all tourism activities, cultural tourism includes both tangible and intangible heritage, contemporary culture, and creative industries. In China, cultural tourism has contributed to poverty eradication by stimulating tourism consumption, capital accumulation, and structural transformation through high-quality cultural tourism integration (Liu, 2022). However, researchers have expressed differing viewpoints, especially regarding issues of integration and religion in cultural tourism, where concerns about cultural resources may outweigh those about tourism (Hunter, 2020).

The impact of emerging technologies on the cultural tourism experience is also a subject of consideration. Cultural tourism predominantly centres around major tangible heritage sites and encompasses the cultural environment, including destination scenery, values, lifestyles, and local heritage assets. Tourists value the integration and utilization of destination resources in cultural tourism, ranging from physical and intellectual aspects to spiritual and emotional features, such as art, architecture, historical and cultural heritage, culinary heritage, literature, music, creative industries, living cultures, and traditions. Scholars have witnessed a gradual interest in the domain of cultural tourism and souvenirs, the interplay between cultural exploration through tourism and the acquisition of souvenirs has gained prominence as a subject of rigorous inquiry and examination. Simultaneously, scholarly also extends toward the sustainability dimension for souvenirs within the context of cultural tourism (Guo & Zhu, 2023; Soukhathammavong & Park, 2019). In addition, policymakers recognize the importance of integrating tourism with cultural and creative industries, the redesigning of tourism products is becoming a priority (Wu & Lin, 2022). Creating awareness of the value of cultural resources is crucial to foster meaningful synergies between tourism and culture. The prominence of intangible cultural heritage tourism research is also offering promising prospects for the development of corresponding to tourism industries.

2.2 Characteristics and Classification of Handicrafts

Handicraft is a term with multiple meanings, and its definition varies depending on the cultural and social context. Scholars have greatly studied the traditional handicrafts, and recognized them as significant drivers of cultural heritage and local economies (Husa, 2020; Sun et al., 2023; Yang et al., 2018). Handicrafts' historical, cultural, social, and symbolic values are closely linked to local development. Researchers agreed that handicrafts always integrate with tangible and intangible resources and various categories of handicraft products are produced in different regions (Sun et al., 2023). The importance of handicrafts to consumers increases beyond their practical functions and expression into aesthetic awareness. Besides that, the handicrafts also exhibit several distinct features that distinguish them from mass-produced industrial products, emphasizing their manual and skilled nature and their significance in cultural, artistic, and economic contexts.

Handicrafts can be classified into various categories based on criteria such as the materials used, the techniques employed, and the purpose or function of the craft. Material-based classifications include textile crafts, ceramics, metal crafts, wood crafts, and glass crafts. Technique-based classifications include woven crafts, pottery, ceramic embroidery, carved crafts, and paper crafts such as paper cutting. Purpose-based classifications encompass decorative crafts like sculptures and vases, functional crafts for everyday use, ceremonial, or religious crafts for religious or ceremonial purposes, and souvenirs and gifts crafted specifically for visitors or special occasions. Handicrafts are typically handmade and involve manual skills, craftsmanship, and meticulous attention to detail. This aligns with the concept of craft as a handicraft, emphasizing the process of creating craft products.

Products carry deep-rooted traditions and cultural significance, often passed down through generations to preserve cultural heritage and historical connections (Yang et al., 2018). It reflects on the creativity and aesthetic sensibilities of artisans, crafts convey cultural stories, symbols, and meanings. They frequently use natural materials like wood, clay, fiber, or metal, showcasing local characteristics and promoting sustainability. Furthermore, in the mass consumption and tourism era, souvenirs often form part of the tourism market supply, and traditional crafts serve as the foundation for creating authentic and culturally significant tourism souvenirs (Brennan & Savage, 2012). Local artisans leverage their expertise to handicraft souvenirs that embody the essence of the destination, incorporating elements of the region's culture, architecture, folklore, or natural beauty into the design.

2.3 Value and Innovation of Handicraft Souvenir

The purchase of souvenir is an important part of the travel experience, embodying both tangible elements of tourism consumption and intangible experiences (Naqvi et al., 2018). Through souvenirs, tourists can relive special moments and emotions associated with travelling and share aspects of a destination's cultural heritage with friends and family. Souvenirs carry the elements of local culture, including handicrafts, artifacts, traditional clothing, cuisine, and symbolic objects, and provide tourists with insights into local customs, artistic expressions, and historical heritage, promoting cross-cultural understanding and appreciation. They play a vital role in preserving and promoting the cultural heritage of a destination. They embody cultural knowledge, stories, and practices passed down from generation to generation in the same way as traditional craft products, making artisans and local communities key players in their production and in enhancing the sustainability of local economies and cultures (Duan et al., 2023; Shafi et al., 2021). Overall, souvenirs are of great value in enhancing the travel experience, preserving cultural heritage, supporting local economies, and promoting responsible and sustainable tourism practices. However, the mass production of generic souvenirs poses a challenge to the process of cultural transmission and diminishes their cultural significance.

Sustainable tourism practices, therefore, promote the use of authentic, locally made souvenirs, which requires that the process of souvenir development and design seeks to preserve classic elements while employing innovative forms of cultural creativity to ensure that tourists have a meaningful connection with the culture of the destination. Cultural innovation in souvenirs can be found around the world. Innovation of cultural handicraft souvenirs involves creativity to give authenticity and connection to the purpose. it increases value and attractiveness of handicraft souvenirs for tourists while supporting the preservation and promotion of local traditions and crafts. For example, In Japan, local artists have redesigned traditional wooden wasabi dolls with contemporary designs, giving them a modern twist while preserving their cultural significance. Meanwhile, in Peru, traditional textiles and designs have been incorporated into contemporary fashion items such as scarves and bags, attracting travellers who love both history and fashion.

2.4 Souvenirs, Handicrafts, and Cultural Tourism

Souvenirs and handicrafts play a vital role in cultural tourism, serving as a tangible bridge connecting tourists with the cultural identity of their destination. In the context of cultural tourism, the act of souvenir shopping differs from typical home shopping, as tourists seek mementos to concretize and preserve memories of their journey (Hu & Yu, 2007). Therefore, understanding the rationale behind travellers' souvenir purchasing behaviour becomes crucial. However, traditional crafts and souvenirs, as embodiments of local cultural heritage, face challenges such as homogenization and over-exploitation (Duan et al., 2023). Preserving the value of traditional crafts in souvenir making becomes imperative to safeguard their cultural significance.

Peach (2007) argues that tourism generates demand for local craft products consumed as souvenirs, emphasizing the importance of culturally integrated and authentic souvenirs that reflect the destination's local identity and the tourists' experiences. Each souvenir holds unique meanings for individual tourists, prompting them to seek genuine and distinctive handicrafts as integral parts of their complete journey. Consequently, continued support for local aboriginal communities in producing and selling authentic crafts and souvenirs is essential for enhancing tourist experiences and satisfaction. The production and consumption of authentic souvenirs can contribute to sustainable cultural tourism. The synergies between handicrafts, cultural tourism, and souvenirs are crucial for fostering cultural exchange, preserving cultural heritage, and driving regional economic development in tourist destinations. The thriving tourism industry presents opportunities for the transformation of traditional crafts and artisans. Simultaneously, supporting local handicrafts through cultural tourism and souvenir purchases contributes to the preservation of traditional handicrafts, generates employment opportunities, and promotes sustainable development for the destination (Tosun et al., 2007).

3. Material and Method

A qualitative method was adopted to conduct semi-structured interviews in Zibo, Shandong Province, China, spanning from February 2023 to July 2023. Interviews were held at various locales including attractions, souvenir shops, and coffee houses, tailored to the preferences of the interviewees. The interviewees encompassed tourists and artisans, with most interviews lasting around 10 minutes. The duration was chosen to grasp their overall travel plans, motivations for visiting Zibo, and perceptions of souvenirs and purchasing preferences. The intention behind this approach was to capture the genuine thoughts of visitors without impacting their travel experience. Importantly, informed consent was secured from all interviewees before the interviews commenced. These participants were duly apprised of the interview's purpose and willingly agreed to partake in the discussions.

Interviews with tourists commonly commence by inquiring about their travel plans, setting the stage for discussions regarding souvenir acquisition, including motivations for such purchases. Following this, a series of queries are posed with the intent of uncovering the allure of the souvenirs. In addition, respondents organically delve into their preferences, expounding on specific attributes of the souvenirs that resonate with them. The exploration extends to examining the degree of synergy between these souvenirs and local traditional crafts, or how they symbolize distinctive facets of the destination. Conversely, interviews with craftspeople follow a divergent trajectory. The line of questioning covers the interviewees' backgrounds, motivations for embarking on traditional handicrafts, intricate details of their craft practice, the perceived value of souvenirs, and their strategies for promoting their wares within cultural tourism contexts. These inquiries are purposefully designed to elicit artisans' articulation of their viewpoints regarding traditional craftsmanship. The focus subsequently shifts to queries like, "In your perspective, do these souvenirs authentically embody Zibo culture?" and other comparable questions. Throughout these Interviews, the researcher documented moments of tourists engaging in souvenir purchases through photography and recorded observations during or after post-interviews.

4. Result and Discussion

By preserving and promoting traditional handicrafts and souvenir it can enhance the economic growth through a unique and authentic destination. In this study, the literature review offers intense information related to the subject and gain inclusive perception of culture and tourism.

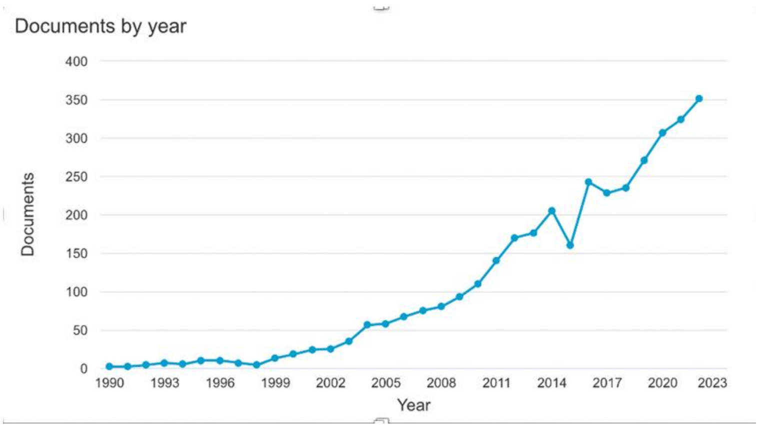

Figure 1: Cultural tourism and souvenirs publications 1990-2022

Source by Scopus

Figure 1 show the cultural tourism and souvenir study. Since 1990, cultural tourism has been significant topic and increasing until nowadays. It involves analysing by scholars, researchers' industry, etc., to explore from variety perspective of cultural tourism and souvenir. The exploration includes benefits, challenges, trends, and impacts of cultural tourisms and role of souvenirs as artisanal consumer goods in supporting the regional economic and cultural sustainability.

4.1 Zibo Tourism Industry and Souvenir Product

Clarifying the symbiotic relationship between tourism, cultural heritage, and handicraft products is crucial in Zibo handicraft products. Zibo, a city in Shandong Province, China, is renowned for its rich cultural heritage and traditional handicrafts. Zibo's booming tourism industry attracts many domestic and international tourists. The surge in tourism has naturally led to high demand in the souvenir market as tourists seek tangible mementos to encapsulate their travelling experience. With a rich cultural heritage spanning over a thousand years, Zibo has laid a solid foundation for nurturing a thriving souvenir industry that authentically showcases its traditions, crafts, and local arts. Known for its traditional handicrafts such as ceramics, Boshan glaze, paper-cutting, willow weaving, and wood carving, Zibo has the potential to transform these artistic expressions into unique and authentic souvenirs. At the same time, the success of the products depends on innovations in design and production techniques that emphasise the competing cultural identities embodied in these souvenirs. Exploration involves the integration of sustainable practices, a move that resonates with environmentally conscious tourists and enhances the appeal of these souvenirs.

As the focus on cultural tourism continues to grow, so does the demand for souvenirs that embody the essence of Zibo's cultural heritage. These souvenirs can significantly enhance tourists' understanding of and connection to local culture. However, development must be accompanied by several challenges. These include protecting the authenticity and quality of souvenirs, ensuring that artisans are compensated, and skilfully marketing and promoting tourist souvenirs to a wider audience. Zibo's souvenir industry has the potential to become not only a source of valuable souvenirs for tourists, but also a powerful channel for preserving and promoting the city's cultural heritage. By capitalising on its unique handicrafts and cultural treasures, Zibo can become a unique and fascinating cultural tourism destination. The synthesis of authenticity, innovation, emotional value, and sustainability can propel Zibo into a distinctive and compelling destination, enriching both the visitor experience and the local community. It can be imperative for stakeholders, including artisans, businesses, and policymakers, to collaborate in crafting a future that celebrates the legacy of traditional crafts while embracing the dynamism of contemporary tourism.

4.2 Sustainable Tourism Souvenir

Interviews with master craftsmen, practitioners, and tourist has been provided new insights of traditional handicraft product specifically on the commercial value as tourism souvenir. In this study presents three (3) key recommendations 1) introducing new concepts and opportunities in the cultural tourism market, 2) establishing a direct link between local traditional crafts, creative tourism, and experiential offerings, and 3) promoting traditions that contribute to local development. The outcomes underscore the potential of souvenirs in fostering sustainable cultural tourism practices and encourage stakeholders to embrace innovative approaches to preserve cultural heritage and promote community well-being. Furthermore, there are three (3) others significant issue that should take into consideration by designer and industry during the design and development of traditional culture handicraft product are:

a) Consumer Preferences for Handicraft Souvenirs

In recent years, there has been a clear preference for authentic, locally made souvenirs. Travellers are increasingly inclined to opt for unique and meaningful souvenirs that truly reflect the essence of the region. This trend has sparked a renaissance in traditional crafts, offering unique alternatives to mass-produced, generic items. Souvenirs rooted in traditional crafts play a pivotal role in preserving cultural heritage. However, the souvenir industry faces the contemporary challenge of balancing authenticity with modern design and production techniques. Combining sustainable practices with innovative design can help keep these crafts relevant in a fast-moving world. Notably, customised souvenirs are gaining traction as younger generations are placing more emphasis on spiritual experiences.

b) Shaping Emotional Connections

Souvenir design continues to evolve, incorporating advanced technology and modern aesthetics while retaining cultural authenticity. Researchers are exploring how innovative design can enhance the appeal of souvenirs to modern tourists. Participation in cultural tourism promotes emotional connections and lasting memories. These experiences provide travellers with the opportunity to learn about different customs, traditions, and lifestyles, enriching their journey by broadening their horizons and promoting cross-cultural understanding. These emotional bonds often lead to positive word-of-mouth recognition and the sharing of experiences through various platforms, thus contributing to the promotion and reputation of the destination, which in turn boosts the regional economy.

c) Integration of Sustainable Concepts

The integration of sustainable concepts permeates all areas of cultural tourism, craft heritage, and souvenirs, injecting a new sense of mission and responsibility into these areas. Modern travellers are increasingly aware of the ecological and social impact of their actions. Travellers seek immersive experiences that enrich their understanding of local cultures and traditions. Souvenirs that are ethically produced, culturally recognised, and environmentally responsible have a special appeal to conscious consumers. Sustainable production of souvenirs must focus on environmentally friendly materials, waste reduction, and environmentally conscious production processes that provide direct economic benefits to local communities. Sustainability, a pervasive theme in modern tourism, assumes a central role in the souvenirs and traditional crafts ecosystem. Ethical considerations and environmentally conscious practices resonate with conscientious travelers, elevating the appeal of souvenirs that carry cultural weight and leave a minimal ecological footprint. This integration of sustainability reinforces the symbiotic relationship between cultural heritage, economic prosperity, and responsible tourism.

5. Conclusion

In conclusion, the intricate interplay between cultural tourism, sustainable souvenirs, and traditional handicrafts has unveiled a dynamic tapestry of opportunities and challenges. As tourist destinations become increasingly saturated and commercialized, the quest for authentic cultural experiences has become a pivotal driver for travelers. This shift has elevated the role of souvenirs and traditional crafts, transforming them from mere keepsakes into potent vessels that encapsulate the essence of a destination. The preference for authentic, locally made souvenirs reflects a profound desire among modern travelers to forge genuine connections with the places they visit. This trend has reignited interest in traditional crafts, breathing new life into time-honored practices and fostering cultural preservation. However, this resurgence comes with the imperative to strike a delicate balance between authenticity and contemporary design, a challenge that underscores the need for innovation and sustainable practices. it is worth noting that the growing inclination towards customized souvenirs speaks to the evolving expectations of younger generations, who seek not only physical tokens but also spiritual and emotional connections. It provides a tangible representation of personal journeys, embedding souvenirs with deeper significance and resonance.

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6th Langkawi International Multidisciplinary Conference 2023 (6th LIMC 2023)
eISSN 2976-3223
9th – 10th September 2023
Bayview Hotel, Langkawi, Malaysia

Durio dulcis: AN EXPLORATION ACROSS ECOLOGY, NUTRITIONAL, VOLATILE AND FLAVOUR PROFILING

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Abstract: *Sarawak is recognized for its remarkable biodiversity, serving as the home to 16 unique* Durio *species. Among these, one locally known as Tutong or* Durio dulcis Becc. *shines as a unique variety. While the common durian,* Durio zibethinus, *is rich with nutrients properties encompassing dietary fibre, vitamins, minerals and also a source of healthy fats, the wild edible* D. dulcis *remains relatively unexplored and sparsely documented. Therefore, this study aims to fill the knowledge gaps, delving into its ecology, nutritional content, phytochemical attributes, sugar and fatty acid profiling, and its volatile compounds relation to the sensory. Two genotypes of* D. dulcis *were collected at the northern region of Sarawak. This species observed to occurs wild in lowland tropical rainforests and found scattered in mixed dipterocarp forest along the riverside. This fairly large, evergreen tree produce fruits with yellow flesh and vibrant red exocarp. Findings on proximate analysis revealed that a hierarchy of components in* D. dulcis, *with moisture > carbohydrate > fat > fiber > protein > ash. Notably, both genotypes exhibited a significant presence of sucrose ranging from 67.38%-67.42%, followed by glucose (13.26%-13.51%) and fructose (11.83%-12.80%). The trend of macronutrients content in both genotypes categorically as potassium > phosphorus > magnesium > sodium > calcium while for micronutrients, iron > zinc >copper > magnesium was among the prevailing elements. The genotypes of* D. dulcis *showed robust bioactive properties, highlighting potent antioxidant attributes that those of* D. zibethinus. *It was found that half of the fatty acids was saturated (49.62%), and the other half was unsaturated (50.38%), slightly higher in composition. For the volatile compounds, a sum of 10 esters, 5 alcohols, 5 ethers, 3 aldehydes, 3 ketones and one sulphur-containing compounds were detected.* Durio dulcis *was described as the most pungently scented among Durio species, a characteristic attributed to its elevated content of butanoic acid, 2-ethyl-, ethyl ester and 2-butenoic acid, 2-methyl., ethyl ester. There are enormous potential of* D. dulcis *to diversifying our sources of nutrition. As an indigenous fruit,* D. dulcis *stands as a valuable resource fostering collaborative research, cultural preservation, and sustainable practices leading to benefits for nutrition, culture, agriculture and biodiversity.*

Keywords: *Durio dulcis, Indigenous fruits, Sarawak, Wild durians*

Introduction

Among the 16 unique *Durio* species, *Durio dulcis* or locally known as Tutong that residing in Sarawak's lowland tropical rainforests (Lim, 2012), yielding edible fruit (Uji, 2005), stands out for possessing the most pungent aroma among the *Durio* species. *Durio dulcis* holds promise as a reservoir of exotic fruits, exhibits distinctive attributes (Sujang et al., 2023). Despite having relatively thin flesh and strong aroma, Tutong stands out for its sweet-tasting flesh with bright red rind and lengthy thorns (Choo, 1991). Unfortunately, the presence of *D. dulcis* trees in Sarawak's forests has becomes increasingly scarce (Lim, 2012) and they are also listed as vulnerable in the IUCN Red List of Threatened Species (IUCN, 2023). This presents a significant gap in exploration and documentation concerning *D. dulcis*. In this context, this present study directs its focus towards unravelling its ecology, nutritional content, phytochemical attributes, and its volatile compounds relation to the sensory. Through these efforts, the study seeks to a more comprehensive understanding of *Durio dulcis* and advocate for its conservation in light of its rising rarity and vulnerability.

Materials and Methods

Durio dulcis fruit samples were gathered from the Tatau district (N2°45'47.88", E112°57' 43.92") and Bekenu (N4°3'29.47", E113°50' 39.09"). *Ex-situ* and *in-situ* observations were conducted to examine the ecology and plant morphology. The morphology of the fruits was described based on Descriptors Durian (*Durio zibethinus*) (Bioversity, 2007). The edible flesh was separated from the seeds and subjected to standard AOAC protocols to assess its nutritional, mineral and phytochemical properties, while sugar content analysis conducted using high-performance liquid chromatography (HPLC) (Shaffiq et al., 2013). The volatile organic compounds were detected using solid phase microextraction (SPME) coupled with gas chromatography-mass spectrometry (GC-MS). Quantitative Descriptive Analysis (QDA) was used to evaluate the sensory attributes using trained panellists. All the data were statistically analysed by unpaired T-test using SAS window program 9.4.

Results and Discussion

Ecology

Durio dulcis observed to be found on ridge and crest of sandstone hill forest or also in swampy forest to 100 m altitude in Sarawak (Idris, 2011). Based on our sampling, the two genotypes of *D. dulcis* were observed still occurring wild in primary or secondary forests. The *D. dulcis* tree observed at Bekenu was grow at hilly forest area (Figure 1a) while at Tatau, the tree observed to grow at hilly and swampy forest area (Figure 1b, c).

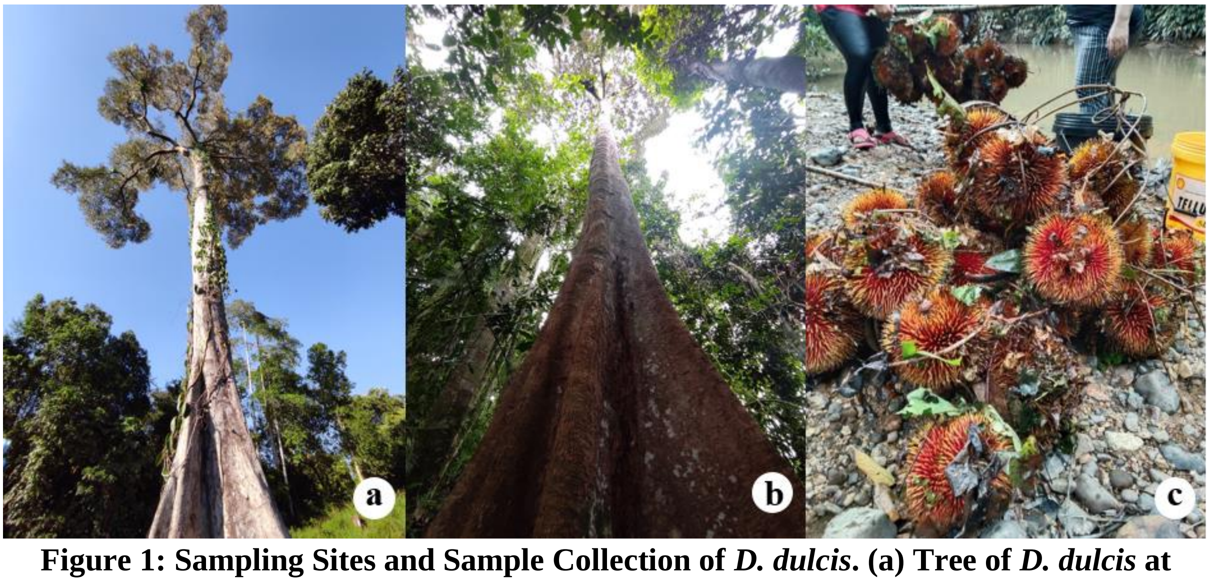
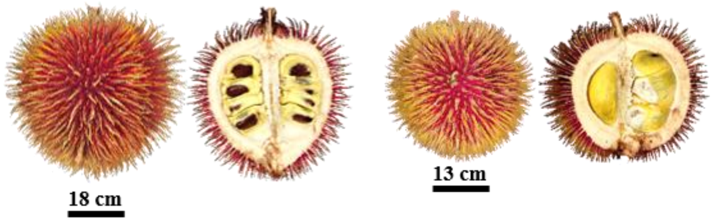


Figure 1: Sampling Sites and Sample Collection of *D. dulcis*. (a) Tree of *D. dulcis* at Bekenu (b) Tree of *D. dulcis* at Ulu Anap, Tatau. (c) Fruit collection at Ulu Anap, Tatau.

Morphology of Durio dulcis

Durio dulcis is the most attractive in *Durio* species with its bright red pericarp with long, sharp conical shape thorns (Table 1). Unlike its striking outer appearance, its arils range from pale yellow to yellow, where the genotype found in Tatau district, Tutong 1 (T1), exhibit pale yellow flesh while genotype found in Bekenu district, Tutong 2 (T2), have bright yellow flesh. Both genotypes showed same fruit shape, oblate to globose with truncate or convex base shape. It is very difficult to open the fruit, which requires a machete to cut it into half (cross-section method of splitting), as demonstrated by local consumer. The fruit of T1 was bigger in size and two times heavier than the T2 gentoype. The T1 genotype almost having the same size compared to the commercial varieties, *D. zibethinus*, commonly, 13-16 cm wide 15-25 long with approximately 3 kg in weight (Wisutiamonkul et al., 2017). *Durio dulcis* genotypes exhibited lesser aril thickness, range 0.50-1.21 mm, than commercialized *D. zibethinus* clones of D24 (24.00 mm), D168 (22.60 mm), and D190 (21.70 mm) (Ariffin et al., 2019).

Table 1: Morphology of The *Durio ducis* Genotypes in Sarawak



Genotypes	Tutong 1 (T1)	Tutong 2 (T2)
Fruit shape	Oblate to globose	
Base shape	Truncate to convex	
Easiness splitting	Difficult	
Spine shape	Conical	
Pericarp colour	Red to dark red	
Aril colour	Pale yellow	Yellow
Length (cm)	17.40 ± 0.42***	12.00 ± 0.94***
Width (cm)	18.80 ± 0.45*	13.60 ± 1.78*
Weight (g)	1265.2 ± 142.3***	574.2 ± 185.1***
Aril thickness (mm)	1.21 ± 1.20ns	0.50 ± 0.13ns

Mean comparison p<0.05*, p<0.01**, p<0.001***, ns = not significant.

Proximate analysis and physicochemical properties of Durio dulcis *genotypes*

The results of the proximate analysis and physicochemical properties of *D. dulcis* genotypes were shown in Table 2. For both genotypes, there is no significant differences (p<0.05) were observed in the proximate analysis and physicochemical properties except for pH value. Proximate analysis of the flesh of *D. dulcis* genotypes showed that the fresh fruit has a moisture range from 54.62 ± 1.40% to 55.29 ± 2.63%, ash range from 1.41 ± 0.08% to 1.64 ± 0.28%, fiber range from 4.11 ± 0.05% to 4.04 ± 0.08%, fat range from 7.23 ± 0.20% to 7.63 ± 0.46%, protein range from 2.03 ± 1.98% to 2.04 ± 1.99& and carbohydrate rangeing from 29.37 ± 2.94% to 30.60 ± 1.51%. Previous study by Susi (2017) reported that *D. dulcis* have 56.32% moisture content, 7.18% fat content, 1.30% ash content which is inaccordance with the present study. Comparatively, the fat content of *D. zibethinus* varities of D24, Udang merah and Durian kampung, reported by Isa et al (2019), was three times lower to the fat content of these *D. dulcis* genotypes. There was significant difference (p<0.05) in pH value of *D. dulcis* genotypes where it is slightly acidic, with a range of 6.10 to 6.22. However, contradict to the result of *D.*

zibethinus varities reported by Isa (2019) where the *D. zibethinus* varities, D175 and D24, have neutral to slightly alkaline pH value (7.35 to 7.88).

Table 2: Proximate and Physicochemical Properties of *Durio dulcis* Genotypes in Sarawak.

	Proximate						Physicochemical		
	MC (%)	Ash (%)	Fiber (%)	Fat (%)	Protein (%)	Carbs (%)	pH	TSS (^{O}Brix)	TTA (%)
T1	54.62 ± 1.40	1.41 ± 0.08	4.11 ± 0.05	7.23 ± 0.20	2.04 ± 1.99	30.60 ± 1.51	6.19 ± 0.03	27.33 ± 0.76	0.20 ± 0.07
T2	55.29 ± 2.63	1.64 ± 0.28	4.04 ± 0.08	7.63 ± 0.46	2.03 ± 1.98	29.37 ± 2.94	6.12 ± 0.03	28.00 ± 1.80	0.27 ± 0.06
F value	3.51	12.26	2.82	5.50	1.00	3.79	1.00	5.57	1.33
$LSD_{0.05}$	ns	ns	ns	ns	ns	ns	*	ns	ns

Abbreviation: T1= Tutong 1, T2 = Tutong 2, MC= Moisture Content, Carbs= Carbohydrate, TSS = Total Soluble Solid, TTA = Total Titratable Acidity.
Mean comparison p<0.05*, p<0.01**, p<0.001***, ns = not significant.

Mineral content of Durio dulcis *genotypes*

There is no mineral details reported on *Durio dulcis* on previous study. The trend of macronutrients and micronutrients in *D. dulcis* genotypes was categorically as, K > P > Mg > Na > Ca and Fe > C > Zn > Mn, respectively (Table 3). However, the concentration of minerals content varied between *D. dulcis* genotypes. Comparatively to *D. zibethinus* cultivar, D123 (Aziz *et al*., 2019) and monthong (Haruenkit *et al*., 2010), the *D. dulcis* genotypes having higher concentration in macronutrients but similar in concentration of micronutrients. *Durio dulcis* genotypes contain significantly high amount of K, ranging from 785.67 ± 0.25 to 901.83 ± 0.84 mg/100 g DW, similar to other varieites of *D. zibethinus*, within range of 800-1100 mg/100 g DW (Hasmadi *et al*., 2021). This potassium content meets around 15-20% of our daily requirement and contributes to healthy bone development (Tan and Asohan 2021).

Table 3: Mineral Contents in *Durio dulcis* Genotypes in Sarawak.

	Macronutrients (mg/100 g)				Micronutrients (mg/100 g)				
	K	P	Mg	Na	Ca	Cu	Fe	Zn	Mn
T1	901.83 ± 0.84	502.05 ± 15.57	71.17 ± 0.58	31.82 ± 0.10	10.73 ± 0.03	1.25 ± 0.02	2.25 ± 0.12	1.36 ± 0.03	0.71 ± 0.04
T2	785.67 ± 0.25	554.50 ± 23.34	79.33 ± 8.28	28.19 ± 2.56	9.07 ± 0.19	1.09 ± 0.01	2.84 ± 0.13	1.44 ± 0.03	0.51 ± 0.02
F value	11.11	2.25	205.75	706.07	38.11	7.00	1.07	1.00	3.00
$LSD_{0.05}$	***	*	ns	ns	**	***	*	*	*

Abbreviation: T1= Tutong 1, T2 = Tutong 2, K = Potassium, P = Phosphorus, Mg = Magnesium, Na = Sodium, Ca = Calcium, Cu = copper, Fe = Ferum, Zn = Zinc, Mn = Manganese.
Mean comparison p<0.05*, p<0.01**, p<0.001***, ns = not significant.

Sugar content of Durio dulcis *genotypes*

The total sugar of *D. dulcis* range from 21.90 ± 0.16 to 22.20 ± 0.11 g/100 g (Figure 2). Sucrose was the predominant sugar in *D. dulcis* (67.38-67.42%), followed by glucose (13.26-13.51%), fructose (11.83-12.80%) and maltose (6.26-7.63%). The D. dulcis flesh possessed slight higher sugar content then the many other *D. zibethinus* cultivars, ranging from 7.52 to 19.97 g/100 g with predominant by sucrose (Aziz and Jalil, 2019). Generally, all the durian varieties contain high sugar and carbohydrate level and should be consume in limited amount on a daily basis (Thiyajai *et al*., 2020).

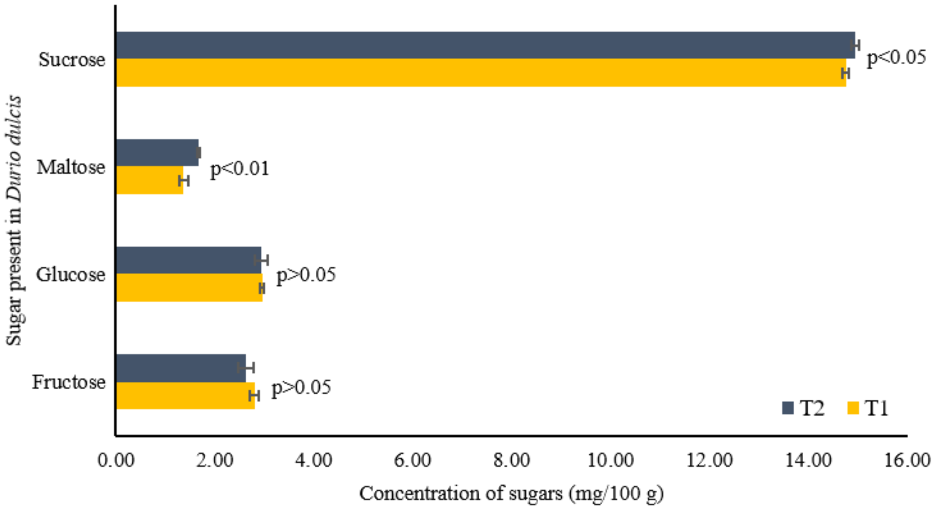


Figure 2: The Sugar Contents of The Two Genotypes of *Durio dulcis* in Sarawak.

Phytochemical properties of* Durio dulcis *genotypes

The phytochemical ptroperties of *D. dulcis* are presented in Table 4. The ascorbic acid content of *D. dulcis* ranging from 45.38 ± 3.03 mg/ 100 g to 45.99 ± 1.29 mg/ 100 g showed that these genotypes having slightly higher ascorbic acid than the *D. zibethinus* cultivars, D24 (37.29 mg/100 g) (Aziz *et al*., 2019). The lower total carotenoid value (0.38-0.40 x10^{-5} kg/kg FW) in *D. dulcis* is expected due to its dull flesh colour. The phenolic and flavonoid contents in this study were within the range of Ashraf *et al.* (2011), where *D. zibethinus* cultivars of D11, Chaer Phoy, and Yang Kang clones exhibited content ranging from 69.06-99.83 mg GAE/100 g for TPC and 21.13-22.03 mg QE/100 g for TFC. Phenolic and flavonoid contents can vary due to species, genetics, climate, developmental stages, cultivation stages, and analytical methods used for measurement (Hum *et* al., 2005; Pineli *et al*., 2011). Concerning the antioxidant properties among the *D. dulcis* genotypes, only the FRAP sshowed higher significant values at $p<0.01$. The lower the EC_{50} values, the stronger the antioxidant properties. Concurrently to its dull flesh colour, it possessed low antioxidant activity of DPPH and ABTS as it had high value to scavenge the DPPH (ranging 8.29 ± 0.67 to 9.37 ± 0.36 mg/mL) and ABTS (ranging 8.29 ± 0.67 to 9.37 ± 0.36 mg/mL) radical. The DPPH content in *D. zibethinus* reported by Aziz *et al.* (2019) have a range from 3.82 to 53.86 mg/mL which the present DPPH value was within the reported range. This can be a prove that *D. dulcis* having similar potential as the common durian cultivars for harnessing phytochemicals with potential nutraceutical and functional food additive applications.

Table 4: Phytochemical Properties of *Durio dulcis* genotypes in Sarawak

	AA[a]	TC[b]	TPC[c]	TFC[d]	FRAP[e]	DPPH[f]	ABTS[f]
T1	45.38 ± 3.03	0.40 ± 0.02	72.48 ± 4.60	13.81 ± 4.55	1.68 ± 0.04	8.29 ± 0.67	12.24 ± 0.03
T2	45.99 ± 1.29	0.38 ± 0.01	67.95 ± 1.67	8.71 ± 1.76	1.37 ± 0.09	9.37 ± 0.36	14.71 ± 1.16
F value	5.50	7.00	7.56	6.67	5.62	3.53	1302.19
$LSD_{0.05}$	ns	ns	ns	ns	**	ns	ns

Concentration: [a]: mg/100 g, [b]: x10^{-5} kg/kg FW, [c]: mg GAE/100 g, [d]: mg QE/100 g, [e]: µM/g, [f]: mg/mL.

Abbreviation: T1= Tutong 1, T2 = Tutong 2, AA = Ascorbic acid, TC = Total Carotenoid, TPC = Total Phenolic Content, TFC = Total Flavonoid Content, FRAP = Ferric Reducing Antioxidant Power Assay, DPPH = DPPH Radical Scavenging Activity, ABTS = ABTS Radical Scavenging Assay.
Mean comparison p<0.05*, p<0.01**, p<0.001***, ns = not significant.

Volatile organic compounds (VOCs) and sensory of **Durio dulcis** *genotypes*

The identified volatiles and their relative amount in *D. dulcis* genotypes are presented in Figure 3a and 3b. A total of 27 VOCs were identified in the genotypes, comprising 5 alcohols (16.55% to 17.10%), 3 amines (1.42% to 1.46%), 10 esters (65.00% to 65.41%), 5 ethers (2.93% to 3.01%), 2 ketones (3.36% to 5.18%), one sulphur (1.60% to 2.19%) and aldehyde (6.84% to 7.95%). Esters were the major compounds in *D. dulcis* genotypes, where butanoic acid, 2-methyl-, ethyl ester is the dominant ester compound with relative amount ranging from 1234.72-1467.11, which described as giving fruity and wine-like odour (Good Scent; Burdock, 2016). Ethanol and 1-propanol, 2-methyl- were alcohol compounds that have the highest amount among the alcohol compounds with relative amount ranging from 157.26-217.52 and 173.55-181.00, respectively. Ethanol compound was described giving vinous odour (Good Scent; Burdock, 2016) while 1-propanol, 2-methyl- compounds contributing to sweet and musty aroma (Good Scent; Burdock, 2016). 5-hydorxymethylfurfural is an aldehyde compound that detected as the third major compound, that giving chamomile or floral scent *D. dulcis* genotypes with 224.72 to 272.89 of relative amount. The mixture of these three major VOCs might explain the strong aroma that often described as pungent smell of *D. dulcis*. The present study was relevant according to Sujang *et al* (2023), where ester compounds were also reported as major compounds following by alcohol compounds that detected in wild edible durians that present in Sarawak. The sensory evaluation by the 15 trained panellists were presented in Figure 3c. The *D. dulcis* genotypes having high score in a good combination of sweet and creamy tastes. In the terms of aroma, *D. dulcis* possessed a higher sweet, fruity, sulphur and alcohol aroma and least in nutty aroma which *D. dulcis* that have high concentration of alcohol compounds that can exhibit floral, fruity or herbal aromas (Gamero *et al.*, 2020).

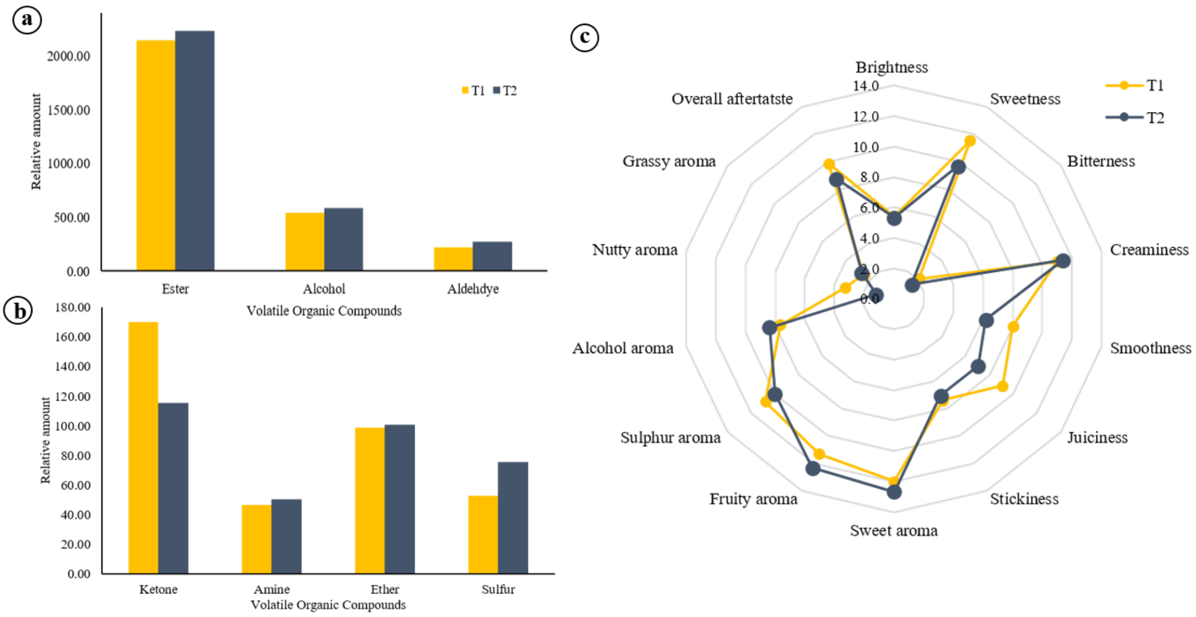


Figure 3: The Relative Amount of Volatile Organic Compounds and The Sensory Attributes of The *Durio dulcis* genotypes .

Conclusion

In conclusion, as the unique indigenous fruit that present in Sarawak which facing the threat of rarity and vulnerability, this finding revealed that *Durio* dulcis has a great potential in diversifying our source of nutrition and economic prospects. Thus, it is important to emphasize the conservation efforts to preserve its unique attributes and potential benefits for nutrition, agriculture and biodiversity.

Acknowledgement

Thank you to the Ministry of Higher Education Malaysia under the Fundamental Research Grant Scheme FRGS/1/2020/STG03/UPM/02/10, Universiti Putra Malaysia for the facilities and the durian growers who helped us throughout this research. Grateful thanks to Sarawak Biodiversity Centre for granting approval (JKM/SPU/608-8/2/1 Vol.3) for our research on indigenous durians in Sarawak.

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6th Langkawi International Multidisciplinary Conference 2023 (6th LIMC 2023)
eISSN 2976-3223
9th – 10th September 2023
Bayview Hotel, Langkawi, Malaysia

STAGNATION-POINT FLOW AND HEAT TRANSFER OVER AN EXPONENTIALLY STRETCHING/SHRINKING INCLINED PLATE IN A MICROPOLAR FLUID

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Abstract: *Study investigates the characteristics of fluid flow and heat transfer over an exponentially stretching/shrinking inclined plate immersed in a micropolar fluid. The micropolar fluid model considers additional rotational effects of microelements within the fluid, making it suitable for describing complex fluid behaviour encountered in various industrial and engineering applications. Using similarity variables, the governing equations for fluid flow and heat transfer are transformed from Partial Differential Equations (PDEs) to Ordinary Differential Equations (ODEs). The ODEs are numerically solved using MATLAB software with BVP4c, and the results are compared with previous findings, showing good agreement. The effects of key parameters such as plate inclination angle, stretching/shrinking rate, and micropolar fluid parameters are examined. Notably, the micropolar parameter significantly influences the skin friction for both stretching and shrinking flows. An increase in the micropolar parameter leads to increased skin friction for stretching flows, while for shrinking flows, the skin friction decreases within a specific range of stretching/shrinking values. The behaviour of the local couple stress becomes complex as the micropolar parameter increases. Additionally, the local Nusselt number decreases as the micropolar parameter increases for shrinking flows, indicating a reduction in heat transfer from the solid surface during shrinking flow. Moreover, an increase in the Sherwood number suggests a relatively slower rate of mass transfer compared to momentum transfer. These findings offer valuable insights into the behaviour of micropolar fluids over exponentially stretching/shrinking inclined plates, providing guidance for optimizing heat transfer and fluid flow in practical engineering systems.*

Keywords: *Micropolar Fluid, Inclined Plate, Stretching/Shrinking, Heat Transfer, Stagnation*

Introduction

The study focuses on the flow and heat transfer characteristics of a micropolar fluid over an exponentially stretching/shrinking inclined plate with an emphasis on the stagnation-point region. Magneto-Hydro Dynamic (MHD), radiation and concentration also taken into account. Micropolar fluids exhibit unique behaviour due to additional microstructural properties, such as rotations and higher-order gradients. Stagnation-point flow and heat transfer phenomena are of significant interest in fluid dynamics and heat transfer research due to their wide's applications in various engineering and industrial processes. The exponentially stretching/shrinking plate offers variable deformation effects, making it an interesting case for investigation.

The study formulates and solves the governing equations for micropolar fluid flow and energy transfer. Exploring the complex interplay between micropolar fluid effects, plate deformation, and inclination angle will be interpret using graph. Similarity variables were employed to turn the governing partial differential equations (PDEs) into ordinary differential equations (ODEs). The amended equations were then numerically solved in MATLAB using BVP4c. The outcomes of this research have potential applications in advanced cooling techniques, materials processing, and boundary-layer control strategies in non-Newtonian fluid systems.

Furthermore, understanding micropolar fluid behaviour in complex geometries provides insights into fundamental aspects of fluid dynamics and heat transfer in non-Newtonian systems, contributing to the broader knowledge in this interdisciplinary field. The results gained will be beneficial for applications and as a supplement to prior research.

Literature Review

Micropolar Fluid

Micropolar fluid is non-Newtonian fluid exhibit additional microstructural effects that influence their flow behaviour such as spinning particles, the rotation of which is defined by an independent microrotation vector (Soid et al., 2018). These fluids can be utilized to study the behaviour of exotic lubricants, animal blood, polymer fluids, dust clouds, river sediments, and liquid crystals containing rigid molecules (RamReddy & Pradeepa, 2016).

The concept of micropolar fluid dynamics was first introduced in the mid-20th century by Eringen (1966). Since then, researchers have made significant advancements in the theoretical formulation and practical applications of micropolar fluid dynamics. (Ishak et al., 2010) studied the steady two-dimensional stagnation-point flow of a micropolar fluid over a shrinking sheet. The shrinking velocity and the ambient fluid velocity are assumed to vary linearly with the distance from the stagnation point. The studies of micropolar fluid was extended in numerous ways such as Nazar et al. (2004), Ishak et al. (2007), Borrelli et al. (2013) and Mohammed et al. (2021).

Understanding micropolar fluid has practical applications. Micropolar fluids' special characteristics present new possibilities for flow optimization and control in engineering device.

Stagnation-Point Flow and Heat Transfer

Stagnation-point flow used to describe the fluid motion around the stagnation area at the front of a blunt-nosed body, is shown by all solid bodies moving in a fluid. The stagnation area has the highest rates of pressure, heat transmission, and mass deposition. Stagnation point flow is evident in the aerodynamics of an airfoil, where the movement of the airfoil through the air impacts the air flow around its leading edge due to the presence of a stagnation point. Stagnation point flow plays a crucial role in a wide range of engineering and scientific applications, influencing design decisions, performance optimization, and fundamental understanding of fluid behaviour.

Heat transfer is a significant technological challenge in various industrial and engineering applications. Heat transfer, which involves the movement of energy from one part to another due to temperature differences, is a crucial aspect of these processes (Sheikoleslami et al., 2014). In many industrial operations, especially those requiring efficient heat transfer, fluid movement plays a vital role. A fluid is often employed to extract heat from its source during the heat transfer process. As a result of the temperature difference between the surface and the fluid in the system, a thermal boundary layer is formed. Heat naturally flows from regions of high temperature to those of lower temperature, making the understanding and management of heat transfer essential in various technological applications.

In various industries, there are numerous practical uses for stagnation point flow combined with heat transfer over a surface that is either stretching or shrinking. Bhattacharyya et al. (2011), have expanded the study on this type of flow and heat transfer. They specifically explored how the slip effect influences the boundary layer stagnation-point flow and heat transfer over a shrinking sheet. Their work contributes valuable insights to this fascinating field of research. It finds use in various areas such as managing the boundary layer along material handling conveyors, understanding blood flow challenges, improving aerodynamics, plastic sheet manufacturing, cooling metallic plates in a bath, and optimizing processes in textile and paper industries, among others. The study of this flow phenomenon plays a crucial role in enhancing efficiency and performance across different industrial sectors. Several recent studies, including those conducted by Norzawary et al. (2020), Dzulkifli et al. (2022), Japili et al. (2022), and Ismail et al. (2022), have contributed to the understanding of stagnation-point flow and heat transfer. These works represent significant extensions and advancements in the field.

Exponentially Stretching/Shrinking Inclined Plate

Exponentially stretching/shrinking inclined plates have been a subject of interest in the field of fluid mechanics and heat transfer due to their relevance in various engineering and industrial applications. In recent years, researchers have conducted several studies to investigate the flow and heat transfer characteristics of fluids over such plates. (Waini, et al., 2020, Aurangzaib et al., 2016, & Ur Rehman et al., 2018)

The exponentially stretching/shrinking plate provides an interesting and practical case for exploration as it offers a variable stretching or shrinking parameter, allowing researchers to examine a wide range of deformation effects on the flow and heat transfer characteristics. Furthermore, the inclination of the plate introduces additional complexities, affecting the flow separation, recirculation zones, and thermal boundary layer development.

The findings from these studies have applications in various engineering fields, such as aerospace, manufacturing, chemical processing, and renewable energy, where heat transfer optimization is critical for performance enhancement and system design.

Mathematical Formulation

In this study, we delve into the graceful movement of a micropolar fluid toward a stagnation point on an inclined plate, as illustrated in Figure 1. The plate is elegantly set at an acute angle, α, with the x and y axes serving as the backdrop. Amidst this journey, the fluid is propelled by a constant free stream velocity, $u_e(x) = ae^{x/L}$ where $a > 0$ (constant) and accompanied by the touch of a reference length, L. A dance of expansion and contraction ensues, with

$u_w(x) = be^{\frac{x}{L}}$ denoting the exponential velocity for stretched $(b > 0)$ or shrunk $(b < 0)$ surfaces, while $b = 0$ gracefully embodies the static surface's essence. The surface temperature is given as $T_w(x) = T_\infty + T_0 e^{\frac{2x}{L}}$ where T_0 is a constant and T_∞ is the ambient temperature. The concentration on the surface is $C_w(x) = C_\infty + C_0 e^{\frac{2x}{L}}$ where C_0 is a constant and C_∞ ambient concentration. Hence, g is a symbol of acceleration due to gravity.

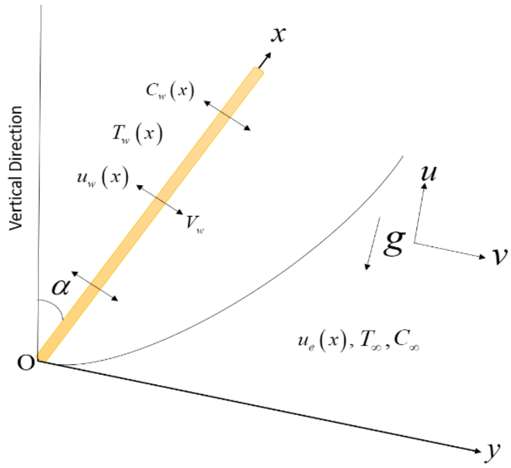

Figure 1: Physical Model

This study focuses exclusively on the behaviour of a micropolar fluid as it encounters a stagnation point over an inclined plate that is exponentially either stretching or shrinking. This analysis includes the influence of radiation, magnetohydrodynamics (MHD), mixed convection, and radiation effects. The study further presents solutions for specific parameter values related to stretching, shrinking, and the direction of buoyancy-assisted or opposing flow. The fundamental governing equations for the boundary layer are a set of parabolic partial differential equations (PDEs) that encompass continuity, linear momentum, angular momentum, energy, and concentration equations.:

Continuity equation:

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0 \tag{1}$$

Linear momentum equation:

$$\begin{aligned} u\frac{\partial u}{\partial x} + v\frac{\partial u}{\partial y} &= u_e \frac{du_e}{dx} + \left(\upsilon + \frac{\kappa}{\rho}\right)\frac{\partial^2 u}{\partial y^2} + \frac{\kappa}{\rho}\frac{\partial N}{\partial y} \\ &\quad + g\left[\beta_T (T - T_\infty) + \beta_c (C - C_\infty)\right]\cos\alpha - \frac{\sigma B^2}{\rho}(u - u_e) \end{aligned} \tag{2}$$

Angular momentum equation:

$$u\frac{\partial N}{\partial x} + v\frac{\partial N}{\partial y} = \frac{\chi}{\rho j}\frac{\partial^2 N}{\partial y^2} - \frac{\kappa}{\rho j}\left(2N + \frac{\partial u}{\partial y}\right) \tag{3}$$

Energy equation:

$$u\frac{\partial T}{\partial x}+v\frac{\partial T}{\partial y}=\frac{k}{\rho c_p}\frac{\partial^2 T}{\partial y^2}-\frac{1}{\rho c_p}\frac{\partial q_r}{\partial y} \tag{4}$$

Concentration equation:

$$u\frac{\partial C}{\partial x}+v\frac{\partial C}{\partial y}=D\frac{\partial^2 C}{\partial y^2} \tag{5}$$

The boundary requirements must be satisfied at all points along the boundary of a region in order for a set of differential conditions to be solved. The boundary conditions applicable to the flow are:

$$u=u_w=be^{x/L},\ \ v=0,\ \ T=T_w=T_\infty+T_0e^{2x/L},\ \ N=-m\frac{\partial u}{\partial y},\ \ C=C_w=C_\infty+C_0e^{2x/L}\ \text{ at }\ y=0$$

$$u\to u_e,\ \ T\to T_{\infty},\ \ N\to 0,\ \ C\to C_\infty\ \text{ as }\ y\to\infty \tag{6}$$

Imagine considering the velocities in two directions: one along the x-axis and the other along the y-axis. In this scenario, the symbol $\upsilon=\mu/\rho$ represents the kinematic viscosity, ρ stands for fluid density, μ is the fluid viscosity coefficient, N represents microrotation or angular velocity, $j=2L\upsilon e^{-x/L}/a$ is micro-inertia per unit mass, $\chi=\mu(1+K/2)j$ represents spin gradient, and κ is vortex viscosity. The fluid's electrical conductivity is denoted as σ, and we have a varying magnetic field denoted as $B(x)=B_0e^{x/2L}$, where B_0 is a constant. Additionally, c_p represents the specific heat of the fluid, and β_T, β_C are the coefficients representing thermal and concentration expansion, respectively. To simplify the equations from (1) to (5), including the boundary condition in Eq. (6), we can introduce a similarity transformation:

$$\eta=\sqrt{\frac{a}{2\upsilon L}}e^{\frac{x}{2L}}y,\qquad u=ae^{\frac{x}{L}}f'(\eta),\qquad v=-\sqrt{\frac{a\upsilon}{2L}}e^{\frac{x}{2L}}\left(f(\eta)+\eta f'(\eta)\right),\qquad \theta(\eta)=\frac{T-T_\infty}{T_w-T_\infty},$$

$$N=a\sqrt{\frac{a}{2\upsilon L}}e^{\frac{3x}{2L}}h(\eta),\ \ \phi=\frac{C-C_\infty}{C_w-C_\infty} \tag{7}$$

Where η is similarity variable, while u and v denotes the stream function that the continuity Eq. (1) is identically fulfilled. Thus, the transformed linear momentum Eq. (2), angular momentum Eq. (3), energy Eq. (4) and concentration Eq. (5) become:

$$\begin{gathered}(1+K)f'''+ff''-2(f')^2+2+Kh'+2\lambda\left(\theta(\eta)+\delta\phi(\eta)\right)\cos\alpha-M(f'-1)=0\\ \left(1+\frac{K}{2}\right)h''-K(2h+f'')+fh'-3f\hbar=0\\ \frac{1}{\Pr}\left[1+\frac{4}{3}R\right]\theta''+f(\eta)\theta'(\eta)-4f'(\eta)\theta(\eta)=0\\ \frac{1}{Sc}\phi''+f\phi'-4f'\phi=0\end{gathered} \tag{8}$$

The corresponding boundary conditions:

$$f'(0)=\frac{b}{a}=\varepsilon,\ f(0)=0,\ \theta(0)=1,\ h(0)=-mf''(0),\ \phi(0)=1 \text{ at } \eta=0$$
$$f'(\eta)\to 1,\ \theta(\eta)\to 0,\ h(\eta)\to 0,\ \phi(\eta)\to 0 \text{ as } \eta\to\infty \qquad (9)$$

where the prime indicates differentiation with respect to η and $M=2\sigma B_0^2 L/\rho a$ is Hartmann number or magnetic parameter. $\lambda = g\beta_T T_0 L/a^2$ is buoyancy parameter, $\delta=\beta_c C_0/\beta_T T_0$ is constant concentration buoyancy parameter, α is an angle for inclined plate parameter, $\varepsilon = b/a$ is the stretching/shrinking parameter. Next, $K=\kappa/\mu$, $\Pr=\mu c_p/k$ $R=4\sigma^* T_\infty^3/k^*$ and $Sc=\upsilon/D$ are the micropolar parameter, Prandtl number radiation, and Schmidt number parameters, respectively.

The involved physical quantities are the skin friction coefficient C_f, the local Nusselt number Nu_x, the local couple stress M_x and the local Sherwood number Sh_x (Soid et al., 2023):

$$C_f=\frac{\tau_w}{\rho u_e^{\,2}},\ M_x=\frac{\chi\left(\frac{\partial N}{\partial y}\right)_{y=0}}{\rho x u_e^{\,2}},\ Nu_x=-\frac{xk}{k(T_w-T_\infty)}\left(\frac{\partial T}{\partial y}\right)_{y=0},$$
$$Sh_x=-\frac{x}{(C_w-C_\infty)}\left(\frac{\partial C}{\partial y}\right)_{y=0} \qquad (10)$$

Using the similarity variables Eq. (7) then,

$$C_f(\mathrm{Re}_x)^{1/2}\sqrt{\frac{2L}{x}}=\left[1+(1-m)K\right]f''(0),\ M_x\mathrm{Re}_x=\left(1+\frac{K}{2}\right)h'(0),$$
$$Nu_x(\mathrm{Re}_x)^{1/2}\sqrt{\frac{2L}{x}}=-\theta'(0),\ Sh_x(\mathrm{Re}_x)^{1/2}\sqrt{\frac{2L}{x}}=-\phi'(0) \qquad (11)$$

Result

The transformed governing boundary layer equations have been efficiently tackled through numerical solutions utilizing the BVP4c function in MATLAB. The interplay of micropolar effects, stretching/shrinking phenomena, and inclination plate factors is elegantly brought to light through both graphical representations of velocity, angular velocity, temperature, and concentration profiles.

Intriguing insights emerge as the skin friction coefficient, $C_f(\mathrm{Re}_x)^{1/2}\sqrt{2L/x}$, the local couple stress, $Nu_x(\mathrm{Re}_x)^{1/2}\sqrt{2L/x}$, the local Nusselt number (a measure of heat transfer rate), $M_x\mathrm{Re}_x$, and the local Sherwood number (an indicator of mass transfer rate), $Sh_x(\mathrm{Re}_x)^{1/2}\sqrt{2L/x}$, gracefully evolve. This captivating dance of parameters unfolds across various combinations of micropolar, and inclination angle attributes. Radiation, magnetic, Schmidt number and concentration buoyancy parameters are fixed and consider in this study.

The culmination of this exploration is aptly captured in Table 1, where a harmonious comparison of the skin friction coefficient $C_f\left(\mathrm{Re}_x\right)^{1/2}\sqrt{2L/x}$ and the local Nusselt number $Nu_x\left(\mathrm{Re}_x\right)^{1/2}\sqrt{2L/x}$ is artfully presented. The results from Soid et al., and Waini et al., are thoughtfully juxtaposed with the findings of the present study, creating a rich tapestry of insights.

Table 1: Comparison for Numerical Values $C_f\left(\mathrm{Re}_x\right)^{1/2}\sqrt{2L/x}$ and $Nu_x\left(\mathrm{Re}_x\right)^{1/2}\sqrt{2L/x}$ for $\varepsilon = -0.5, 0, 0.5$

	$C_f\left(\mathrm{Re}_x\right)^{1/2}\sqrt{2L/x}$			$Nu_x\left(\mathrm{Re}_x\right)^{1/2}\sqrt{2L/x}$		
ε	**Waini et al.,**	**Soid et al.,**	**Present Study**	**Waini et al.,**	**Soid et al.,**	**Present Study**
-0.5	2.1182	2.1182	2.1182	0.0588	0.0588	0.0588
0.0	1.6872	1.6872	1.6872	2.5066	2.5066	2.5066
0.5	0.9604	0.9604	0.9604	4.0816	4.0816	4.0816

The comparisons of the values in the Table 1, observed that the present results show an excellent agreement with the previous study. Therefore, this verifies the reliability and accuracy of the method used for this study. It is observed that the values of $C_f\left(\mathrm{Re}_x\right)^{1/2}\sqrt{2L/x}$ decreases but the values of $Nu_x\left(\mathrm{Re}_x\right)^{1/2}\sqrt{2L/x}$ increases when $\varepsilon = -0.5$.

It's worth noting that while we're delving into the intricacies of these parameters, we're keeping other aspects constant. For instance, material properties $m = 0.5$, and the Prandtl number $\mathrm{Pr} = 6.2$, magnetic $M = 2$, concentration buoyancy $\delta = 1$, and the Schmidt number $Sc = 0.2$ will remain steady in our analysis. This approach allows us to isolate the specific effects of the parameters we're studying.

The effects of K on the $C_f\left(\mathrm{Re}_x\right)^{1/2}\sqrt{2L/x}$, $M_x\,\mathrm{Re}_x$, $Nu_x\left(\mathrm{Re}_x\right)^{1/2}\sqrt{2L/x}$, and $Sh_x\left(\mathrm{Re}_x\right)^{1/2}\sqrt{2L/x}$ are presented in Figures 2-5, respectively for varies values of $K = 0, 0.5, 1$. From figure 2, it can be seen that when the plate shrinks, the skin friction coefficient decreases, while on a stretching plate, it increases. This change is due to the micropolar parameter becoming more prominent. On the shrinking plate, a larger micropolar parameter brings about a more significant drop in the skin friction coefficient. This implies that the microstructural characteristics play a more substantial role, causing less resistance on a shrinking plate. In contrast, on a stretching plate, a higher micropolar parameter leads to a more noticeable rise in the skin friction coefficient. This suggests that the microstructural effects create a livelier interaction between the fluid and the surface, resulting in increased resistance on a stretching plate. It also shows the transition from increase to decreases at the range between 1 and 1.5 that the skin friction approximately to zero (no drag force). The micropolar parameter seems to intensify the influence of microstructure on how fluid and surface interact, leading to distinct trends in skin friction for different flow scenarios of stretching and shrinking.

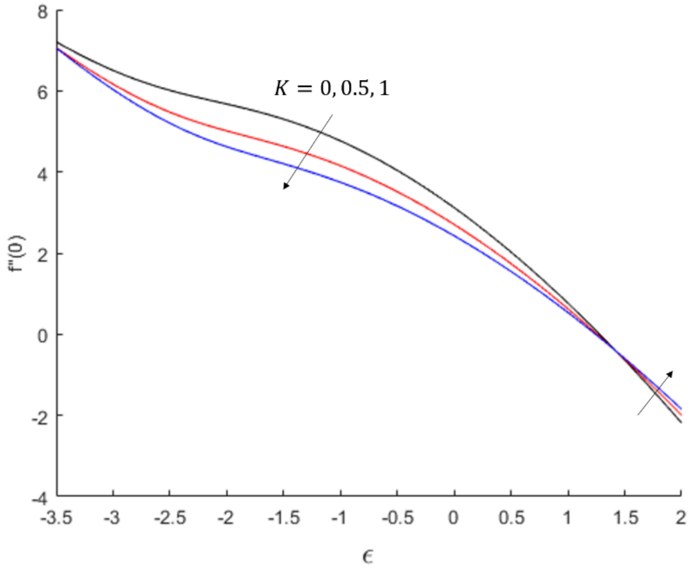

Figure 2: $C_f \left(\mathrm{Re}_x\right)^{1/2} \sqrt{2L/x}$ **for Varies of** K

Next, figure 3 shows an increase in the value of the micropolar parameter lead to an increase of the local couple stress. The couple stress is related to a particle rotational speed gradient on the surface. It also shows the local couple stress become decreases between -1.5 and 1.5, and increases again due to the stretch. When the values of the surface shear stress and the local couple stress are zero, in terms of physics, zero surface shear stress occurs when the fluid and solid surfaces move at the same speed, resulting in no friction at the fluid-solid interface. While, the couple stress is zero, it may be due to the non-effect of micro-structure, which causes the particle at the surface to be unable to rotate in a zero-gradient rotation.

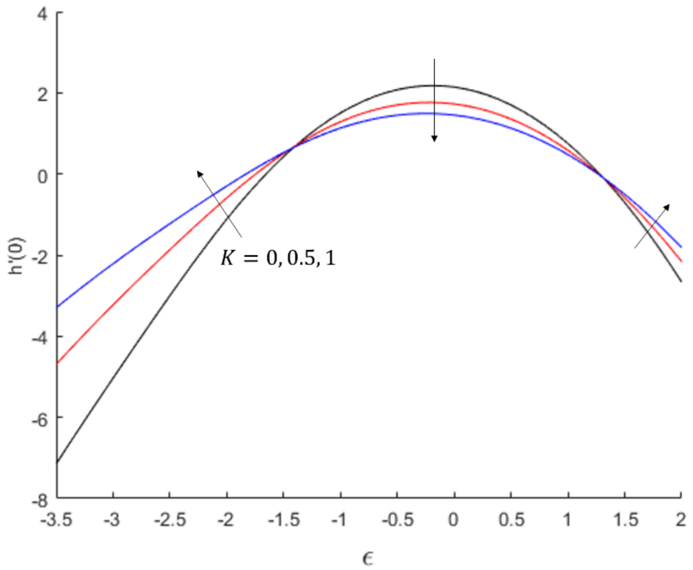

Figure 3: $M_x \,\mathrm{Re}_x$ **for Varies of** K

Figure 4 indicates that when the plate is subjected to shrinking, the local Nusselt number decreases. The decrease in the local Nusselt number suggests reduced heat transfer efficiency in shrinking flows. This behaviour could be due to reduced flow area, leading to lower convective heat transfer rates. For stretching flows, the local Nusselt number shows a trend of increasing. However, there is a specific point on the graph where the local Nusselt number increases for the stretching plate but with a relatively smaller change compared to other points. This indicates that while stretching flows generally enhance heat transfer, there's a particular region where the improvement is less pronounced.

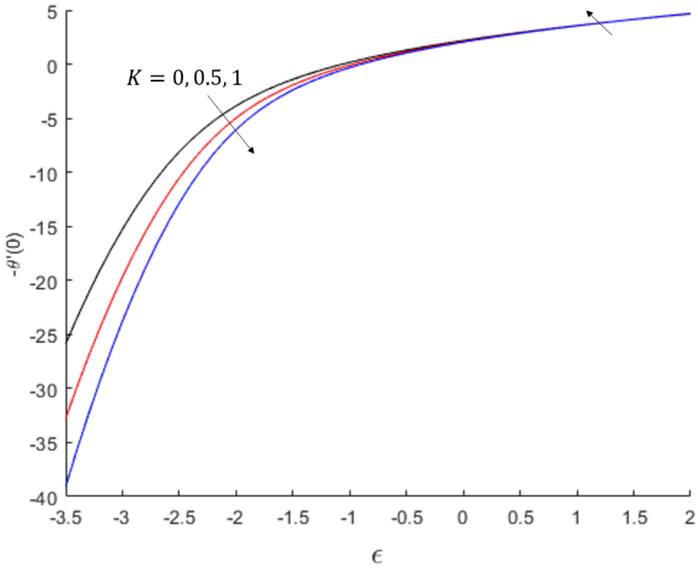

Figure 4: $Nu_x \left(\mathrm{Re}_x\right)^{1/2} \sqrt{2L/x}$ **for Varies of *K***

Figure 5 illustrates the relationship between the local Sherwood number and the type of flow (stretching or shrinking) under different conditions. It indicates that the local Sherwood number decreases for shrinking flows, possibly due to slower diffusion in the reduced flow area. On the other hand, the local Sherwood number increases for stretching flows, indicating improved mass transfer efficiency due to enhanced fluid-surface interaction.

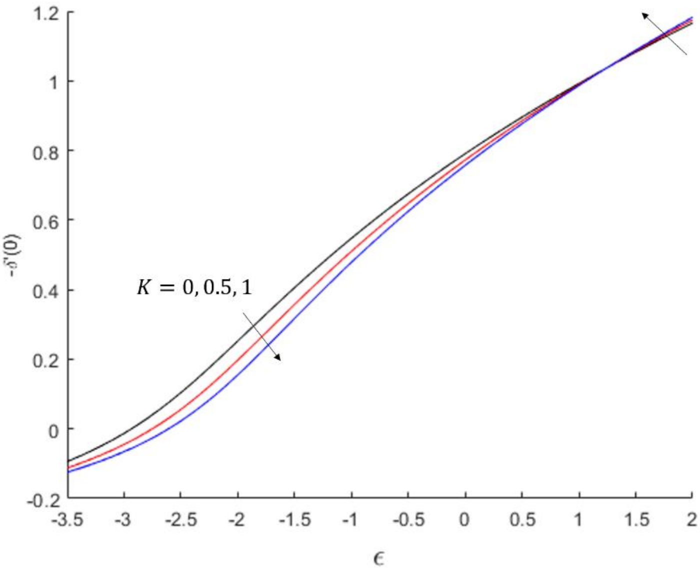

Figure 5: $Sh_x \left(\mathrm{Re}_x\right)^{1/2} \sqrt{2L/x}$ **for Varies of *K***

Figure 6-9 shows the velocity, angular, temperature and concentration profiles for various values of K with shrinking plate $(\varepsilon = -1)$. These profiles asymptotically satisfy the free stream Eq. (11), thus giving us confidence in the accuracy of the current solutions. Figure 6 illustrated the graph's trend of decreasing velocity with increasing micropolar parameter indicates that these microstructural effects, introduced by the higher micropolar parameter, are causing the fluid to slow down.

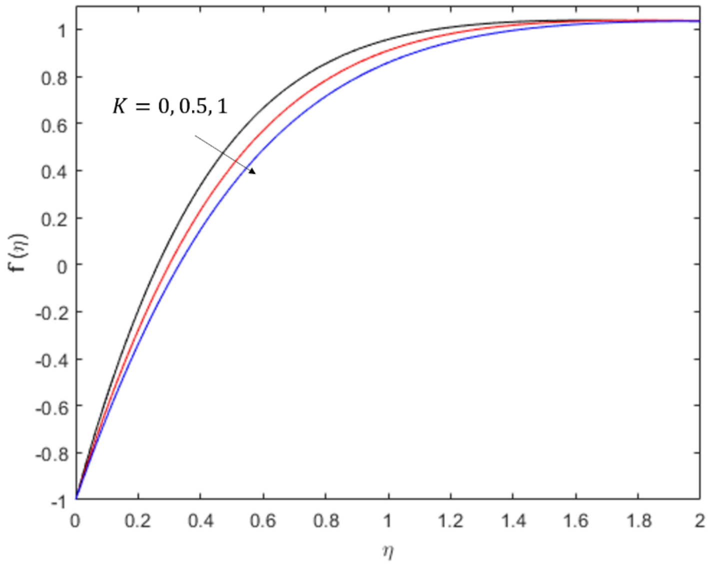

Figure 6: Velocity Profile for Varies of *K*

Figure 7 demonstrates that the angular profile of a certain parameter increases as the micropolar parameter increases. This suggests that higher micropolar parameter values amplify the variations of the measured parameter across different angles or orientations.

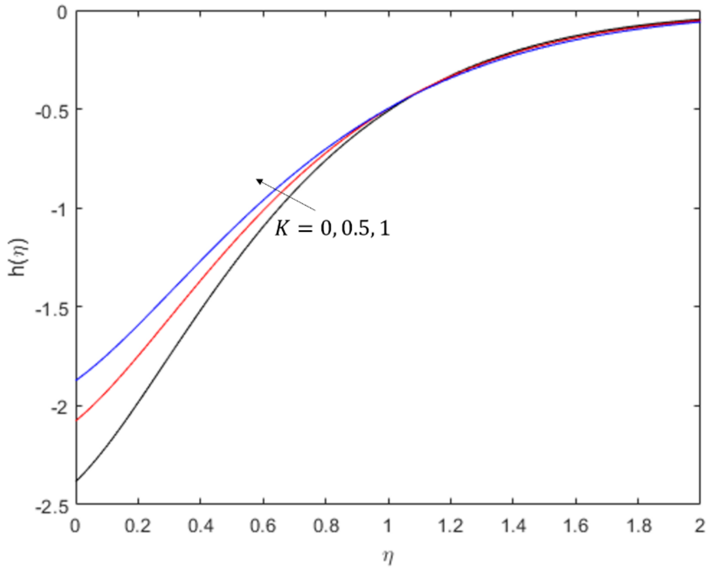

Figure 7: Angular Profile for Varies of *K*

Figure 8 demonstrates that the temperature profile of the fluid increases as the micropolar parameter increases. This indicates that higher micropolar parameter values enhance the thermal behaviour of the fluid, resulting in higher temperatures across the surface being measured.

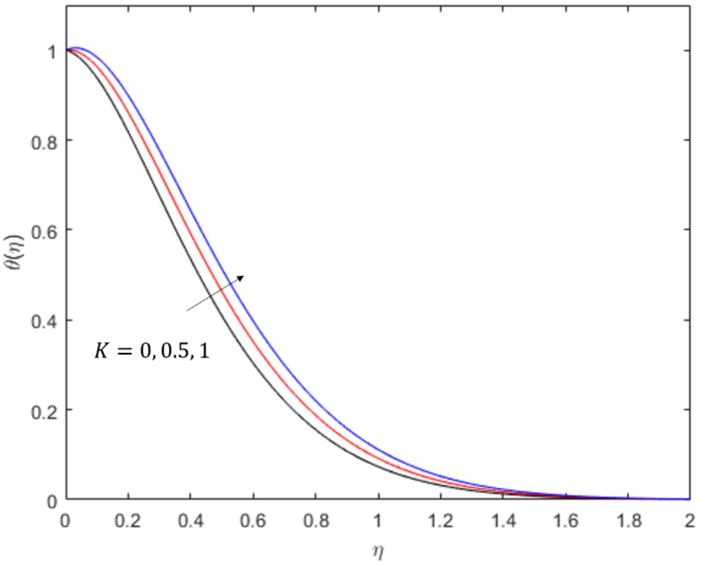

Figure 8: Temperature Profile for Varies of *K*

In figure 9, the micropolar parameter and the concentration profile of a particular substance increases. This means that when the micropolar parameter is higher, the behaviour of the substance's concentration becomes more pronounced. As a result, you'll observe higher concentrations across the surface being studied.

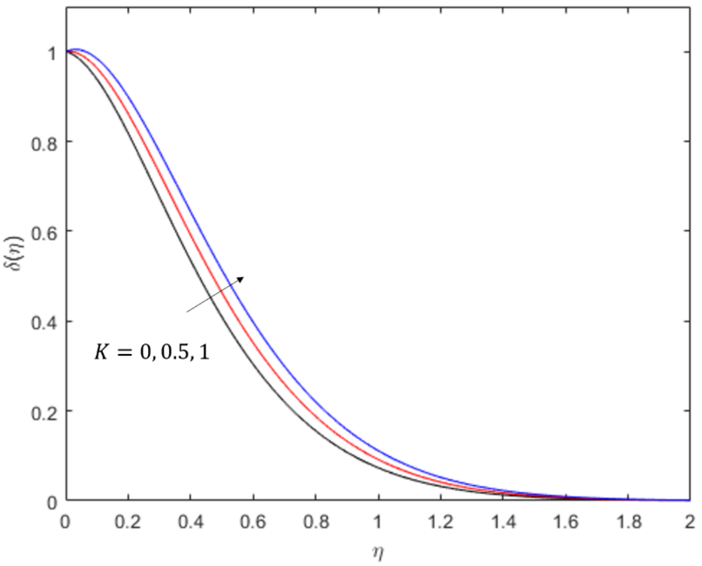

Figure 9: Concentration Profile for Varies of *K*

The effects of α on the $C_f\left(\mathrm{Re}_x\right)^{1/2}\sqrt{2L/x}$, $M_x\,\mathrm{Re}_x$, $Nu_x\left(\mathrm{Re}_x\right)^{1/2}\sqrt{2L/x}$, and $Sh_x\left(\mathrm{Re}_x\right)^{1/2}\sqrt{2L/x}$ are presented in Figures 10-13, respectively for varies values of $\alpha = 0, \pi/6, \pi/3$. The angles of the plate considered are 0 (horizontal), π/6 (approximately 30 degrees), and π/3 (approximately 60 degrees). It can be seen that the skin friction decreases as the angle of the plate increases on figure 10. It also shows that the decreasing on the skin friction for stretching and shrinking. Additionally, the graph indicates a consistent trend of decreasing skin friction for both stretching and shrinking flows, regardless of the plate's angle. These trends collectively suggest that inclined plates tend to experience reduced skin friction, and both stretching and shrinking flows contribute to lower skin friction coefficients.

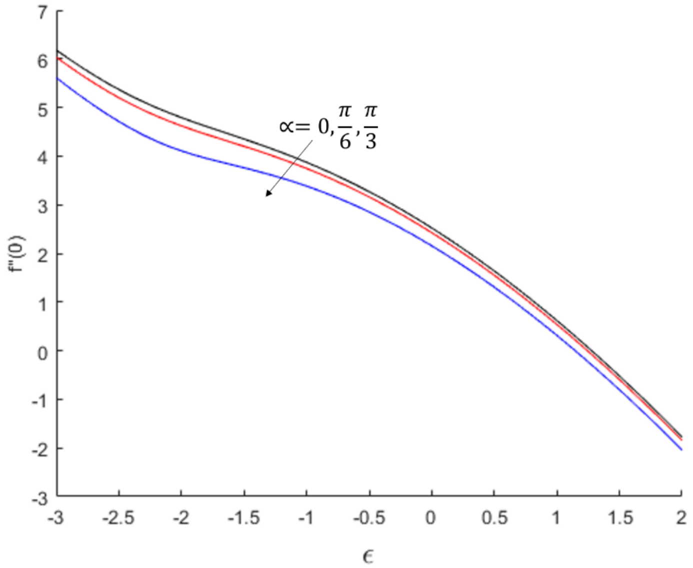

Figure 10: $C_f\left(\mathrm{Re}_x\right)^{1/2}\sqrt{2L/x}$ **for Varies of** α

Figure 11 illustrates that the local couple stress decreases as the angle of the plate parameter decreases for stretching and shrinking. However, it also shows that the local couple stress values are higher for stretching flows compared to shrinking flows, regardless of the plate's angle. The trend of decreasing local couple stress with plate angle suggests that the influence of couple stresses decreases as the plate becomes more horizontal.

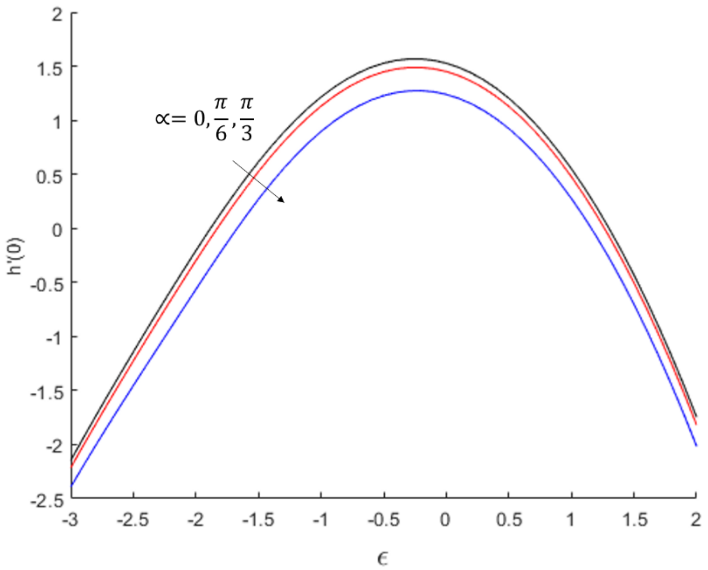

Figure 11: $M_x\,\mathrm{Re}_x$ **for Varies of** α

Figure 12 shows that the local Nusselt number decreases as the angle of the plate parameter decreases for stretching and shrinking plate. In addition, the trend of decreasing local Nusselt number with plate angle suggests reduced heat transfer efficiency as the plate becomes more horizontal. Furthermore, the enhancement in heat transfer efficiency from shrinking to stretching conditions indicates that stretching the plate improves heat transfer.

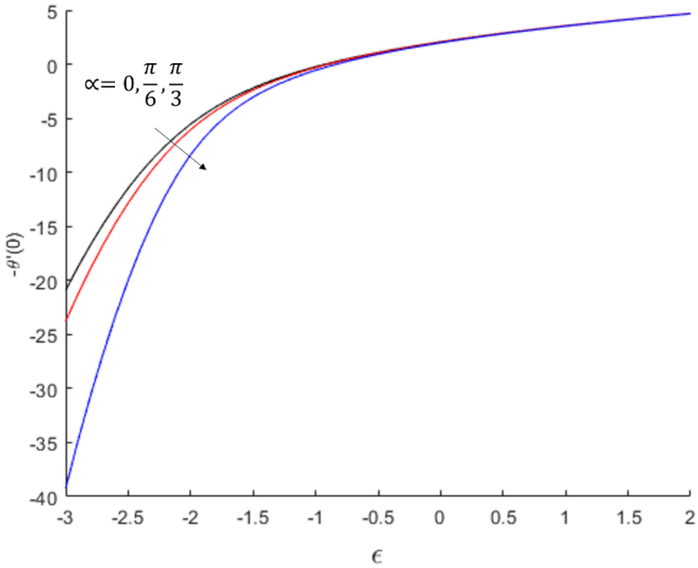

Figure 12: $Nu_x \left(\mathrm{Re}_x\right)^{1/2} \sqrt{2L/x}$ **for Varies of** α

Figure 13 demonstrates that the local Sherwood numbers decreases as the angle of the plate parameter decreases. It shows that the values of the local Sherwood number increase from shrunk to stretch. The trend of decreasing local Sherwood number with plate angle suggests reduced mass transfer efficiency as the plate becomes more horizontal. Furthermore, the enhancement in mass transfer efficiency from shrinking to stretching conditions indicates that stretching the plate improves mass transfer.

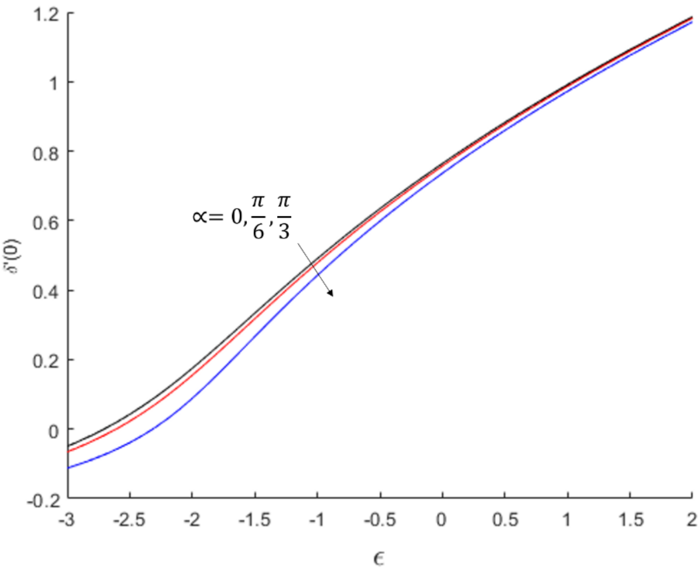

Figure 13: $Sh_x \left(\mathrm{Re}_x\right)^{1/2} \sqrt{2L/x}$ **for Varies of** α

Figure 14-17 shows the velocity, angular, temperature and concentration profiles for various values of α. In figure 14, the velocity decreases as the angle of the plate parameter decreases. This indicates that the fluid flows more slowly as the plate becomes more horizontal. The trend of decreasing velocity with plate angle suggests that the fluid experiences reduced flow speed as the angle of the plate decreases.

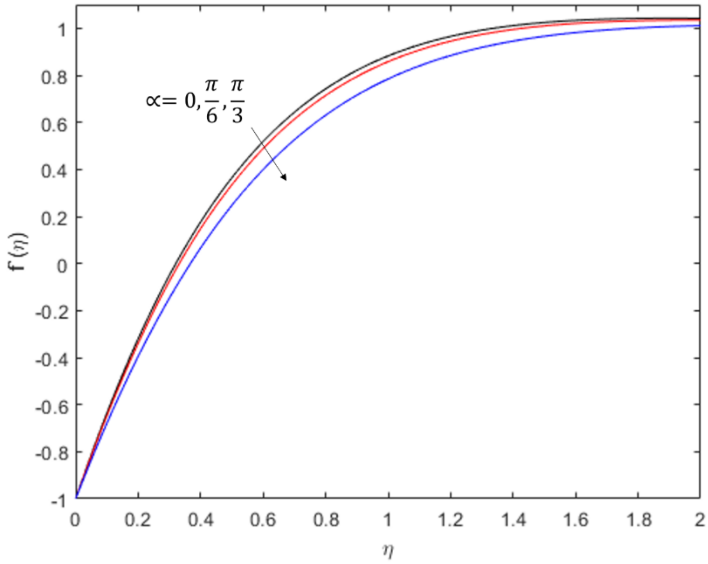

Figure 14: Velocity Profile for Varies of α

Figure 15 illustrates that the angular profile of a certain parameter increases as the angle of the plate parameter increases. This indicates that the variations in the parameter's values across different angles become more pronounced as the plate becomes more inclined. The trend of increasing angular profile with plate angle suggests that the parameter's behaviour is influenced by the orientation of the plate.

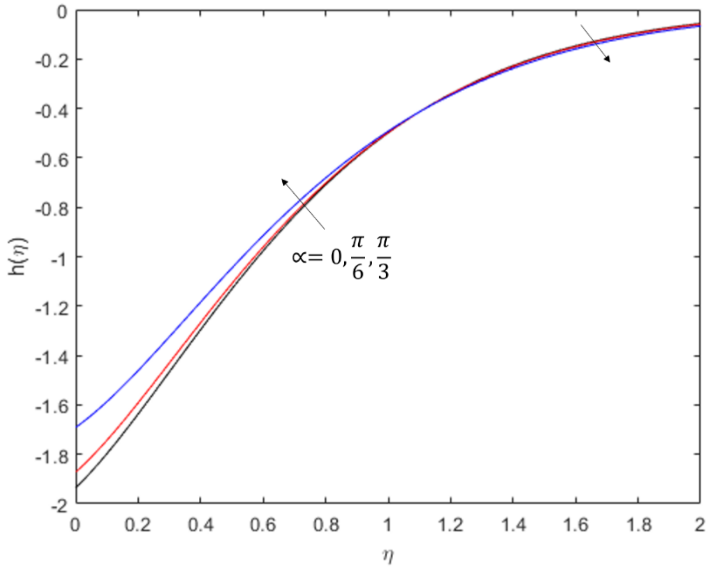

Figure 15: Angular Profile for Varies of α

The temperature profile shows in the figure 16. It demonstrates that the temperature profile increases due to increases the angle of the plate parameter. This suggests that more inclined angles of the plate result in higher temperatures across the region or surface of interest. The trend of increasing temperature profile with plate angle indicates that the orientation of the plate influences the thermal behaviour of the fluid.

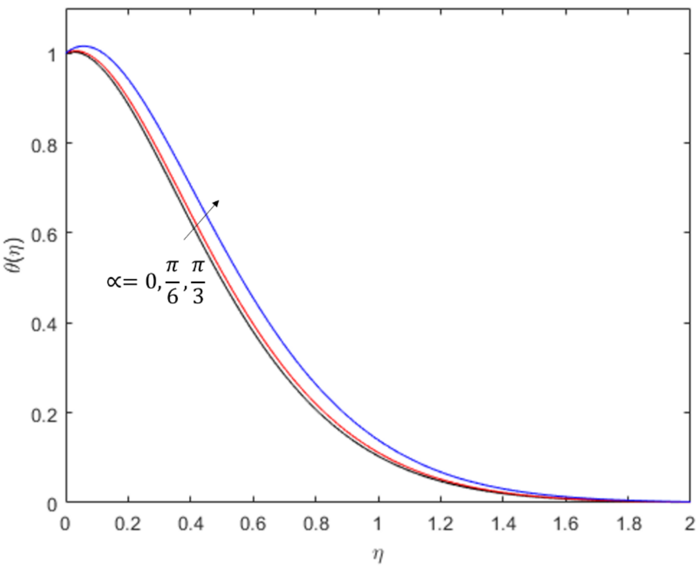

Figure 16: Temperature Profile for Varies of α

Figure 17 illustrates that the concentration profile of a specific substance increases as the angle of the plate parameter increases. This indicates that the substance's concentration becomes more pronounced across the region or surface of interest as the plate becomes more inclined. The trend of increasing concentration profile with plate angle suggests that the orientation of the plate has an impact on the distribution of the substance's concentration.

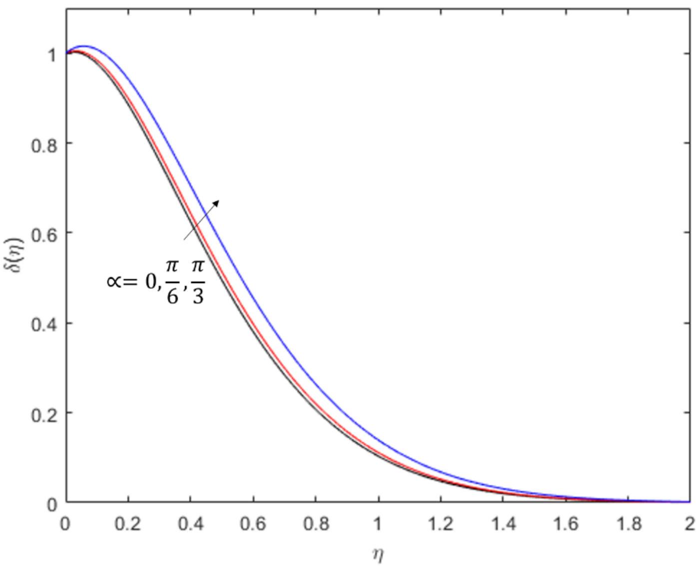

Figure 17: Concentration Profile for Varies of α

Conclusions

in the present study, a stagnation-point flow and heat transfer over an exponentially stretching/shrinking inclined plate with radiation, MHD, and concentration has been accomplished. The governing equations has been transformed using similarity transformation which then solved by BVP4c solver in Matlab. Some parameters are being considered in this study which are micropolar parameter K, angle of the plate α, stretching/shrinking ε and others constant parameters to determine the behaviour of the $C_f\left(\mathrm{Re}_x\right)^{1/2}\sqrt{2L/x}$, $M_x\,\mathrm{Re}_x$, $Nu_x\left(\mathrm{Re}_x\right)^{1/2}\sqrt{2L/x}$, $Sh_x\left(\mathrm{Re}_x\right)^{1/2}\sqrt{2L/x}$, and also the velocity, temperature and concentration profiles respectively. The results obtained are as follow:

i. Larger micropolar parameter decreases the skin friction on shrinking plates and increases it on stretching plates. Otherwise, it leads to higher local couple stress. Shrinking leads to decreased local Nusselt number, indicating reduced heat transfer efficiency and stretching enhances heat transfer, with a specific point showing minor improvement. Local Sherwood number increases for stretching, suggesting improved mass transfer efficiency.
ii. Increasing micropolar parameter leads to decreased velocity, possibly due to microstructural effects. Angular profile increases enhancing variations across angles. Temperature profile increases, indicating enhanced thermal behaviour. Concentration profile increases resulting in more pronounced substance distribution.
iii. Inclined plates experience reduced skin friction. Stretching flows have higher local couple stress than shrinking flows. Local Nusselt number decreases with decreasing plate angle. Stretching flows enhance heat transfer, with a specific point showing minor improvement. Local Sherwood number increases for stretching flows, suggesting improved mass transfer efficiency
iv. Velocity decreases as plate angle increases, indicating slower fluid flow for more horizontal plates. Angular profile increases with plate angle, indicating stronger variations across different orientations. Temperature and concentration profiles increases with increasing plate angle, influencing thermal behaviour and affecting substance distribution respectively.

Acknowledgement

This research was funded by a grant from the Ministry of Higher Education of Malaysia (FRGS/1/2021/STG06/UITM/02/11) and Universiti Teknologi MARA Shah Alam is gratefully acknowledged

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6th Langkawi International Multidisciplinary Conference 2023 (6th LIMC 2023)
eISSN 2976-3223
9th – 10th September 2023
Bayview Hotel, Langkawi, Malaysia

TECHNOLOGICAL ACCEPTANCE OF VIRTUAL VOLUNTEERING AMONG MALAYSIAN VOLUNTEERS

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Abstract: *This research aims to investigate the technological acceptance of virtual volunteering platforms among members of Yayasan AFS Antarabudaya Malaysia. As the world embraces digital transformations, virtual volunteering offers unique opportunities for global engagement and impact. However, the adoption of such platforms depends on users' willingness to accept and integrate technology into their volunteering experiences. To uncover the key themes influencing technological acceptance, this study employed a qualitative approach through two focus groups. The first focus group consisted of 7 members from the management team of Yayasan AFS Antarabudaya Malaysia, representing the organisational perspective. The second focus group involved 7 volunteers actively engaged in virtual volunteering activities, providing insights from the user perspective. Participants shared their attitudes towards technology, perceptions of virtual volunteering, and motivations for adopting or hesitating in using the platforms. Additionally, the study delved into the perceived benefits and barriers the current virtual volunteering platforms. The findings revealed other essential themes, including attitudes towards technology and motivations. The results of this study contribute valuable insights into promoting technological acceptance in the context of virtual volunteering, thereby empowering the organisation to harness the full potential of technology in their pursuit of meaningful global contributions.*

Keywords: *Technological Acceptance, Virtual Volunteering, Volunteerism*

Introduction

In this digital era human interactions changed and undergone a profound transformation due to the pervasive influence of modern technology. The interconnection between technology and social interaction has given rise to novel forms of human connections, where various tools and gadgets have become integral to communication such as smart phone and tablets. These tools not only serve as communication platforms but also function as sources of information and entertainment where its impact the individual's reliance on technology (Juliana et al., 2021). According to Nurzaimah et al. (2023), pandemic Covid 19 prompted a significant shift in the execution of volunteer activities. Volunteer organisation faces challenges in conducting face to face volunteering activities therefore the volunteer organisation had to embrace online volunteering also referred to as virtual volunteering which become a prevalent approach during the pandemic. Various terms of online volunteering included virtual volunteering, digital volunteering, micro- volunteering and more represent the same concept, which involves performing tasks remotely from physical workplace, utilising the internet as the primary means, engaging in a formal or informal capacity as workers, volunteers and encompassing tasks that can be either short-term or long-term. Virtual volunteering can be defined that the work is online voluntary and devoid of any anticipation of financial compensation (Norzaila et al., 2019). Virtual volunteering encompasses the utilisation of social media platform for the purpose of generating and sharing information with both immediate and extensive networks (Whittaker et al., 2015). Pal (2018) stated that the significance of digital platform for fostering connections and social capital among internet users, which can subsequently promote volunteerism, connectivity, and motivations. It was also emphasised social media is an important online platform for virtual volunteering during pandemic (Ibid). The engagement of volunteers with the technology developments was discussed in a previous study (Cheryl et al., 2019). The engagement of this platform could be channelled into a positive outcome, which is technological savvy. Therefore, this study aims to explore the technological acceptance of virtual volunteering among volunteers in Malaysia.

Literature Review

Technological Acceptance of Virtual Volunteering

Tapping into the power of technology by conducting virtual volunteering as an alternative for traditional volunteering is gaining acceptance among society especially the new generation of Gen-Z as well as millennial. Based on Seddighi et. al. (2020), various studies have indicated that virtual volunteering is a smart strategy to minimise inequality in volunteering participation which invites more prospects to be part of the volunteering efforts. In fact, a study in 2020 found that 58% of Americans are more inclined to volunteer with non-profit organisations that provide better technology solutions for participants to use while carrying out volunteering activities (Turnbull, 2022).

Practically, a study reveals that there is a positive acceptance on physicians' intentions to engage in virtual volunteering during health crises as an effective strategy to offer support and assist public health institutions as well as emergency management (Bouarar, 2023). Digital platforms, such as social media profiles or web pages, were analysed to find the best method for virtual volunteers' recruitment strategies. Non-profit organisations are currently using digital platforms to recruit new volunteers to support their virtual projects and help the organisations achieve their goals both virtually and physically (Saura, 2020).

Opportunities and Challenges in Virtual Volunteering

Virtual world makes everything easier and quicker despite some challenges and pitfalls. The same goes for volunteering activities conducted on virtual platform that would be further discussed in this proceeding. It is undeniably flexible when it comes to virtual volunteering which attract better number of participants to join in and offer their assistance to whichever their preferred causes are.

The flexible characteristic of virtual volunteering permits a seamless integration into our daily lives and can be tailor-made to suit anyone's needs. According to Simbi (2022), the concept of work-life combination has been attaining popularity in recent years for its aim in permitting workers to accomplish their responsibilities at times that suits them best. This echoed with Reno-Weber (2017) in which it was mentioned that virtual volunteers are not restraint by distance, physical disabilities, or other obligations. Anyone with a smartphone and/or an Internet connection could be a volunteer, building personal and professional connections through a virtual network, and make an impact to the society and the world at large. Simbi

(2022) added that these latest opportunities for virtual roles and global reach, cultivate inclusion for those who are limited by geography factor, work arrangements, or physical ability.

While virtual volunteering can prove to be a rewarding experience, it is still unable to run from having some hiccups as well. The present study found several challenges in online volunteering in Iran including lack of commitment, various cultural issues, limited infrastructure, reimbursement, and volunteer management issue. However, these are the challenges from managers' perspectives (Seddighi et. al., 2020). In addition, private large companies can control information overload and online issue with the assistance of their web care team. Unfortunately, other relief organisations do not have such experience and resource of those private and large companies. As for the volunteers' point of views, there are some obstacles that they may experience such as having the difficulty in feeling connected, unified, and comradery without physical interaction as found in traditional volunteering, lack of technical expertise, and connectivity issues (Mitchell, 2021).

Findings and Discussion

The data gathered was analysed qualitatively using thematic analysis to identify the technological acceptance among the participants of the focus groups conducted. The focus groups involved two groups of participants from Yayasan AFS Antarabudaya Malaysia. Table 1 shows the details of the two groups. Each participant identified by using codes to ensure the anonymity and confidentiality of their identities.

Table 1: Details of Focus Groups

Group	Details	Number of Participants
P1	Management personnel of Yayasan AFS Antarabudaya Malaysia	7 (A, B, C, D, E, F, G)
P2	Volunteers of Yayasan AFS Antarabudaya Malaysia	7 (A, B, C, D, E, F, G)

The feedbacks received during the focus group discussions were arranged in a tabular format and four key themes emerged. These themes give a glimpse of the acceptance of the volunteers in Malaysia on virtual volunteering. Based on the themes, the findings found that most of the participants are open to virtual volunteering and believed that it benefits them in certain ways. However, it is worth to note that there are certain barriers to their acceptance to the new technology and what motivates and makes it easier for them to continue to pursue volunteering activities virtually. Table 2 below indicates the key themes and sub-themes emerged through the thematic analysis.

Table 2: Thematic Analysis for Technological Acceptance of Virtual Volunteering

Key Themes	Sub-themes	Significant Quotes
Attitudes	Receptive Hesitant	*"I find technology quite exciting. It makes volunteering more accessible, especially for us with busy schedules. Virtual volunteering platforms can be a game-changer."* (P1D)

		"To be honest, I'm a bit hesitant about using technology for volunteering. I prefer face-to-face interactions. But if it's user-friendly, I might give it a shot." (P2A)
Perceived benefits	Flexibility Convenient Global reach	*"The best part is the flexibility. I can volunteer to global causes without from home. That is a good thing."* (P1E) *"Virtual volunteering allows us to connect with people from all around the world. It helps me to volunteer and get to know more things at one time."* (P2D) *"It is convenient. I can volunteer at any time that suit me, and that helps me to slot in volunteering works in between other things on my life."* (P2E)
Barriers	Technical preparedness Digital literacy	*"I struggle with the technical things at first. Setting up accounts and dealing new platforms were challenging."* (P1D) *"I find it quite hard for me to shifting to virtual is a bit overwhelming. But it is probably because I am not too familiar with digital platforms."* (P2F)
Motivation	Values Connections Recognition	*"I want to contribute to causes I am passionate about without the hassle of commuting, which saves me time and allows me to do more."* (P1B) *"I feel like I am part of a global community working together when I do it virtually with others from other countries. That's what motivates me."* (P1F) *"The recognition part is very important to me. It helps me to feel like doing more and more, even if doing it virtually."* (P2C)

The attitudes of participants towards virtual volunteering appear to be a crucial factor in its adoption. While majority of participants expressed receptiveness towards virtual volunteering, there were notable of hesitancy within the two groups. This suggests a need for targeted interventions and information dissemination to address the concerns of hesitant individuals. Understanding these attitudes can help organisations like Yayasan AFS Antarabudaya Malaysia to tailor their messaging and outreach strategies to appeal to a wider audience.

In terms of perceived benefits, majority of the participants stated benefits associated with virtual volunteering, including flexibility, convenience, and the potential for a more global reach. This indicates that virtual volunteering aligns well with the lifestyle of volunteers, who often seek opportunities that accommodate their schedules. Organisations can emphasise these advantages in their volunteer's recruitment efforts to attract more people to join their causes.

As for barriers, technical preparedness and digital literacy emerged as the sub-themes. The focus groups participants expressed their concerns about the resources required for virtual volunteering especially on the access to technology and digital skills. These barriers should be addressed through training and support programs to ensure that all volunteers have equal opportunities to participate in virtual volunteering initiatives.

The motivations of the focus groups participants to engage in virtual volunteering revolved around the values, connections, and recognition. Understanding that volunteers are primarily driven by their intrinsic values and the potential to build new connections and gain recognition highlights the importance of aligning virtual volunteering opportunities with these motivations. This can be achieved by designing virtual volunteering programs that offer meaningful experiences and provide avenues for volunteers to network and receive acknowledgment for their contributions.

Conclusion

In conclusion, this study provides valuable insights into the acceptance and adoption of virtual volunteering platforms among members of Yayasan AFS Antarabudaya Malaysia. The exploration of key themes reveals a spectrum of attitudes, ranging from receptiveness to hesitancy, emphasising the need for nuanced strategies to engage a diverse volunteer base. Participants recognise the benefits of virtual volunteering, including flexibility, convenience, and global reach, aligning with modern volunteer expectations. However, significant barriers related to technical preparedness and digital literacy must be addressed through targeted training and support. The study also highlights intrinsic motivations, such as values, connections, and recognition, underscoring the importance of aligning virtual volunteering opportunities with these motivators. Furthermore, a user-centric approach, focusing on interface design, usability, and functionality, is pivotal to fostering acceptance and sustained engagement. By comprehensively understanding and addressing these themes, Yayasan AFS Malaysia can tailor its strategies and platforms to promote virtual volunteering effectively, harnessing technology's potential for volunteer engagement and social impact in a rapidly evolving digital landscape.

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6th LIMC 2023

6th Langkawi International Multidisciplinary Conference 2023 (6th LIMC 2023)
eISSN 2976-3223
9th – 10th September 2023
Bayview Hotel, Langkawi, Malaysia

QUARTZ HYDROLYSIS ANALYSIS OF PURE QUARTZ FOR ENHANCED OIL PRODUCTION; INFLUENCE OF TIME, PH, AND SALINITY ON HYDROLYSIS

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Abstract: *The issue of sand production in reservoirs has been recognized as a critical problem in oil and gas fields for several years due to its numerous negative impacts on oil and gas production. Sand production from wells can damage both surface and subsurface equipment, reduce well productivity, and negatively impact the oil production economy. Oil production challenges arise when sand production increases as the water cut increases. Several factors have been associated with this phenomenon, with the most critical factor being silica dissolution - a chemical reaction between quartz and water that decreases formation strength. This study explores the dissolution of silica on pure quartz and the effects of added electrolyte (NaCl, $CaCl_2$, $MgCl_2$, and KCl) concentration, temperature, and pH on the dissolution process. The concentration of silica dissolved in solution was measured using UV-Vis spectrophotometry to determine the dissolution of silica on quartz. The results outcome indicate that the rate of silica dissolution is significantly influenced by variations in temperature and alterations in pH levels. The salinity conditions exhibit minimal alterations in comparison to distilled water. The highest concentration of silica dissolved in a solution has been seen at pH levels of 12 and 3, with concentrations of 118 mg/l and 68 mg/l, respectively. In terms of temperature, it was observed that there was an increase in the dissolution of silica from 30C° to 90C°, ranging from around 170% to 600%. Regarding salinity, it can be shown that NaCl and KCl exhibit the most significant impact on silica dissolution when compared to other brine solutions, with concentrations of 45 and 49 mg/l, respectively. The study claims that the formation strength may be influenced by water quality through the processes aimed at stimulating or lowering silica dissolution. Therefore, the optimal water quality design for water injection is paramount in mitigating sand production challenges.*

Keywords: *Silica dissolution; Sand production control; Water breakthrough; semi-consolidated formation*

Introduction

sand production is a common concern throughout the life of oil and gas wells and is more likely to occur in poorly consolidated sands (Bianco, Petrobras, Halleck, & Pennsylvania, 2001). Sand production may adversely affect the excellent completion due to plugging perforations or production liners, wellbore instability, and failure of sand control completions (Acock et al., 2004). In addition, sand-related problems increase production costs considerably by causing erosion of pipelines and surface facilities, reduced productivity, intervention costs and complexities, and other environmental effects (Rahmati et al., 2013).

Sand production is identified as both mechanical and fluid flow effects. The mechanical impact involves mechanical instability and degradation around the wellbore/perforation (Rahmati et al., 2013) caused by shear, tensile, or compressive failure (Wang, 2018). This relates to stresses, rock strength (Yin, Lu, Wang, Du, & Li, 2022).

Sand production happened because of the shear failure, which occurs on the surface of the rock (i.e., borehole surface) due to high shear stress. During production, the induced shear failure surfaces are mobilized, and sand debris is produced due to drag forces caused by the reservoir fluid flow. The produced sand will then flow into the well and the reservoir fluids (Al-Awad & Desouky, 1997). In unconsolidated and weak formations, production occurs when the drag forces caused by the flowing reservoir fluids overcome the natural inherent cohesion of the formation (Al-Awad, 2019). Furthermore, an increase in water-cut in the reservoir formation during the late life of the reservoir is unavoidable, be it because of water injection or water coning (Bailin Wu, Tan, & Lu, 2006). The injection of water/brine will increase the water cut and minimize the capillary pressure that exists between the water and the capillary fluid and rock strength (Han & Dusseault, 2002).

The consequence of water cuts on sand production has been a significant concern in the oil and gas industry. It has been seen in numerous events in the field that the initiation of sand production coincides with water breakthrough (Veeken, Davies, Kenter, & Kooijman, 2005). The effect of water cut on sand production has been an area of research for several years, and several mechanisms have been hypothesized to explain the effect (Bianco et al., 2001; Han & Dusseault, 2002; JPT staff, 1998; Vaziri, Barree, Xiao, Palmer, & Kutas, 2002; B. Wu & Tan, 2001). Water flooding is an improved oil recovery method that operates at a lower cost than other recovery methods. Water flooding has been widely implemented in sandstone oil reservoirs to support pressure and improve oil displacement efficiency. However, Sand production is highly related to an increase in water saturation and is considered a common problem in oil fields, especially for weakly consolidated sand; when the mobility of water is more significant than oil, the water-oil interface sees the upward movement of water into the perforations of a producing well (Karami, Manshad, & Ashoori, 2014).

The predominant mineral in the sandstone reservoir is quartz (SiO_2), Which is the most common silica crystal and the second most common mineral on the earth's surface. The quartz (silica) has a relationship with water, weakening the silica structure by a chemical reaction between water and quartz called quartz hydrolysis. Chemical reactions can be divided into two types: one group is the interaction between rock skeleton and water; the other is between cementation minerals and water. Both could reduce rock stability by decreasing rock strength (Griggs, 1967; Han & Dusseault, 2002).

eISSN 2976-3223

$$\text{-Si-O-Si-} + H_2O \rightarrow \text{-Si-OH} + \text{HO-Si-}$$

Figure 1: Quartz hydrolysis chemical reaction between quartz and water

This paper aims to evaluate the impact of pH and electrolytes (including NaCl, CaCl2, $MgCl_2$, and KCl) at various concentrations on quartz hydrolysis (silica dissolved) during a chemical reaction between quartz and water. The outcomes of this study will lead to a better understanding of the geochemical processes taking place in reservoirs and offer insightful information on the mechanisms underlying silica dissolution, which leads to sand production.

Material and Methods

Materials

The dissolution test was conducted using pure quartz (SiO2). This quartz, which is purer than 99.8%, was acquired from the Lingshou Jiaqi Mineral Processing Factory (Shijiazhuang). Two types of quartz were available: coarse particles with a diameter of 200 µm and small particles with a diameter of 50 µm. Four salts, including sodium chloride (NaCl), calcium chloride ($CaCl_2$), potassium chloride (KCl), and magnesium chloride ($MgCl_2$), were used to explore how brine concentrations affected silica dissolution. Without further purification, these salts came from trustworthy suppliers, including QREC (Selangor, Malaysia) and Merck Chemicals (Germany).

Quartz Hydrolysis Reaction Study

The approach of this study is to evaluate quartz hydrolysis reaction throughout many batch experiments utilizing 15 g of crushed quartz to 45 ml of distilled water. This water has been mixed with various solutions. The solutions have different brine types (NaCl, KCl, MgCl2, CaCl2) at various concentrations (200, 400, and 800 ppm). The solutions were prepared and combined in a 250 ml container, submerged in a water bath, and agitated at 170 revolutions per minute for 60 hours at ambient temperature. The centrifugation technique was used to separate temperature-sensitive quartz particles from the solution, followed by a UV-Vis Spectrophotometer DR3900 to quantify the silica concentration.

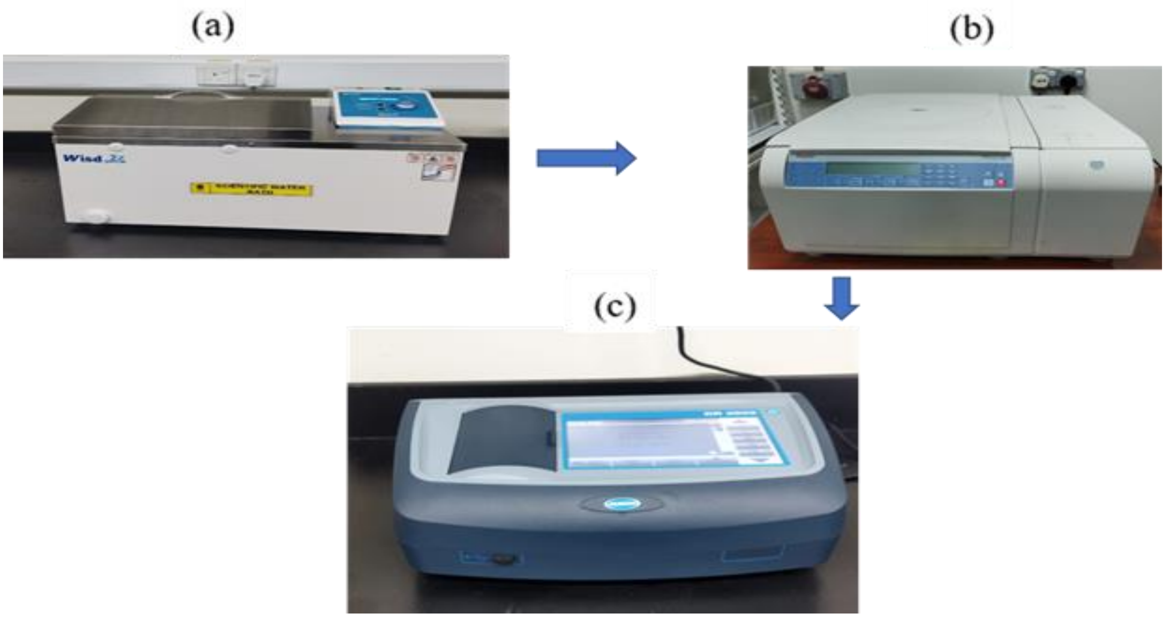

Figure 2: Experimental set-up for the silica dissolution experiments showing (a) water bath (b) Thermo Scientific Multifuge X1R Centrifuge (c) UV–Vis Spectrophotometer DR3900

Results and Discussion

Quartz Characterization Test

The mineralogy of a rock sample, as determined by X-ray diffraction (XRD) examination, plays a crucial role in identifying the surface charge of the rock (Kumar & Mandal, 2019). The X-ray diffraction (XRD) analysis confirms that the sample's predominant form of silicon oxide is quartz, as shown in Fig. 3, with about 97.7% composition. The remaining 0.3% of the sample consists of various oxides. The statement verifies that the quartz used in the experiment was composed of pure quartz and consisted of silicon oxide.

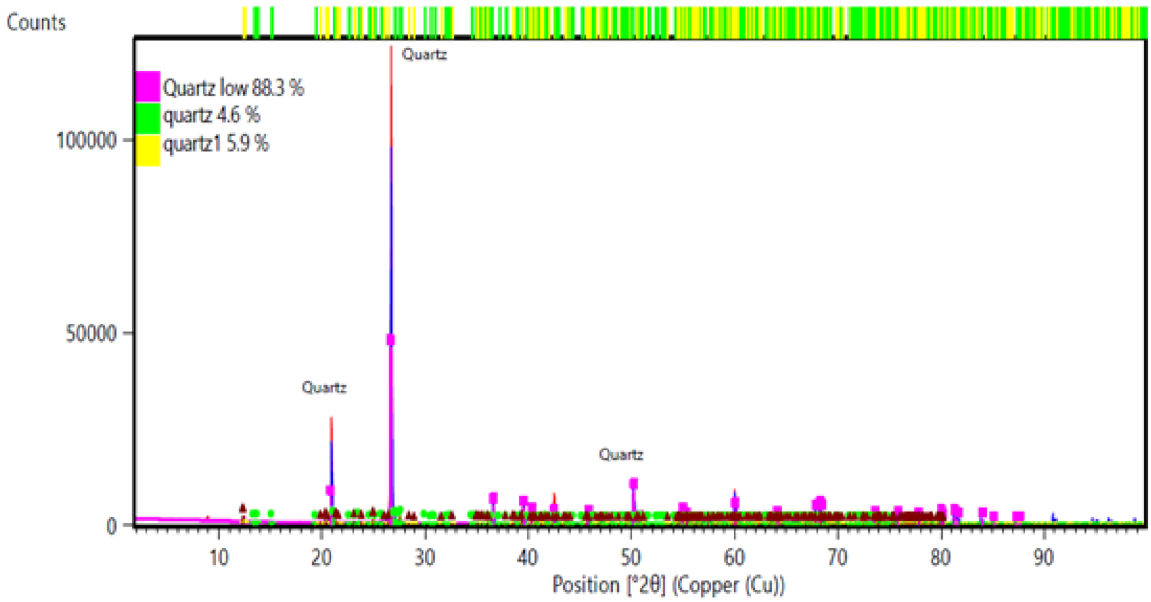

Figure 3: X-ray diffractogram image of quartz

The Time Impact on Quartz Hydrolysis

Fig. 4 illustrates the behavior of silica dissolution with different time intervals in distilled water at ambient temperature. The main objective of this test is to determine the time required for the reaction between quartz and water to achieve equilibrium. The silica dissolution started with around 25 mg/l silica dissolved at 24 hours. The trend gradually increased as time increased until around 38 mg/l at 48 hours. The peak has been reached at 60 hours with 45 mg/l silica dissolved; once the duration of the reaction exceeds 60 hours, no further chemical reactions occur, indicating that the process has reached equilibrium and no additional reaction will proceed. Based on the observed graph pattern, it can be inferred that the optimal time for achieving equilibrium in the quartz hydrolysis reaction is approximately 60 hours—the rationale for selecting a fixed duration of 60 hours for conducting experiments.

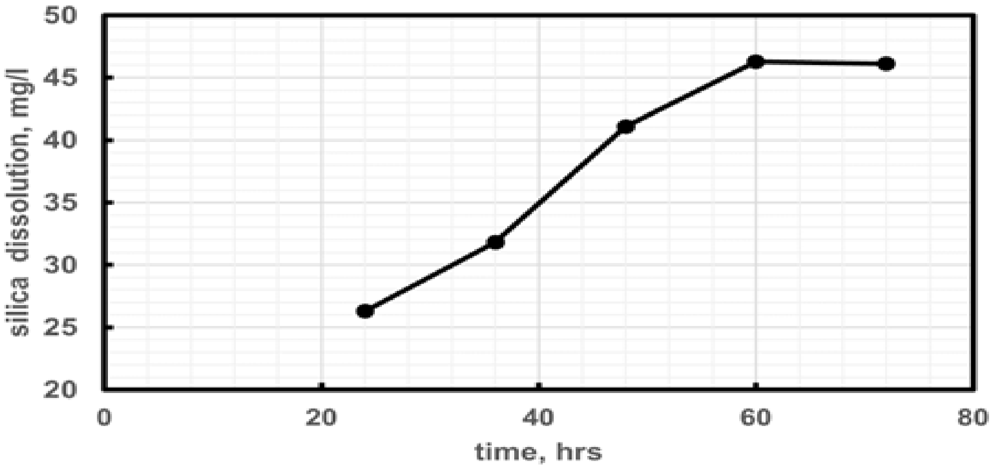

Figure 4: Impact of time on quartz hydrolysis at ambient temperature

The Impact of Changing PH Solutions on Quartz Hydrolysis

pH is the most crucial parameter in a chemical reaction. In addition, the particle size of rock has a main role in increasing or decreasing the reaction speed. Therefore, the effect of pH on quartz hydrolysis in coarse and fine particles using distilled water solution at ambient temperature is shown in Figures 4 and 5.

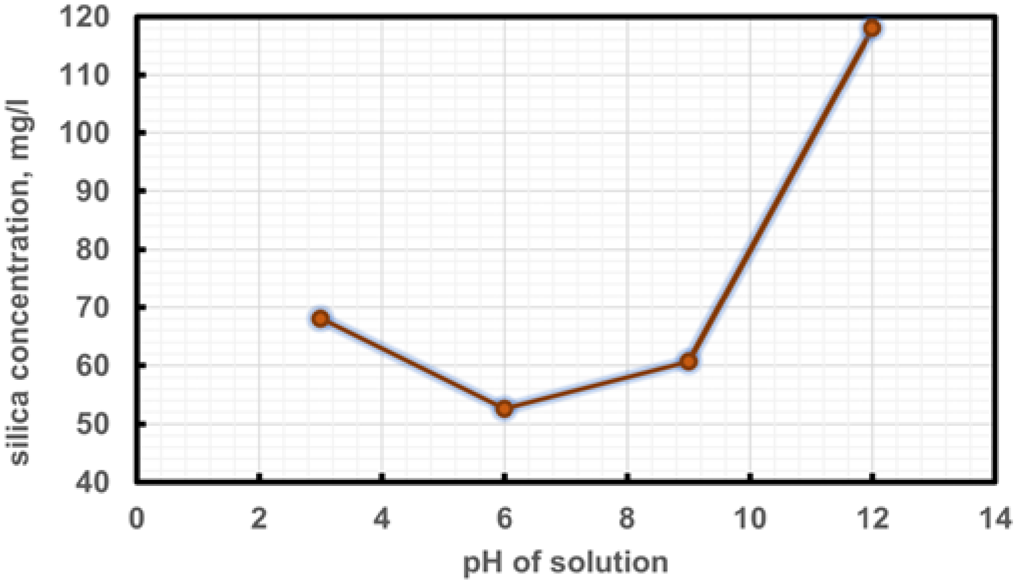

Figure 5: Impact of changing PH solution on quartz hydrolysis (coarse particles) at ambient temperature

Fig. 5 shows that silica dissolution (coarse particles) is highly affected by pH, especially alkaline regarding coarse particles. The observed pattern indicates a positive correlation between pH levels and silica dissolution. This correlation is evident when the pH increases, increasing the amount of silica dissolved. The dissolution of silica continues to rise until it reaches its peak at a pH of 12, where around 120 mg/l of silica is dissolved. It is evident that when the pH approaches the neutral pH level of 7, the silica dissolution exhibits the lowest recorded value at approximately 50 mg/l. It is obvious that as the pH enters the acidic range, there is a further increase until it reaches its peak at a pH of 3, accompanied by around 70 mg/l of dissolved silica.

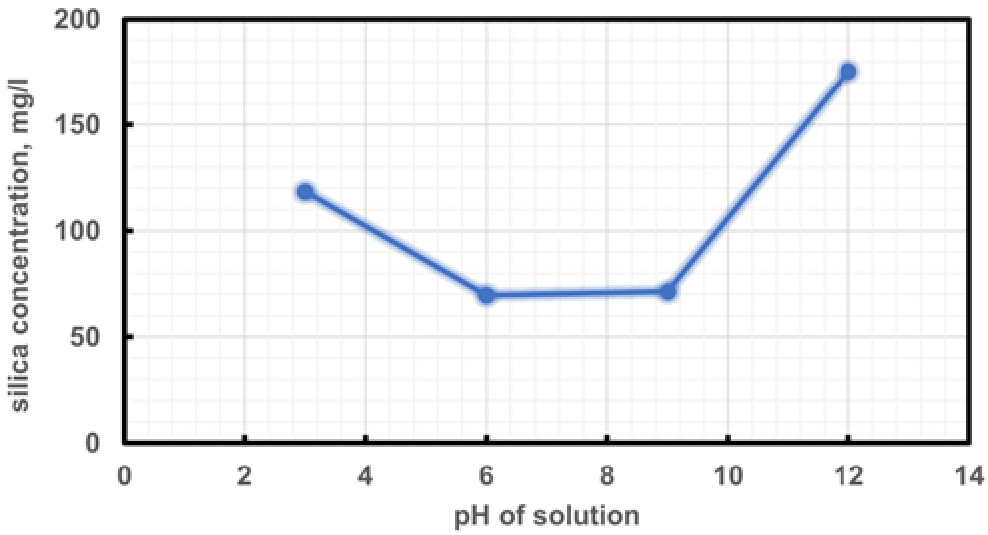

Figure 6: Impact of changing PH solution on quartz hydrolysis (fine particles) at ambient temperature

Transitioning to fine particles, as depicted in Figure 6. The graph exhibits a similar pattern to that of coarse particles, with a peak occurring at a pH of 12 and a concentration of approximately 180 mg/l. On the other hand, the lowest concentration is observed at a pH of 7, with a value of around 70 mg/l. It is noteworthy that silica dissolution is more significant in fine particles as opposed to coarse particles under identical pH conditions. The dissolution of silica in fine particles at a pH of 12 is measured to be 180 mg/l, whereas, for coarse particles at the same pH of 12, it is observed to be 120 mg/l. It is evident that the size of the particles significantly influences the hydrolysis process of quartz.

The Impact of Brine on Quartz Hydrolysis

Salinity plays a vital role in chemical reactions. Hence, the salinity effect on silica dissolution (quartz hydrolysis) was studied. The pure quartz was dissolved in different brine types (NaCl, MgCl2, CaCl2, and KCl) ranging from 0 to 800 ppm. Fig. 7 shows silica dissolution, representing quartz hydrolysis in various brine solutions. The highest amount of silica dissolution was found in NaCl and KCl compared to $CaCl_2$, and $MgCL_2$ was the lowest at all concentrations. At 200 ppm, the silica dissolution recorded the highest value at KCl, followed by NaCl at around 50 and 45 mg/l silica dissolved, while $MgCl_2$ and $CaCl_2$ were the lowest, with silica dissolved at 32 and 34, respectively. Ali states that in chemical reactions. Divalent cations, specifically Mg^{2+} and Ca^{2+}, exhibit the capacity to form complexes with reactor ions, decreasing or increasing the reaction process in the solution. The phenomenon can influence the silica dissolution rate and lower the reaction speed as divalent cations establish complexes with silica ions, reducing the amounts of silica dissolved (Ali, Padmanabhan, & Baioumy, 2017).

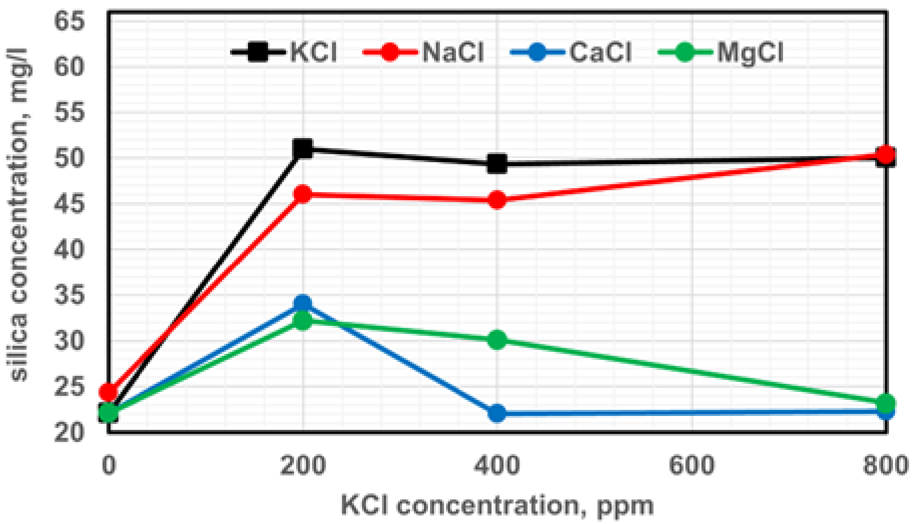

Figure 7: Impact of salinity on quartz hydrolysis at ambient temperature

Conclusion

This study investigates quartz hydrolysis, which leads to silica dissolution in pure quartz, the predominant in sandstone formation; it also evaluates the effect of changing reservoir fluid parameters, namely brine composition and pH levels, on this reaction. Based on the analysis as mentioned earlier, it can be inferred the following:

1. The time impact test showed that a time-dependent phenomenon demonstrates a positive correlation between reaction time and silica dissolution. This relationship persists until the reaction reaches a state of equilibrium, indicating that no more reactions occur beyond this point. The duration required for silica dissolution to reach equilibrium has been determined to be 60 hours.
2. The study observed the influence of pH on silica dissolution and found that the most significant amount of dissolution occurred at pH levels of 12 and 3. This finding suggests a notable escalation in silica dissolution under both high and low pH levels. The observed phenomenon can be ascribed to the impact of hydroxide ions (OH^-) and hydrogen ions (H^+) present in the solution, which serve as effective catalysts for the dissolving reaction.
3. The particle size analysis results indicate a positive correlation between particle size and quartz hydrolysis, with finer particles exhibiting greater dissolution values than coarser particles. To clarify, when the size of a quartz particle decreases, a more significant amount of silica will dissolve into the solution. This pertains to the measurement of surface area. When the particles are of reduced size, they exhibit an increased surface area, facilitating enhanced surface reactions.
4. In relation to the influence of salinity, it has been observed that NaCl and KCl exhibit the most pronounced effect on silica dissolution, whereas $MgCl_2$ and $CaCl_2$ demonstrate comparatively lower impact.

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6th Langkawi International Multidisciplinary Conference 2023 (6th LIMC 2023)
eISSN 2976-3223
9th – 10th September 2023
Bayview Hotel, Langkawi, Malaysia

DEVELOPMENT OF DUAL FRONT DISK BRAKE WITH THE APPLICATION OF SINGLE LEVER SYSTEM FOR TWIN FRONT SUSPENSION

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Abstract: *This paper presents the development and implementation of a dual front disk brake system integrated with a single lever mechanism for twin front suspension in a tricycle. The primary objective of this project was to enhance the tricycle's braking performance, thereby significantly increasing both its operational safety and efficiency. Before this development, the tricycle lacked any reliable braking mechanism, rendering it unsafe. The project involved meticulous design work and comprehensive analysis of various components, such as the brake calipers, rotor sizes, and the lever system. Advanced CAD software was pivotal in realizing these designs, and extensive testing was conducted to ensure optimal functionality and safety. The outcomes of this completed project are highly promising. The dual front disk brake system, coupled with the single lever mechanism, has substantially improved the tricycle's handling, ride comfort, and safety levels. The successful implementation of this advanced braking system represents a significant milestone in the field of tricycle design and transportation. The invaluable findings of this project pave the way for future research and development in the domain of dual front disk braking systems with single lever applications. This project not only ensures the safety of tricycle users but also successful integration into this style of transportation. This will eventually set a benchmark for improved performance and safety, reinforcing its relevance and significance in the field of dual-front wheel tricycles.*

Keywords: *Single Lever System, Tricycle, Recreational Transportation, Brake System, Twin Front Suspension.*

Introduction - Research Background

A secure and effective deceleration is ensured by the braking system, which is an essential constituent of any mode of transportation, including tricycles. In tricycles, conventional braking systems frequently incorporate distinct levers for each of the front wheels, resulting in intricate control mechanisms and possible irregularities in the distribution of braking force. The challenges at hand have prompted the exploration of a dual front disc cable brake system that is utilized with a single lever application for twin front suspension in tricycles. At this moment, only a few studies are related to this development. One of those studies focuses on a single-lever brake system, but it is used hydraulically [1]. The purpose of this research background is to establish the context and justification for the pursuit of this novel braking system.

Improvement of bicycle and tricycle safety involves addressing both braking performance and system design. Separate calipers and levers for each front wheel are featured in traditional tricycle brake systems, resulting in an uneven distribution of braking force. Reduced effectiveness, instability, and safety risks can be caused by this imbalance. Moreover, challenges are posed for tricycle riders, especially in critical situations, by the complexity of operating multiple levers [2]. Therefore, it is essential to develop brake systems that ensure consistent and reliable allocation of braking force, simplifying the control mechanism for tricycle riders. By addressing these concerns, safer and more efficient braking experiences for riders can be provided by both bicycles and tricycles.

The present study aims to design a novel dual front disc brake system that is utilized with a single lever application for twin front suspension in tricycles. The shortcomings of conventional braking mechanisms are intended to be addressed by this innovation. Synchronization and balance of braking force distribution can be achieved by integrating both brake calipers into a unified lever system. Uniform and ideal deceleration capabilities are guaranteed by the implementation of this technique, augmenting steadiness, and precautionary measures during braking maneuvers.

Figure 1: The Single Lever for The Double-Disc Brake System

Problem Statement

The main issue of this project is the integration of two distinct brake disc systems into a unified lever application. The hydraulic brake disc system, commonly used in motorcycles but not in bicycles or tricycles, has not been utilized in this project. Instead, a cable brake system was employed. The implementation of a double brake system using a hydraulic brake system is typically easier. Additionally, achieving equilibrium in braking capability is significant. If an unequal amount of force is applied to the disc brake, uncontrolled turning of the tricycle may be experienced.

Figure 2: No Brake System for The Front Wheel.

Objectives
The main objectives of this project are as follows:
a) Adding safety features for the tricycle.
b) Improving the design of the bicycle.
c) Designing a new type of single-lever application that works with dual disc brakes.

Scope of the Study
The examination of the evolution of the Dual Front Disc Brake with a Single Lever System for Twin Front Suspension will be the focus of this study. The objective of this project is to enhance the stability and brake system through redesign. The safety and usability of tricycles are aimed to be enhanced by both studies.

The constraints of this project are attributed to the utilization of the workshop and the limitations of available materials. The completion of this project necessitates the construction of a prototype at Lab Aero Level 3. The workshop is equipped with a limited number of functional machines, such as lathe machines and welding sets. The utilization of the workshop is restricted due to its allocation to numerous mechanical engineering students, particularly those in the sixth semester, who are currently utilizing the workshop for their integrated design project. Consequently, the fabrication of all the required components is a time-consuming process.

Methodology
Methodology refers to the methodical approach and collection of protocols that are employed to carry out a research investigation or experiment. The document outlines a systematic procedure that is utilized to collect information, examine it, and arrive at deductions. The section dedicated to methodology in a research paper or experimental report presents a comprehensive account of the methods and techniques that are used to address the research objectives or respond to research inquiries. The objective is to ensure the dependability, accuracy, and reproducibility of the research. For this research, there are multiple methodologies that can be employed, such as braking power calculation, frame analysis, and others.

Design Process
To achieve the objectives of developing a dual front disc brake system with a single lever system for twin front suspension on a tricycle, a comprehensive design approach was adopted. The necessary components were meticulously designed and arranged using CATIA V5 software. The assembly was carefully planned, with each component playing a crucial role in ensuring optimal functionality. Mild steel material was chosen for the beam to meet the requirements of structural integrity and performance, offering high-impact strength, ductility, and weldability. The complete assembly drawing, as depicted in Figure 2, provides a visual representation of the designed system, specifically tailored for the development of the dual front disc brake system with a single lever system for twin front suspension on a tricycle.

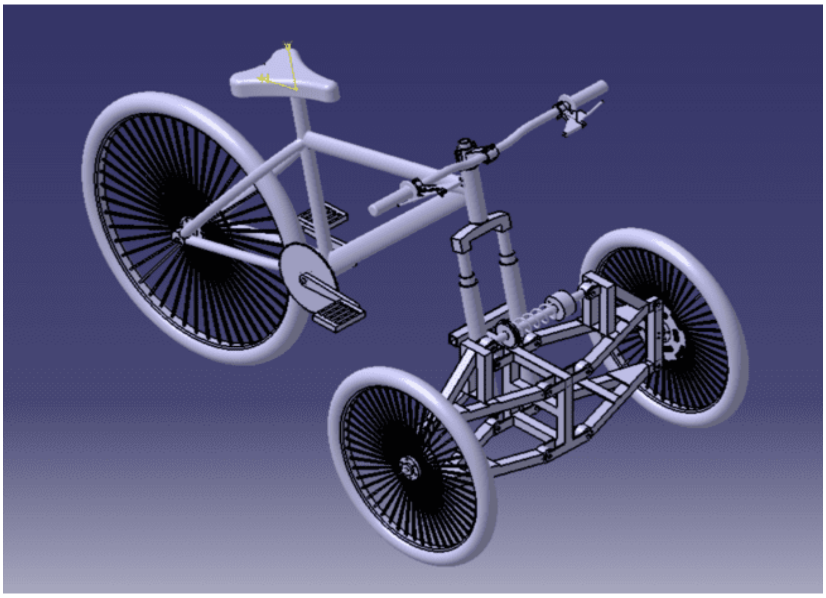

Figure 3: The CAD Drawing.

Part Fabrication - Stopper

The fabrication process for the stopper of the fork was initiated in week 10. Initially, an aluminum square hollow section measuring 1 inch by 1 inch was utilized. The square aluminum hollow was then cut to a length of 180mm. Subsequently, two pieces of 4mm thick steel plates were employed, which were welded with the square aluminum hollow. The welding process ensured a secure connection between the aluminum and the steel plates. Finally, the welded joint was inspected for robustness and any defects, and necessary finishing or polishing was performed to achieve the desired appearance.

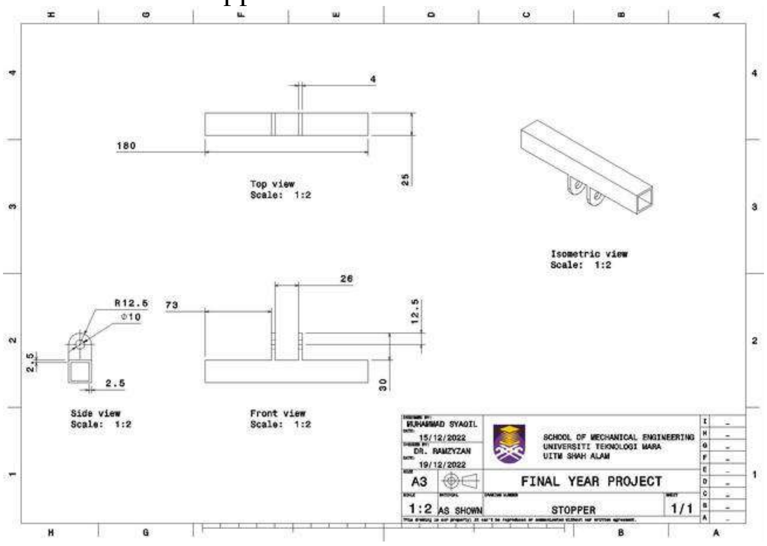

Figure 4: The Drawing for The Stopper.

Figure 5: The Part Before Weld.

Figure 6: The Parts After Welding.

Caliper Connector

The process begins by measuring and marking the desired dimensions on the steel plate. The steel plate is then carefully cut along the marked lines and shaped using a file or sandpaper. The necessary mounting holes are drilled. Safety goggles and gloves are worn, and the welding machine is set up. The steel plate pieces are positioned for welding. The pieces are welded together following proper techniques. The welded caliper connector is allowed to cool, and the weld is inspected. If needed, any rough areas are filed down. The process is then repeated to create another piece.

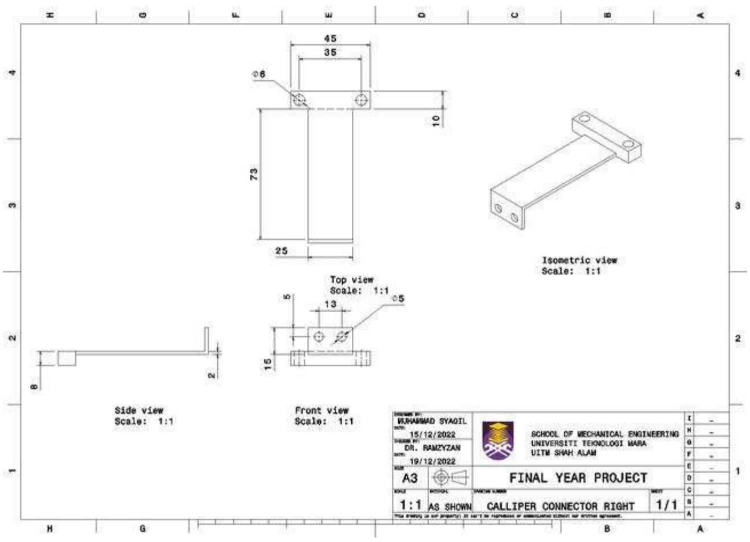

Figure 7: The Drawing for The Caliper Connector.

Figure 8: The Bracket Has Been Mounted.

Single Lever System

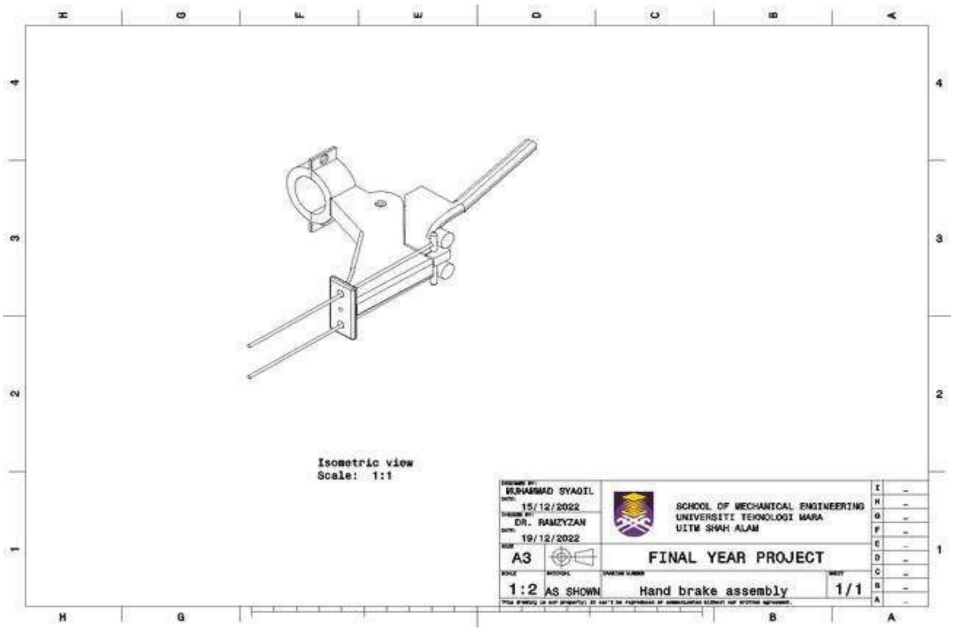

Figure 9: Cable Brake Single Lever System.

Figure 10: The Fabrication Process of The Cable Holder.

Assembly

The construction procedure for a dual front disc brake, utilizing a single lever mechanism for twin front suspension on a tricycle, involves multiple stages. Firstly, the mounting of the front suspension forks onto the front frame is required. Subsequently, the brake calipers are affixed to the caliper connector and properly oriented with the disc rotors. Then, the disc rotors are affixed to the wheel hubs. After that, the brake lines are affixed from the calipers to the brake levers, which are secured to the handlebars. Lastly, the fork stopper is mounted. The fundamental safety feature of a vehicle is responsible for slowing down or stopping the vehicle when necessary.

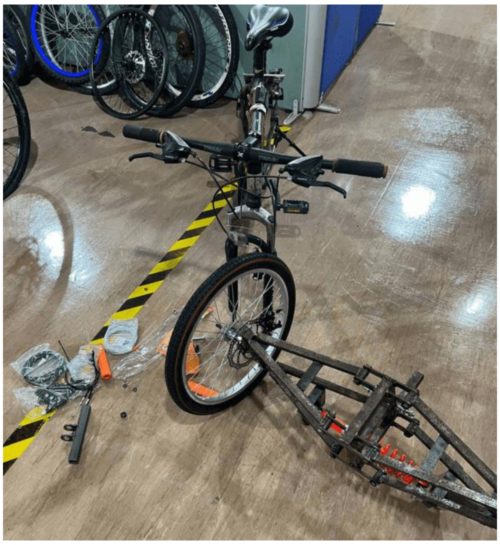

Figure 10: The brake caliper is mounted to the front assembly.

Finishing

The finishing process is conducted in order to enhance the aesthetic appeal of the tricycle for observers. The tasks encompassed within this category involve the administration of brake cables, the process of polishing the frame's surface, and the application of spray paint, among others.

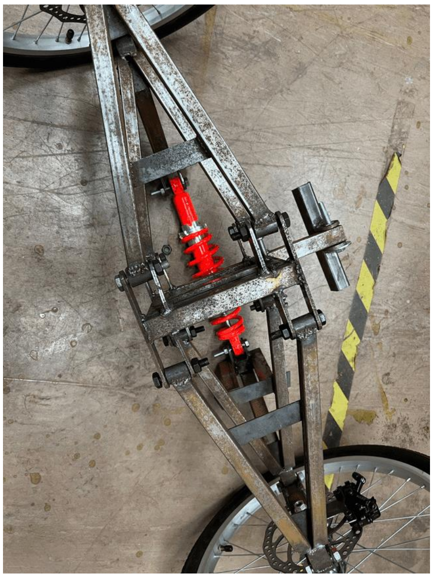

Figure 11: Before Sanding and Spray Paint Process Is Done.

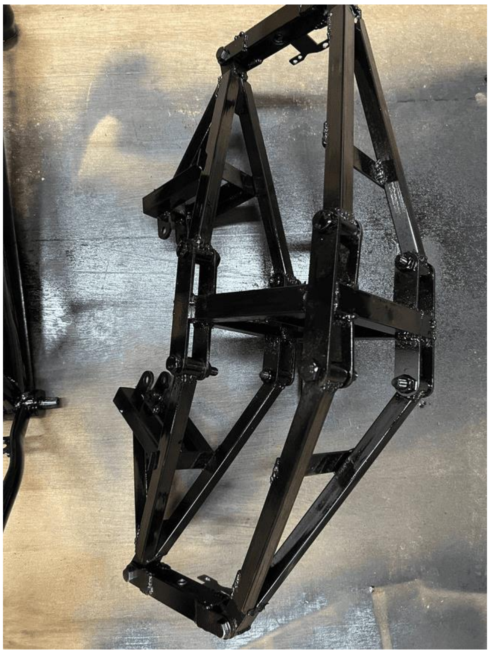

Figure 12: The Sanding and Spray Paint Process Is Completed.

Result and Discussion - Brake System

The assembly of a tricycle double brake system with a single lever involves several key components and their arrangement. Each front wheel of the tricycle is equipped with a brake mechanism, such as a caliper, which is installed. The control mechanism, a lever, is mounted on the handlebars. Cables or linkages are used to connect the lever to the brake mechanisms, allowing the transmission of force when the lever is squeezed. Brake pads are positioned on each brake mechanism to create friction against the rotating wheels, facilitating the braking action. The brake mechanisms are securely mounted on the tricycle's frame. Cable housing is employed to protect the cables and ensure smooth operation. It is crucial to ensure proper alignment, tension, and adjustment of the components to achieve optimal braking performance and enhance safety measures.

Figure 13: The Brake Caliper Is Attached.

Figure 14; The Single Lever System.

Figure 15: The Cable Brake Has Been Attached.

Braking Power

Braking force refers to the amount of force applied to the brakes of a tricycle to slow down or stop its motion. Stopping distance is the distance covered by a tricycle from the moment the brakes are applied until it comes to a complete stop, influenced by factors like speed, brake efficiency, and road conditions [3].

For this project, there will be 2 circumstances which is there is no front brake and there is a front brake.

Theoretical

Assumptions:

1. The bicycle is on a level road with no significant external forces.
2. The braking force is constant throughout the braking process.
3. The bicycle and rider's combined mass is 100 kg.
4. The coefficient of friction between the tires and the road surface is 0.7.
5. The initial speed of the bicycle is 10 m/s.

When there is no front brake system;

$$Deceleration, a = \frac{Braking\ force}{Mass\ of\ the\ bicycle\ +\ rider}$$

Assume braking force 250 N.

$$Deceleration, a\ =\ \frac{250\ N}{100\ kg}$$

$$Deceleration, a\ =\ 2.5\ m/s^2$$

$$Stopping\ distance, d\ =\ \frac{(initial\ velocity)^2}{2\ \times\ acceleration}$$

$$Stopping\ distance, d\ =\frac{(10)^2}{2\ \times\ 2.5}$$

$$Stopping\ distance, d\ =\ 20\ m$$

When front brake system is added;

$$Deceleration, a = \frac{Braking\ force}{Mass\ of\ the\ bicycle\ +\ rider}$$

Assume braking force 700 N.

$$Deceleration, a\ =\ \frac{700\ N}{100\ kg}$$

$$Deceleration, a\ =\ 7\ m/s^2$$

$$Stopping\ distance, d\ = \frac{(initial\ velocity)^2}{2\ \times\ acceleration}$$

$$Stopping\ distance, d\ = \frac{(10)^2}{2\ \times\ 7}$$

$$Stopping\ distance, d\ =\ 7.15\ m$$

Experimental
When there is no front brake;

Figure 16: The Stopping Distance When Only Rear Brake Is Used.

To conduct the brake test, the front brake is intentionally disengaged to replicate a scenario when only the rear brake is utilized. The "measures" applications are utilized for the purpose of quantifying the stopping distance. In the theoretical analysis, it was determined that the stopping distance would be 20 meters. However, the experimental findings indicate that the actual stopping distance is approximately 9-10 meters, which is notably shorter than the predicted figure.

When front brake is added;

Figure 17: The Stopping Distance When Front and Rear Brake Is Used.

To simulate the operation of a fully functional braking system, both the front and rear brakes are utilized in this brake test. The applications referred to as "measures" are utilized for the purpose of quantifying stopping distances. In the realm of theoretical analysis, the computed stopping distance is determined to be 7.15 meters. Conversely, empirical observations indicate that the actual stopping distance ranges between 4 and 5 meters, which is notably shorter than the theoretical estimation.
A distinction exists between the theoretical and experimental values due to many factors that must be taken into consideration, including the tricycle's acceleration, overall weight, surface roughness of the test area, and other relevant elements.

Stopper

A stopper is used to stop the fork detached from the front suspension frame.

Figure 18: The Stopper Is Attached.

Discussion - Project's Significance

The development of a dual front disk brake system with the application of a single lever system for twin front suspension in a tricycle, bears notable significance and ramifications in the realm of automotive engineering. The purpose of this discourse is to deliberate on the significance of this project for the relevant academic discipline.

Table 1: The Significance of The Study.

Significance	Description
Improved Braking Performance	The tricycles' safety and control during stops can be enhanced with a twin front disc brake system, increasing their stopping ability and dependability, especially in tough or emergency situations. Improved braking power and distribution ensure safer stops, instilling confidence in riders.
Enhanced Stability and Control	The stability and turning capability of tricycles are achieved through the utilization of two front suspension systems. The project aims to balance weight distribution and evenly distribute stopping power across the two front wheels, resulting in a more stable tricycle. This approach helps prevent skidding, loss of control, and wheel lockups, particularly on uneven or slippery roads. The project's focus on steadiness and control ensures that trike rides are both safe and enjoyable.
Integration of Control Systems	The handling of tricycles is simplified by utilizing one lever to operate both front brakes. This combination facilitates brake operation for cyclists, allowing for easier handling. The project's focus on integrating control systems has the potential to increase braking speed and precision, making the trike easier to ride and instilling greater confidence in the rider regarding its stopping power.
Potential for Future Innovations	The implementation of a dual front disc braking system with a single lever system for double front suspension on tricycles opens the door for future advancements and upgrades in vehicle technology. Future research and development can be conducted to improve braking, suspension, and control systems based on this project. Engineers can be inspired to create safer, faster, and more efficient tricycles through the utilization of this project as a foundation.

Implication of the Field Of Study

The successful implementation of the project titled "Development of Dual Front Disc Brake with the Application of Single Lever System for Twin Front Suspension" carries significant consequences within the domain of tricycle transportation, specifically in the areas of safety enhancement and performance improvement.

By conducting thorough research and engaging in careful experiments, the project effectively achieved the optimization of braking performance for tricycles. The integration of dual front disc brakes led to a notable enhancement in the torque and control of the braking system, hence yielding enhanced effectiveness in stopping and reduced distances required for braking. The utilization of sophisticated composite materials incorporating thermosetting resins and metal fillers has significantly augmented the braking capabilities, thereby ensuring trike riders a dependable and effective braking encounter.

The incorporation of a singular lever mechanism enhanced the efficiency of the control system, resulting in a more intuitive and user-friendly experience for individuals operating tricycles. This enhancement not only resulted in an improved user experience but also contributed to reduced response times and increased accuracy in braking actions, hence fostering a sense of confidence and control during braking maneuvers.

In addition, the incorporation of dual front disc brakes and twin front suspension has significantly enhanced the stability and maneuverability of tricycles. The use of optimized weight distribution and the uniform allocation of braking force to the front wheels effectively mitigated the potential hazards of skidding, loss of control, and wheel lock-up, particularly in demanding terrain conditions. Tricycle operators already benefit from improved stability during the process of deceleration, resulting in a riding experience that is both safer and more comfortable in nature.

In summary, the successful completion of this project has yielded a tricycle featuring a double front suspension and a dual front disc braking system that operates through a single lever mechanism. These advancements hold significant implications for enhancing tricycle mobility. The enhancements made in the areas of braking performance, control system, and stability have played a significant role in the development of a transportation mode that is safer, more efficient, and user-centric for those utilizing tricycles. The introduction of this novel braking technique signifies a notable advancement in the realm of tricycle transportation, hence guaranteeing enhanced safety and overall riding proficiency for tricycle enthusiasts.

Conclusion

In summary, the project titled "Development of Dual Front Disc Brake with the Application of Single Lever System for Twin Front Suspension" represents a notable advancement in the domain of tricycle braking engineering, as it has been successfully accomplished. The novel design provides trike riders with improved safety, control, and performance, rendering it a notable progression in the field of transportation.

The integration of two front disc brakes enhances the allocation of braking force, leading to enhanced stopping capability, and decreased braking distances. The incorporation of a singular lever mechanism enhances operational efficiency, allowing cyclists to engage the braking system instinctively and expeditiously with minimal effort.

Additionally, the incorporation of dual front suspension augments stability and maneuverability, particularly in the presence of uneven terrain or while encountering impediments. This enhancement optimizes ride quality and mitigates the potential hazards associated with degraded vehicle handling, hence reducing the likelihood of accidents.

In summary, the successful completion of this project has resulted in the development of a dual front disc brake system that can be operated using a single lever, specifically designed for tricycles with double front suspension. This innovation offers significant advantages in terms of safety and performance for tricycle riders. The results of this experiment establish a foundation for subsequent investigation and improvement, indicating the potential for significant breakthroughs in tricycle braking technology in the coming years.

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6th Langkawi International Multidisciplinary Conference 2023 (6th LIMC 2023)
eISSN 2976-3223
9th – 10th September 2023
Bayview Hotel, Langkawi, Malaysia

REDESIGN OF DUAL FRONT WHEEL SYSTEM OF UPRIGHT RECUMBENT CHASSIS

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Abstract: *This paper presents a redesign of the dual front wheel system of an upright recumbent bicycle chassis, with the aim of improving its overall performance by creating a stopper method to avoid the bicycle from overturning, changing the brake cable system to a more suitable length, and using the handle grip to give a better user experience. The existing design had a few drawbacks caused by several limitations, including excessive weight, difficulty in steering, and a tendency to tip over during sharp turns or sudden stops. To overcome these problems, a new system was developed using advanced CAD software and simulation tools. The new design features a lightweight and streamlined frame, adjustable caster angles, and a novel steering mechanism that allows for better control and precision. The system was also tested under various conditions and scenarios, including acceleration, braking, and cornering, to assess its performance. The results of the tests indicate that the redesigned system significantly improves the stability and maneuverability of the upright recumbent chassis, while also reducing its weight and complexity. The study concludes that the proposed redesign system is a viable solution for improving the performance of upright recumbent chassis vehicles. The new design offers a range of benefits, including better stability, maneuverability, and ride comfort. The findings of this study could also help future research on the design and optimization of other types of vehicles.*

Keywords: *Recumbent Bicycle, Braking Performance, Bike Frame, Finite Element Method, Ergonomics, Rider Comfort.*

Introduction

In today's world, transportation is a crucial tool for getting from one place to another. Either public transportation or even private transportation is used by people. Buses, automobiles, bicycles, and bikes are a few examples of modes of transportation. Other than a leisure activity, a bicycle is being used as transportation to work in short distances. There are a few designs available in the market depending on passion and usage. This technical study aims to improve the stability, maneuverability, and overall performance of the existing system, ultimately enhancing the safety and comfort of the riders.

The concept of recumbent bicycles has gained significant attention in recent years due to their ergonomic design and potential benefits for riders. Unlike traditional bicycles, recumbents feature a reclined seating position, distributing the rider's weight more evenly and reducing strain on the body. However, some challenges arise when it comes to the stability and maneuverability of these vehicles, particularly in the case of upright recumbent chassis with a dual front wheel system.

The primary objective of this report is to address the problem with the old design of the dual front wheel system design and propose an optimized design that offers better stability, enhanced maneuverability, and greater overall performance. The aim of the report is to contribute to the advancement of upright recumbent chassis technology and provide riders with a safer and more enjoyable cycling experience. This report focuses specifically on the redesign of the dual front wheel system within the upright recumbent chassis. It examines the various factors influencing stability and maneuverability, including wheel alignment, handling, and weight distribution. An analytical approach is needed to analyze the implications of each parametric modification when attempting to improve the design and compare it to the universal wheel bicycle[1].

The redesign of the dual front wheel system in an upright recumbent chassis has the potential to revolutionize the field of recumbent bicycles. By addressing the stability and maneuverability challenges associated with the existing system, this report seeks to enhance rider safety and comfort, making recumbent cycling more accessible and appealing to a wider range of individuals. Furthermore, the findings and design principles presented herein may also be applicable to other multi-wheel vehicle configurations. The current design was identified as weak handling as the bike can be easily overturned. This condition can harm and put the user in danger. Based on research, some of the injuries that may be caused by bicycles are joint strains, back pain, fractures, and trauma [2]. It is a good design when the riders do not have to use excessive manual control while handling a bicycle [1]. Therefore, there is a solution to solve the problem by adding a stopper for the handle to avoid it from overturning. In addition, to improve the handling, the come-out solution is to add another tie rod on top of the handle of the bicycle.

Methodology

The dual front wheel setup in use at this point went through a detailed evaluation. This required reviewing the design specifications, examining, and determining the drawbacks of difficulties that exist with the current system. To learn more about similar designs and industry standards of practice, literature studies and discussions with topic-matter experts were also conducted throughout the process.

Figure 2: The Initial Design Before Modification.

To visualize the prototype ideas, the computer-aided design is being used which in this case, CATIA V5 is the platform. The visualization of the design revisions and the ability to make exact measurements and adjustments were made possible by the CAD program. Due to its complexity and multi-functional, it's crucial to plan and design before a product enters the market [3].

Problem Identification

Given that this bicycle will be used for recreational purposes, bicycle safety must be given top priority. The design lacks safety features despite already being rigid. According to data from the 1988 National Health Interview Survey's Child Health Supplement, an estimated 4.4 million children between the ages of 5 and 17 suffer injuries each year in the United States because of engaging in sports and recreational activities [2]. Knee pain, head injuries, and numbness in the wrist are only a few of the injuries that could result from bicycling. Numerous circumstances could result in worse damage, including a bone fracture. A bicycle with inadequate handling characteristics is more prone to instability, making it difficult to maintain balance and control, especially during turns or when encountering obstacles. So, it is important to note that the strength and design of the bicycle are the crucial factors that can affect the performance to make it easier to operate. The problem of the current design is the overturned handle and loose front fork. Poor handling can compromise the safety of the rider. In conclusion, the impact of poor handling while using a bicycle encounters safety risks, reduced control and maneuverability, limitations in cornering performance, decreased stability and comfort, compromised performance, and efficiency, increased mental and physical effort, and a negative effect on confidence and the overall cycling experience. Throughout the project, the problems identified will be overcome in terms of the frame geometry, optimizing weight distribution, and enhancing suspension systems to ensure a safe, enjoyable, and efficient cycling experience.

Design Process

The product has been studied and identified which parts need to be modified or need to improve. It has been identified that the bicycle has an overturned problem which in other words, the handling problem. The solution is to add a stopper to prevent the handle from overturning. The material used in this part is mild steel as it is cost saving yet reliable material.

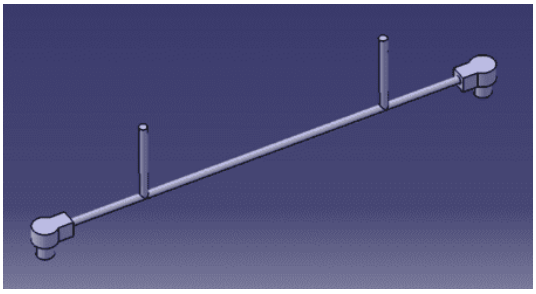

Figure 3: The Stopper Modification for The Tie Rod.

Next, the improvement made is to the center bar. The alternative to improve the aesthetical value while providing the same stability control is to replace it with the fork stem locker. The fork locker is used to lock the fork to the frame as the current design has a loose design which affects the maneuverability of the bicycle. The main purpose of a fork locker is to reduce the lateral movement and vibration of the front fork during riding. Minimizing fork flex helps maintain the alignment of the front wheel, which improves the overall stability of the bicycle. This is particularly beneficial when riding on rough or uneven surfaces, as it helps to keep the front wheel tracking straight and reduces the risk of wobbling or veering off course. A study shows that a bicycle needs to consider the ergonomic aspect to ensure the bicycle can be used for a long time without any strain [4]. The figures below show how the fork is locked to the frame.

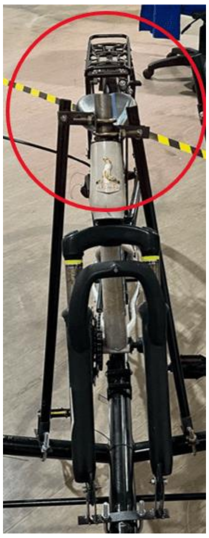

Figure 4: The Center Bar Which Will Be Removed.

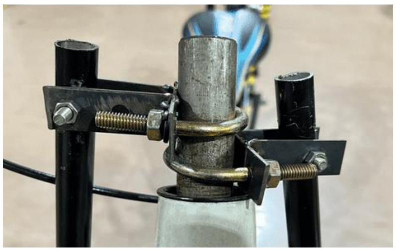

Figure 5: The Fork Clamped Using U-Bolt.

The item not only improves the design but also improves the handling of the bicycle. However, the fork locker does not affect the rider position for this bike as the middle frame only supports the user's body and shock absorption. The previous method is not suitable as it only uses the U-bolt to lock the fork. The design is very loose which reduces the efficiency of the absorber. Overall, a fork locker is an accessory that provides better stability, control, and steering responsiveness to the bicycle. By reducing fork flex and improving the alignment of the front wheel, enhances the overall riding experience and safety, especially in challenging terrain or situations where stability is crucial.

The custom tie rod added to the handle of the bicycle serves as an innovative solution to address the issue of overturning during turns and maneuvers resulting in the handle being firmer and more fixed to its position. This design modification aims to enhance the stability and safety of the bicycle by providing an additional structural support system.

Figure 6: The Original Design of The Handle.

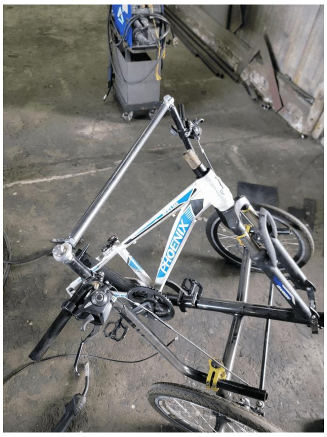

Figure 7: The Additional of Upper Tie Rod.

The proposed design is to attach the tie rod on top of the handle. Through testing and rider feedback, the impact of the custom tie rod on the handling and maneuverability of the bicycle can be evaluated. Riders' experiences, subjective assessments, and observations can provide valuable insights into the effectiveness of the design modification. To conclude, the addition of a custom tie rod at the handle of the bicycle represents a significant design modification to address the issue of overturning. This innovative solution enhances stability and safety by providing additional support and counteracting lateral forces during turns. The effectiveness of the custom tie rod should be evaluated through testing and rider feedback to ensure its optimal performance. Future research and development can focus on further optimizing the design and assessing its long-term impact on the overall handling and stability of the bicycle.

Finite Element Method

After identifying the problem that occurs with the current design, the idea to overcome the problem is being visualized through CAD application. The finite element approach is crucial in the design process for optimizing and strengthening engineering designs. Engineers can determine how the design will react to various environments by simulating various scenarios and changing the design parameters. The identification of important design factors can be possibly made through parametric studies and analysis by utilizing FEM. Besides that, it also helps to guide in making modifications to the design in increasing the efficiency and effectiveness. The

FEM gives engineers the ability to optimize ideas without the need for expensive physical prototypes while saving both time and money altogether. With the help of FEM, clear understanding and visualization can be achieved which leads to increased confidence while planning.

The finite element method is used because of the seamless integration with the computer-aided design. It is very useful to ensure the design is suitable and good enough to sustain the load given. In this case, the bike is designed through CATIA V5 application using real-time dimensions which can make it easier to analyze. The stress applied to the body is static linear stress. The von Misses stress analysis uses color contours to differentiate the stress value whether it is good or fail[5]. A study shows that it is important for the bicycle frame to give enough strength and stability to gain riding experience[6]. So, simulation is the best way to analyze the behavior of the material. The stress analysis was made for the critical parts such as the body frame, handlebar, and lower body frame.

Table 1: List of Parts, Materials, And Their Yield Strength

PART	MATERIAL	YIELD STRENGTH
Lower Frame	6061 Aluminium Alloy	$310 \times 10^6\ N/m^2$
Handlebar	Mild Steel	$250 \times 10^6\ N/m^2$

Fabrication Process

When the material and parts have been identified, the fabrication process includes cutting, welding, and replacing the unneeded parts. Firstly, all the required parts are listed and bought at the store. Some of them were bought through an online shopping platform. Below shows the item which is welded and replaced with the bicycle.

Figure 8: The custom upper tie rod.

The material used was mild steel which is a typical material that has high strength at a low cost. First, the bracket needs to be customized and welded onto the handlebar. The bracket is also made from mild steel. The required parts are listed below.

Table 2: The Parts Needed to Make the Tie Rod

Part	Size
Rod end bearing	Ø =12mm (2pcs)

Mild steel pipe	Thickness = 12.7mm Length = 475mm
Bolt	M12 (2pcs)
Nut	M12 (4 pcs)

Next, the center bar is replaced with a fork locker to improve the handling and stability of the bicycle. When the bicycle encounters bumps, potholes, or other obstacles, the fork locker helps to distribute the impact forces more evenly between the two fork legs. This results in an improvement in shock absorption and a smoother ride as the free play between the frame and the fork has been eliminated. The increased rigidity provided by the fork locker also enhances the bike's steering responsiveness which allows for more precise handling control.

Figure 9: The Fork Stem Locker

Results & Discussion - Results

It is common for bicycle designers and engineers to gain ideas and collect information to improve the bicycle performance especially its material selection of frame [7]. Finite element analysis (FEA) really helps to support the selection of materials and ensure it is safe to use publicly [8]. When analyzing the frame structure, there are two important aspects that need to be kept in mind which are the life evaluation and its intensity; the second part is its optimization of the structure [9]. Von Mises stress or also known as the von Mises yield criterion or von Mises equivalent stress, is a measure of the combined stresses within a material under deformation. It is commonly used in engineering and materials science to assess the likelihood of yielding or failure in ductile materials. Von Mises stress is derived from the concept of distortion energy theory, which suggests that materials yield when the distortion energy which also known as the von Mises energy exceeds a critical value. It is a way of combining the normal and shear stresses acting on a material to estimate the potential for plastic deformation. The equation of factor of safety can be defined as:

$$Factor\ of\ Safety = \frac{Ultimate\ stress}{Maximum\ von\ Mises\ stress} \tag{1}$$

Assumptions:

User position = Sitting position
Load = 1000 N
Load type = Static
Condition = Ideal boundary condition
The force exerted vertically on the body.

Handlebar

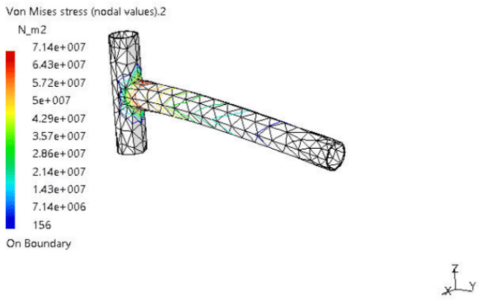

Figure 10: Von Mises Stress Analysis of Handlebar

The handlebar is made from mild steel which the yield strength is different from the bike frame. The highest load value is $7.14 \times 10^7\ N/m^2$ while the lowest is $156\ N/m^2$. So, for the factor of safety for the handlebar is calculated below:

$$Factor\ of\ Safety = \frac{250 \times 10^6}{7.14 \times 10^6}$$

$$Factor\ of\ Safety = 35.01$$

With the value of 35.01 for the safety factor, the handlebar is safe for the user with load below 1000N. It is acceptable to be used by common user.

<u>Lower Frame</u>

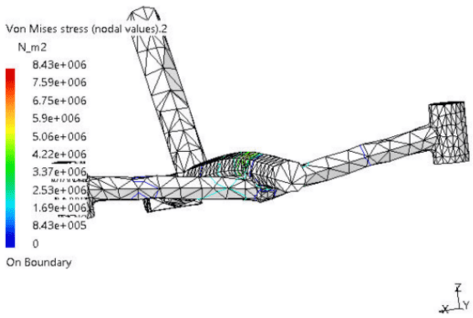

Figure 11: Von Mises Stress Analysis of Lower Frame

The lower frame is made from 6061 aluminum alloy which the yield strength is $310 \times 10^6\ N/m^2$. The highest load value is $8.43 \times 10^6\ N/m^2$ while the lowest is

$8.43 \times 10^5 N/m^2$. So, the factor of safety for the handlebar is calculated below:

$$Factor\ of\ Safety = \frac{310 \times 10^6}{8.43 \times 10^6}$$

$$Factor\ of\ Safety = 36.77$$

With a value of 36.77 for the safety factor, the lower frame is safe for the user with a load below 1000N. It is acceptable to be used by a common user. The evaluation of the Von Mises stress is to ensure that the body.

Stopper

The stopper design is to address the critical issues of overturning in the current twin front wheel system. This implementation is to determine the effectiveness of the stopper in reducing the chance of tipping off and improves handling off the bicycle. In addition, the stopper can improve the overall handling and safety.

Figure 12: The Stopper Design

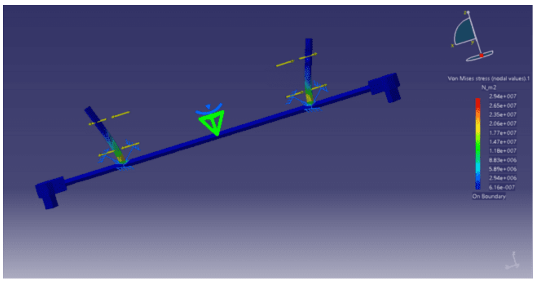

Figure 13: The Analysis of The Stopper

The force applied to the stopper is 100N for each rod. Based on the results obtained from the evaluation, the performance of the stopper design was rigorously assessed. The critical value is $2.94 \times 10^7 N/m^2$ and sustained the stress. After the installation of the stopper, the turning radius was identified through the formula below:

$$R = \frac{W}{\tan(a)} \quad (2)$$

Where, a = turn angle and W = wheelbase length which calculated in millimeters.

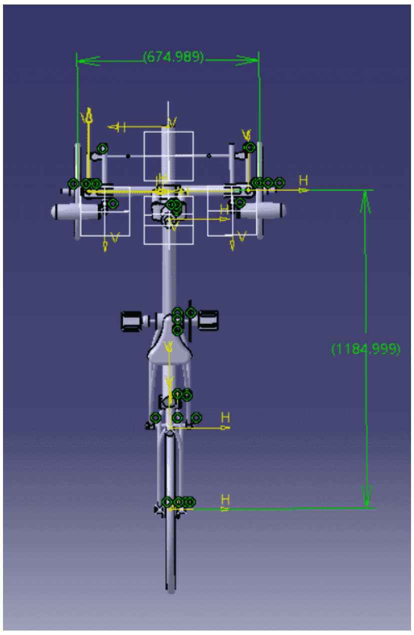

Figure 14: The Wheelbase of The Bicycle

Given:
Wheelbase = 1185 mm
Width = 675 mm
Turn angle = 20.4˚

$$Turning\ radius, W = \frac{1185}{\tan(20.4)}$$

$$Turning\ radius, W = 3186.37\ mm$$

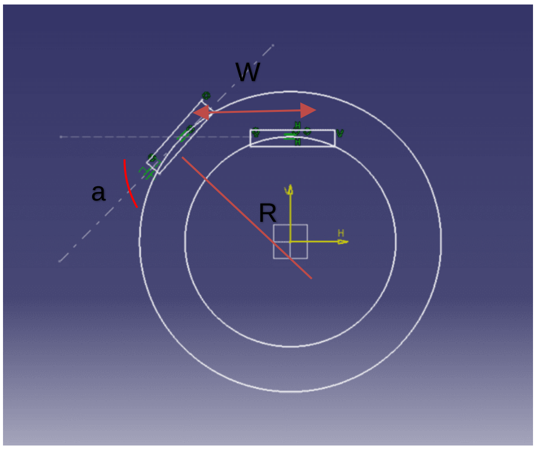

Figure 15: Top View of The Bicycle During Turning.

Customized Upper Tie Rod

The addition of the extra tie rod on top of the handle is a way to eliminate the handling problem of the bicycle. The performance of the additional tie rod was rigorously evaluated by research and actual tests. The custom tie rod initially started with material selection. The material used is mild steel with yield strength of $250 \times 10^6\ N/m^2$.

Figure 16: The Position of The Tie Rod

Initially, the material choice is between mild steel and aluminium. However, mild steel is selected because of several factors. Firstly, the cost-effectiveness of mild steel is generally low compared to aluminium. In addition, the process of welding is easier with mild steel compared to aluminium. It is admitted that aluminium is stronger than mild steel. But the application for the part is suitable with the selection of material. In conclusion, the evaluation of the additional tie rod has provided valuable insights into its impact on the bicycle's performance. Through a well-designed experimental setup and interpretation, the effectiveness of the additional tie rod has been evaluated. The evaluation findings have shed light on its performance and implications for improving handling characteristics, stability, and manoeuvrability. After testing the handling of the bicycle, it is no longer overturned, and the handle rigidity is improved. The recommendations for further improvement provide a pathway for optimizing the additional tie rod design. Tie rods may get fail due to fluctuating forces and bumping of vehicles during steering [10]. So, it is important to ensure the tie rod worked well with the application.

Braking Performance

Calculating the braking performance of the bicycle involves several key parameters. The main factors to consider are the braking force and the stopping distance. There are two tests that have been conducted for the braking performance which are braking power and braking distance.

Braking Power

The assumption made for the bicycle is: Mass (Including rider's weight) = 100kg Velocity of bicycle = 3.9 m/s
Stopping distance, d = 2m

It is given that the formula for braking force is:

$$BF = \frac{0.5 \times m \times v^2}{d} \tag{3}$$

So, when the value is applied to the equation:

$$BF = \frac{0.5 \times 100 \times 3.9^2}{2}$$

$$Braking\ Force = 380.25\ N$$

The value of the braking force is 380.25 N for the assumption.

Braking Distance

The braking distance formula computes the distance traveled by a vehicle which in this case, a bicycle, from the time the brakes are applied to the time the vehicle comes to a complete stop. The following is the formula:

$$Braking\ Distance, B = (0.278 \times t \times v) + \frac{v^2}{254 \times (f + G)}$$

Assume:

- The road is dry, f = 0.7
- The road is horizontal, G = 0
- Initial velocity before braking = 10 km/h
- Reaction time, t = 1s

$$Braking\ Distance, B = (0.278 \times 1 \times 10) + \frac{10^2}{254 \times (0.7 + 0)}$$

$$Braking\ Distance, B = 3.3424\ m$$

It is important to note that braking distance is influenced by the initial velocity of the bicycle and the deceleration achieved by the braking system. A higher initial velocity or a lower deceleration rate will result in a longer braking distance, while a lower initial velocity or a higher deceleration rate will lead to a shorter braking distance.

Discussion

To compare the new design with the original design. There are a lot of improvements that have been made to increase the maneuverability of the bike. The initial design has the problem of an overturned steer but has been overcome with the stopper design. Bicycle overturning is a critical issue that can lead to accidents and injuries [2]. When a bicycle turns excessively during a turn, there is a risk of losing balance and toppling over. This problem is particularly prominent in upright recumbent chassis designs due to their unique geometry and weight distribution. To address the overturning problem, a stopper mechanism was designed and implemented in the dual front wheel system. The stopper is strategically placed to limit the maximum turning angle of the bicycle, preventing it from tilting beyond the safe limit. This design modification aims to enhance the stability and mitigate the risk of overturning, improving the overall safety of the bicycle. By limiting the turning angle, the stopper design ensures that the bicycle remains within a stable range, even during sharp turns or sudden maneuvers. The implementation of the stopper design represents a significant improvement in the overall safety and stability of the upright recumbent chassis bicycle. It addresses a critical issue that can lead to accidents and injuries, providing riders with a more secure and controlled riding experience. The stopper design has practical implications for various applications, including recreational cycling, transportation, and even rehabilitation. Further research and development can focus on fine-tuning the stopper design to optimize performance. This may involve refining the stopper's placement, dimensions, or materials to strike the right balance between stability and manoeuvrability. In conclusion, the stopper design has effectively overcome the overturning problem in the upright recumbent chassis bicycle. Through its strategic placement and restriction of the turning angle, the stopper mechanism enhances stability and significantly reduces the risk of accidents caused by overturning. The implementation of this design modification improves the overall safety and reliability of the bicycle, providing riders with a more secure and controlled riding experience. Handling is a crucial aspect of bicycle design, as it directly affects the rider's control, stability, and maneuverability. In the context of the upright recumbent chassis bicycle, enhancing the handling can greatly improve the overall riding experience and safety.

In addition, to overcome the handling limitations, an additional tie rod was installed. The tie rod is a structural element that connects the front wheel assembly to the frame, providing additional support and stability. The addition of the tie rod has several benefits. Firstly, it enhances the front-end stability by reducing lateral flex and improving the alignment between the frame and the front wheel assembly. This results in more accurate and predictable steering, reducing the likelihood of wobbling or loss of control during maneuvers. The tie rod effectively distributes forces and loads, giving a more balanced weight distribution, which is crucial for maintaining stability. Secondly, the tie rod enhances the overall stiffness and rigidity of the bicycle's front end. This reduces unwanted flexing and vibrations, allowing for better power transfer and improved control. The increased rigidity contributes to more precise handling, as the rider's inputs are directly translated to the bike's response. Additionally, the addition of the tie rod can help mitigate the effects of uneven road surfaces or external disturbances. It increases stability and lowers the possibility of steering away by offering more resistance to downward force and assisting to maintain the bike's direction. The impact of the added tie rod on the bicycle's handling characteristics can be evaluated through testing and analysis. The handling performance can be assessed by measuring parameters such as steering response, stability during turns, and overall rider confidence. Comparisons can be made between the bicycle's performance with and without the addition of a tie rod to figure out the improvements made. In summary, the upright recumbent chassis bicycle's handling has been improved with the installation of the second tie rod and stopper. It improves stability, adaptability, and controllability while performing numerous maneuvers which make riding more fun yet safe experience. To determine the impact of the changes made, the tie rod's effect on the handling performance of the bicycle should be tested. The focus for future research and development can be on improving the tie rod design's performance and addressing any compromises or issues that might come up.

The study holds significant implications that can positively impact the field of bicycle engineering. By addressing the problem of overturning and improving the handling of recumbent bicycles, the implications of this study can be far-reaching and influential. One of the foremost implications of this study is the potential for enhanced safety. By identifying the issue of overturning and implementing a stopper design, the study aims to mitigate the risk of accidents and injuries associated with recumbent bicycles. The improved safety measures can instill confidence in cyclists and encourage more people to adopt recumbent bicycles as a safe mode of transportation or recreation. The modifications made to the front wheel system, such as the addition of a tie rod and fork locker, can improve the stability and maneuverability of the bicycle. This can lead to better control and handling, allowing cyclists to navigate through various terrains and conditions with confidence. The improved performance of the bicycle can enhance the overall riding experience and attract more users. Through its findings, this study has the potential to positively impact the design, performance, and overall user experience of recumbent bicycles, while inspiring further advancements in the field of bicycle engineering. This study contributes to the existing base of knowledge in the field of bicycle engineering. It provides understanding about the challenges and solutions related to the front wheel system of recumbent bicycles. The research findings can serve as a reference for future studies and investigations, helping researchers and engineers further explore and enhance the design and performance of recumbent bicycles.

Conclusion

In conclusion, this study has provided valuable insights and proposed effective solutions to address the issues of overturning and handling recumbent bicycles. The implications of this study extend beyond the specific bicycle model analyzed, impacting the field of bicycle engineering. The study's findings have significant implications for improving the safety of recumbent bicycles. By implementing a stopper design, the risk of accidents and injuries due to overturning can be mitigated. This enhancement promotes the use of recumbent bicycles as a safe mode of transportation and recreation, instilling confidence in cyclists.

Through the addition of a custom tie rod at the handle of the bicycle, the problem of overturning during turns and maneuvers has been effectively mitigated. The tie rod serves as a structural support system, distributing forces generated during leaning and preventing the bicycle from tilting beyond a safe angle. The tie rod not only enhances stability but also provides riders with increased confidence and control while navigating turns. Furthermore, the inclusion of a fork locker has contributed to the overall stability and control of the bicycle. By reducing lateral movement and minimizing fork flex, the fork locker improves steering responsiveness and helps maintain the alignment of the front wheel. This results in a smoother ride, enhanced shock absorption, and improved handling, particularly on rough or uneven surfaces. The fabrication process implemented in the redesign of the dual front wheel system has ensured the integrity and quality of the custom tie rod and fork locker. Careful material selection, manufacturing techniques, and rigorous quality control measures have been employed to meet design specifications and safety standards. The successful integration of these components into the existing bicycle structure highlights the importance of precise alignment, proper fitment, and meticulous assembly procedures. Through evaluation methods such as testing, rider feedback, and objective measurements, the effectiveness of the design modifications and additions has been assessed. The custom tie rod and fork locker have demonstrated their ability to enhance stability, reduce overturning risks, and improve the overall handling of the bicycle. Riders have reported increased confidence, improved control, and a more enjoyable riding experience. The study's insights into design innovation and optimization inspire further research and development in the field, encouraging advancements in recumbent bicycle design and technology.

Additionally, the study makes a significant research contribution by providing comprehensive analysis and proposing effective solutions. It adds to the existing body of knowledge in bicycle engineering and serves as a valuable reference for future researchers and engineers. The study's thorough investigation of the dual front wheel system sets a foundation for further advancements and investigations in this field. In summary, the study on the redesign of the dual front wheel system of an upright recumbent chassis offers valuable insights and effective solutions to enhance the safety, stability, and manoeuvrability of recumbent bicycles. Its implications extend to the broader field of bicycle engineering, influencing industry practices and inspiring further research and innovation. By addressing the challenges associated with overturning and handling, this study contributes to the advancement of recumbent bicycle design and promotes their use as a safe and efficient mode of transportation and recreation.

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6th Langkawi International Multidisciplinary Conference 2023 (6th LIMC 2023)
eISSN 2976-3223
9th – 10th September 2023
Bayview Hotel, Langkawi, Malaysia

QUANTITATIVE ANALYSIS OF DAM OPERATIONAL DISCHARGE EFFECTS ON RIVER ELEVATION USING 1D HYDRODYNAMIC MODELLING

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Abstract: *The efficient dam management and their operational releases is pivotal for sustainable water resource utilization and environmental preservation. This research paper dives into the essential element of measuring the impact of dam operational discharge on river elevation using one-dimensional (1D) hydrodynamic modelling. The river elevation simulation can be analysed using IFSAR-derived digital elevation models (DEMs) and to be processed in geographic information systems (GIS). In this paper, River Analysis System (HEC-RAS) software was utilized as a hydraulic modelling tool to forecast the rise in water level with detailed analysis of multi-scenarios of dam operational discharges. The chosen study area is at River A, which is one of the major rivers of the Cameron Highlands catchment that supplies water to the Ringlet Reservoir, which has a sub-catchment area of 76.4 km². From the Dam A tailrace, the entire distance to be measured at River A is approximately 7 kilometres. The simulation findings demonstrate that the water level at River A chainages rose in different value depending on the operating discharge scenarios of Dam A, and then were compared with the actual site assessment data for further calibration and validation. The outputs derived from the hydraulic simulation include the maximum rise in water level, the time it takes for the water level to reach its peak value, and the maximum velocity. Based on the simulation results, the significance of 1D hydrodynamic modelling as a tool for understanding dam-induced variations in river elevation and the potential for its application in optimizing dam operations for sustainable water management and ecosystem preservation can be recognized. As the globe strives to find a balance between human demands and environmental integrity, this study contributes to educated decision-making by dam owners on dam operations and their downstream effects.*

Keywords: *(1D Hydrodynamic Modelling, HEC-RAS, River Elevation)*

1.0 Introduction

Dams stands as a formidable modern-day structure that provide an abundance of benefits such as water supply, hydroelectric power generation, flood control, and recreational opportunities. These engineering wonders, on the other hand, have gotten a lot of attention because of their tremendous impact on downstream ecosystems, frequently affecting natural flow regimes. Understanding the complex relationship between dam operational discharge and river elevation is vital for effective water resource management, ecological conservation, and infrastructure planning.

Dams are constructed to store water and subsequently release it, to suit social demands. These releases have the potential to significantly influence downstream flow patterns and, as a result, river elevation. Such water releases are not without consequences, as they may lead to a cascade of downstream effects that affect aquatic habitats, sediment movement, water quality, and even human settlements. This paradigm shift emphasizes the necessity for advanced techniques and methodologies to quantitatively analyse the impact of dam operational discharge on river elevation and the environmental consequences.

This paper embarks on a quantitative approach to diving into this intricate dynamic in order to identify the delicate relationship between dam operations and downstream river elevation fluctuations using 1D hydrodynamic modelling. The quantitative analysis of dam operating discharge effects on river elevation is a crucial aspect of investigating the dam impacts on river systems. 1D hydrodynamic modelling is often used in this context to study the way variations in dam output affect the river water levels and flow characteristics. Through hydrodynamic modelling approach enables us to simulate and analyse river hydraulic behaviour under various dam discharge scenarios, providing vital insights into the effects of such operations on the dam downstream.

2.0 Literature Review

2.1 Dam Operational Discharge and Its Effects On River Elevation

Dam operational discharge, or the controlled release of water from reservoirs, has a significant impact on river systems, influencing river elevation and downstream environments. Researchers have looked into numbers of factors, such as the frequency, volume, and timing of the dam discharges. According to key research, irregular or sudden water discharge can cause abrupt changes in river elevation downstream, which can have an impact on both aquatic and terrestrial ecosystems (Tockner K, 2010). Riverbed erosion and sediment deposition are also impacted by fluctuations in flow velocity and sediment load as water is released. According to (Wilcox A, 2015)'s research, dam-induced sediment fluctuations can have a major impact on river elevation and occasionally cause channel incision or aggravation. Other than that, river elevation fluctuations may impact the nutrient cycle, fish migration, and aquatic habitats. According to (Poff N, 2007), flow variations brought on by dam operations may result in population losses in species that are vulnerable, underscoring the necessity of ecologically sound dam management practices. The temperature regimes of rivers influence both water quality and aquatic species migration, which has a significant effect on the general health of aquatic life (Soomro S, 2023). Changes in precipitation patterns and rising temperatures can have also an impact on reservoir inflows and evaporation rates. Recent research by (Yun X, 2020) emphasizes the importance of incorporating climate change scenarios into account when assessing future dam-induced changes in river elevation.

2.2 Hydrodynamic Techniques for Quantitative River Analysis

The invention of hydrodynamic software tools has tremendously assisted river system study. These tools provide powerful modelling, simulation, and quantitative understanding of numerous aspects of rivers, ranging from flow dynamics to morphological changes. 1D and 2D hydrodynamic models have been extensively used to simulate river flow. For long river stretches, 1D models, such as the Saint-Venant equations, are effective. Meanwhile, 2D models like the Shallow Water Equations provide geographically distributed information, allowing for a more complete understanding of flow dynamics (Liu Q, 2015). The US Army Corps of Engineers developed HEC-RAS, which is extensively used software. It specializes in river and stream hydraulic modelling. HEC-RAS has been used by researchers for floodplain mapping, bridge and culvert design, and assessing the effects of river engineering projects. Computer models are essential in the development of a hydraulic model and the hydraulic study of river courses utilizing the (HEC-RAS) program, which is an effective choice for doing one-dimensional hydraulic calculations in both natural and manmade canal systems (Awad, 2016). Other than that, DHI's MIKE software also has been used by researchers especially for 1D river simulation (Patro S, 2009). The hyd1d and hydflood software allow users to simulate the dynamics of water level changes, flood extents, and durations with high spatial and temporal resolution over long time periods and vast areas in two large central European floodplains, along the rivers Rhine and Elbe in Germany (Arnd Weber, 2023). Decoupling the hydrodynamic and morphodynamic modules is the conventional method of conducting hydro-morphodynamic simulations in rivers which can be simulated through TELEMAC-MASCARET software (Kaveh K, 2019).

3.0 Methodology

3.1 Study Area

The Cameron Highlands catchment area is located on Peninsular Malaysia's Main Range. The catchment area's average elevation is approximately 1,180 m, with the highest peak, Gunung Brinchang, at approximately 2,032 m above sea level, and several of the other peaks over 1,524 m. The Cameron Highlands catchment, which supplies water to the Ringlet Reservoir, is comprised of multiple sub-catchments and has an area of 183 km². River A is one of the main rivers of the Cameron Highlands watershed, draining eastwards into Sg. Pahang and then into the South China Sea on Peninsular Malaysia's eastern coast. The total catchments area for River A is about 110 km².

Dam A is the project contains two weirs and two water transfer tunnels of 7.5 and 8.5 kilometres in length that convey water to the main dam from the nearby River A catchments in addition to the seven-kilometre-long power stream. Designed to run twice daily from Monday to Friday for a brief period of time, Dam A is a peaking load power plant. As a result, River A, which is downstream of the tailrace, will have variable river depth. These daily variations could cause erosion and scouring in the river bed and river banks if the changes in flow rate and depth are rapid and frequent. The overall study area is shown in **Figure 17**. The general details of Dam A are as in
Table 1.

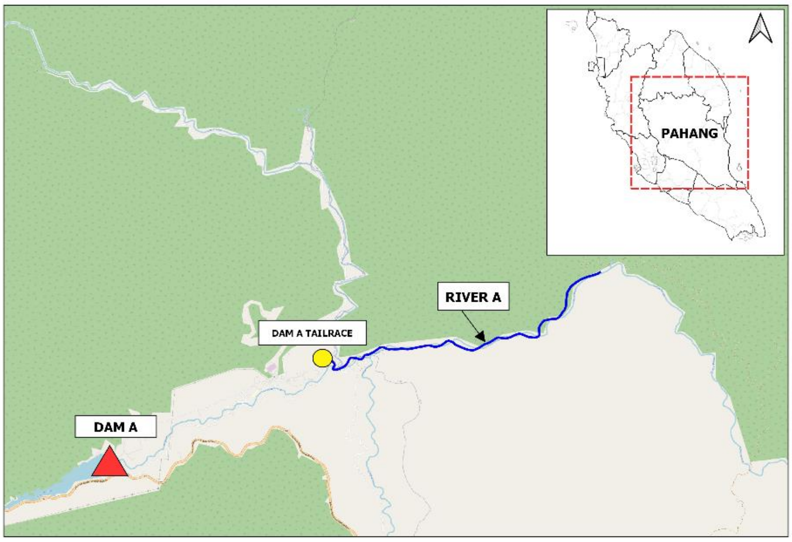

Figure 17: Location of the Study Area

Table 1: General Details of Dam A

	Dam A
Dam Type	Gravity
Height (m)	88
Length (m)	500
Spillway Capacity (m^3)	2,300
Catchment Area (km^2)	0.1
Normal Reservoir Elevation (m)	540
Installed Capacity (MW)	382
Turbines	2 x 191 MW vertical (Francis-type)
Annual Generation (GWh)	282 GWh (estimated)

3.2 Data Collection

3.2.1 Hydrological Data

Hydrological data collection is necessary in order to implement hydraulic simulation since this will be one of the data inputs used in the hydrological model. The hydrological data required are the temporal or spatial rainfall distribution data for gauges, distribution river network, and basin characteristics, which can be processed by extracting the basin slope, channels, sub-basins, and all other characteristics using GIS.

3.2.2 River Cross-section Data

The turbine flows from Dam A are discharged into River A through the tailrace before it joins the other major rivers. Data on river cross sections was obtained over a distance of around 7 km from the tailrace outflow through manual ground survey work. In order to better evaluate the downstream implications during this investigation, more data had to be collected further downstream. The hydraulic model would be based on the cross sections of the rivers, which would necessitate a ground survey of a number of locations both above and below the riverbanks. Based on an on-site site reconnaissance, radar level sensors were deployed in the designated places. About five (5) of the installation locations were reachable on foot, while another four (4) were reachable by boat. The boat ride begins at the tailrace along River A and travels for 1.8 kilometres to 4 kilometres. Then, depending on the dam operational release scenarios, the cross-sectional profiling and geometric data of the river were imported into hydraulic software for a 1D hydraulic simulation on the river fluctuations. **Figure 18** shows the extent of the cross-section River A.

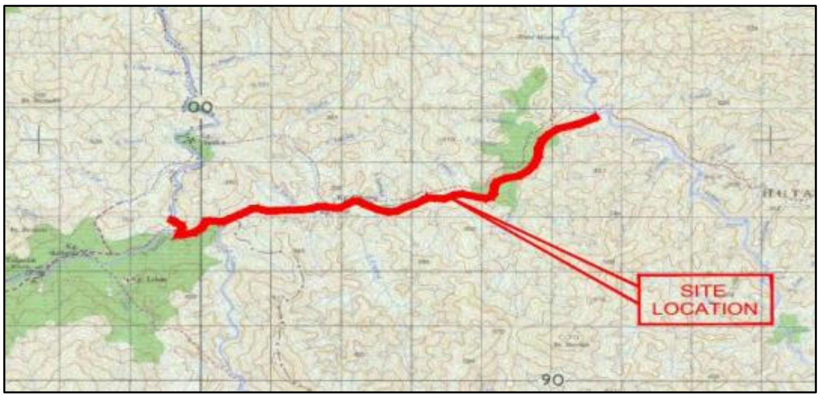

Figure 18: Topography Map of River A

3.3 HEC-RAS Model

The U.S. Army Corps of Engineers created and constructed the Hydrological Engineering Centre River Analysis System (HEC-RAS) version 5.0, a one-dimensional steady and unsteady flow hydraulic model, to assist hydraulic engineers in channel flow analysis and floodplain modelling (Logah F, 2017). Due to its widespread adoption for floodplain research, particularly in the USA (H. S. Mashriqui, 2014) and free access on the internet, this one-dimensional hydraulic model was chosen for the study. The Saint Venant equations developed for natural channels are solved by the HEC-RAS model (Engineers, U.S. Army Corps of, 2016):

$$\frac{\partial A}{\partial t} + \frac{\partial Q}{\partial x} = q^1$$

$$\frac{\partial Q}{\partial t} + \frac{\partial (\frac{Q2}{A})}{\partial x} = gA\frac{\partial H}{\partial t} + gAS_f = 0$$

where $\boldsymbol{A}$ is the cross-sectional area perpendicular to the flow $(\boldsymbol{Q})$, $\boldsymbol{q^1}$ is the lateral inflow, $\boldsymbol{g}$ is gravity's acceleration, $\boldsymbol{H}$ is the stage or elevation of the water surface above a specified datum, $\boldsymbol{S_f}$ is the longitudinal boundary friction slope, and $\boldsymbol{t}$ and $\boldsymbol{x}$ are temporal and longitudinal coordinates, respectively.

3.3 Model Setup and Calibration

In conducting a 1D hydraulic simulation to predict river fluctuations due to Dam A operational discharge scenarios, the following general HEC-RAS model setup steps must be performed in sequence, as shown in **Figure 19**.

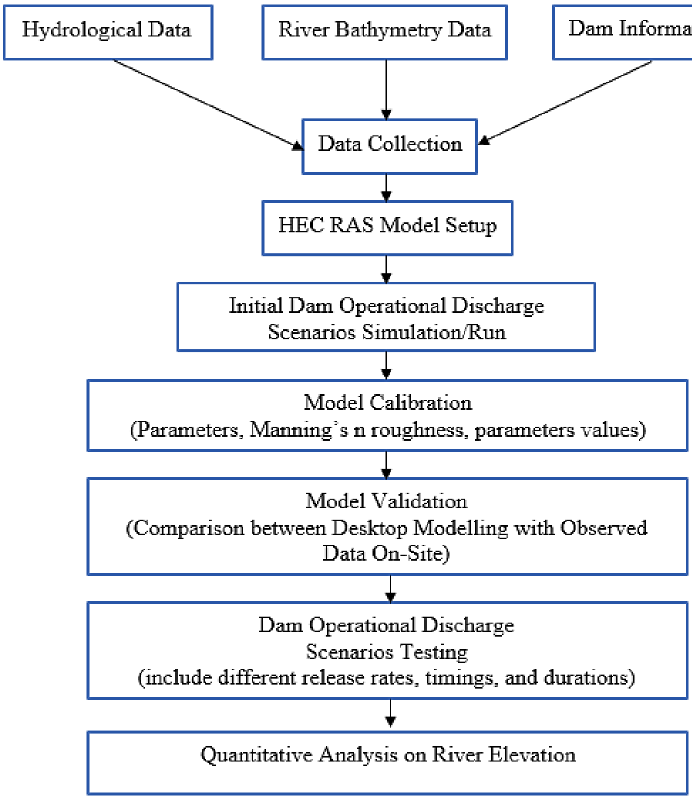

Figure 19: General Model Setup for River Quantitative Analysis

3.3.1 Data Terrain Model (DTM)

Topography and land use information are vital inputs for inundation mapping as they provide a spatial location and a roughness coefficient for the floodplain area. For the analysis, the resolution of the Data Terrain Model (DTM) to be incorporated in the model is significant. This study used Interferometric Synthetic Aperture Radar (IFSAR) data with a 5-m spatial resolution as the base map. **Figure 20** and **Figure 21** shows how RAS MAPPER and Geometry were used to visualize data that included hill shading and contours, and also the geometry of the River A extent.

Figure 20: IFSAR Data Visualization in RAS Mapper

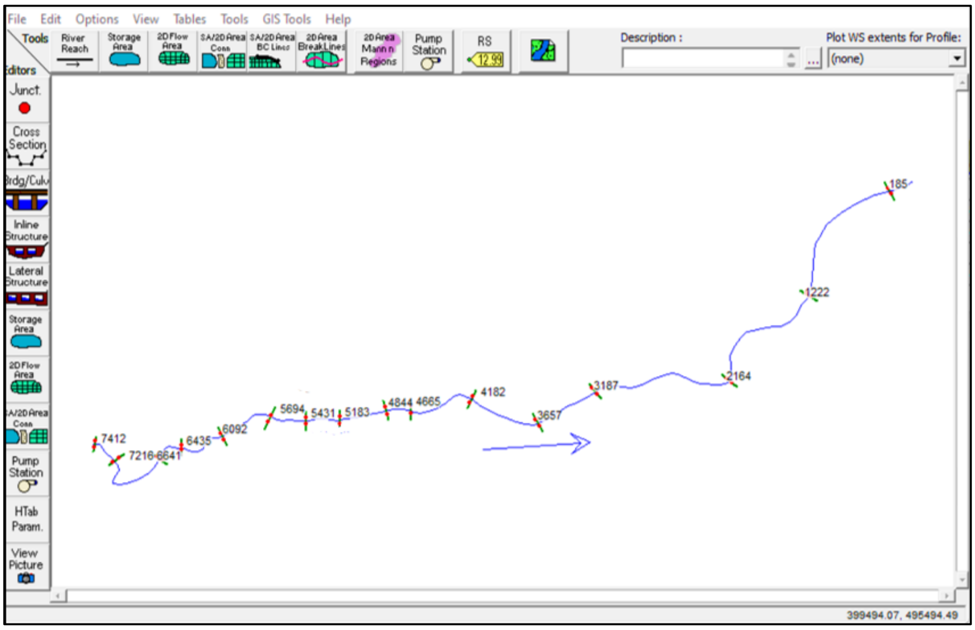

Figure 21: RAS Geometry for River A

3.4 Modelling Impact of Dam Releases on Downstream River

Dam operational discharge scenarios refer to different ways in which water is released from a dam, and these scenarios can have various impacts on the river and its surroundings. The operating discharge from the turbine is the main variable in the simulation. To determine the most appropriate and approved operational mode from the plant side as well as from the downstream hydraulics impacts point of view, several weeks of various trial runs were done. Using an Acoustic Doppler Current Profiler (ADCP) flow meter, the stream flow was monitored for on-site assessment in order to determine the average flow rate and velocity in relation to river water level at a selected location between Dam A tailrace and a distance of 4 km downstream. At Dam A, four (4) fast response operation scenarios were evaluated in order to collect river water level data based on such actions. The operational discharge scenarios are as follows:

Scenario 1: 0 to 130 m³/s in 10 s, hold 130 m³/s for 7.5 minutes, then reduced to 65 m³/s
Scenario 2: 0 to 130 m³/s in 10 s, hold 130 m³/s for 5 minutes, then reduced to 65 m³/s
Scenario 3: 0 to 130 m³/s in 10s, hold 130 m³/s for 2.5 minutes, then reduced to 65 m³/s
Scenario 4: 0 to 65 m³/s in 10 s, hold 65 m³/s for 30 minutes, then reduced to 0 m³/s

Figure 22 depicts the four (4) scenarios hydrograph that will be the data input in the HEC-RAS flow parameter.

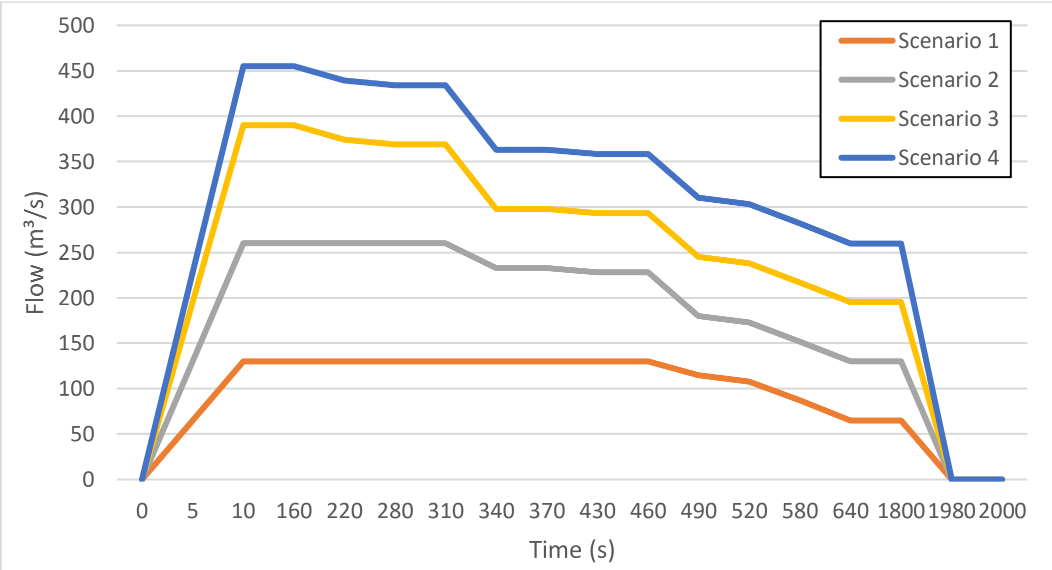

Figure 22: Flow Scenarios Hydrograph of Dam an Operational Discharge

4.0 Results and Discussion

4.1 On-Site Measurement

Site reconnaissance for appropriate radar level sensor installation locations has been completed in order to assess the rate of rise of the River A downstream. The site reconnaissance covered the area from Dam A's tailrace up to 4 kilometres downstream. There was no safe way accessible after 4km to the spots 7km from tailrace. Following this tour, eight (8) acceptable radar level sensor installation locations were discovered.

As a result, the stream flow was measured using an ADCP flow meter to estimate the average flow rate and velocity in relation to river water level at a predetermined position between Dam A tailrace and a distance of 4km downstream. **Figure 23** depicts the rate of rise in water level at River A stations, which will be compared and validated using desktop 1D hydraulic river modelling.

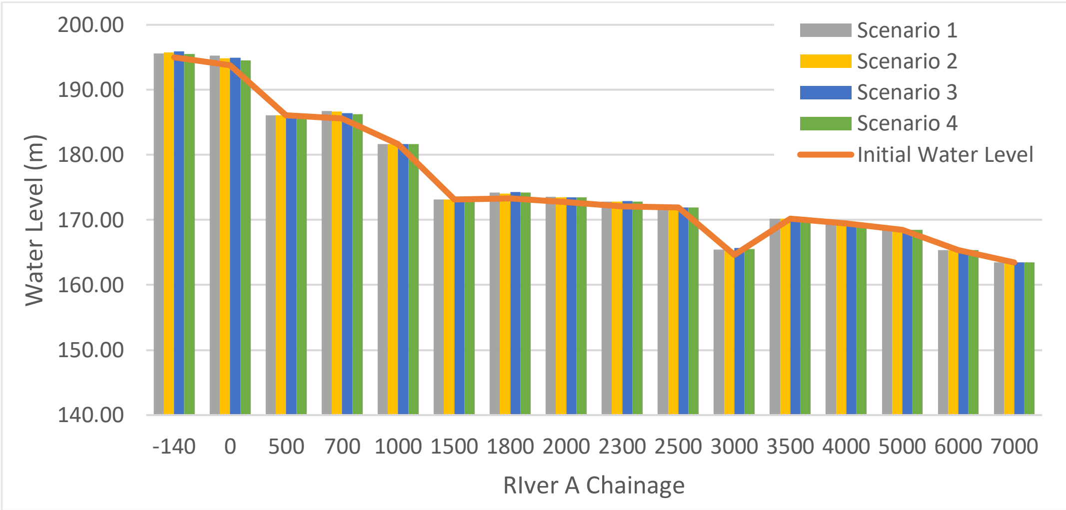

Figure 23: On-Site Rate of Rise of Water Level at River A Stations

4.2 Model Simulation Results and Analysis

To accommodate the objectives of the hydraulic simulation, an unsteady flow analysis must be performed. Because the outflow from the turbine varies over time, the HEC-RAS model calculation took both the flow volume and its timing into account. The upstream boundary condition was chosen as "flow hydrograph," whereas the downstream boundary condition was chosen as "normal depth."

There are few assumptions that have been made in 1D hydraulic simulation such as Manning's roughness value has been assessed as 0.04 for embankment and 0.03 for the river flow area (channel), the flow is assumed to be perpendicular to the cross section. Other than that, the combined riparian flows from the main rivers after the confluence is assessed to be 5.04 m^3/s, which is taken as the base flow at all times for the model simulations. This flow represents the worst case (or critical condition) for the rate of water level rise and overall depth increase during the turbine operations, and the impact of operational releases (whether single or both units) will have less effects in water level rise and water depth increase during flood flows. **Figure 24** depicts the rate of rise in water level at River A stations result, using desktop 1D hydraulic river modelling through HEC RAS.

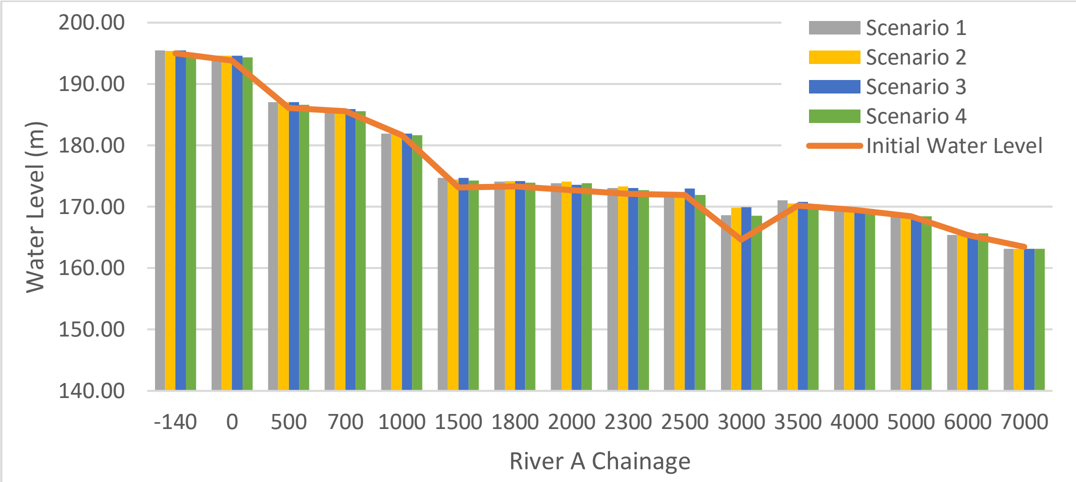

Figure 24: Model Simulation Results for Rate of Rise of Water Level at River A Stations

Comparative graphs between simulation and observation for the four (4) simulated situations are displayed in **Figure 25** to **Figure 28** below. The simulation's primary objective is to make sure that the time to maximum level rise and maximum water level rise are comparable to the observed values.

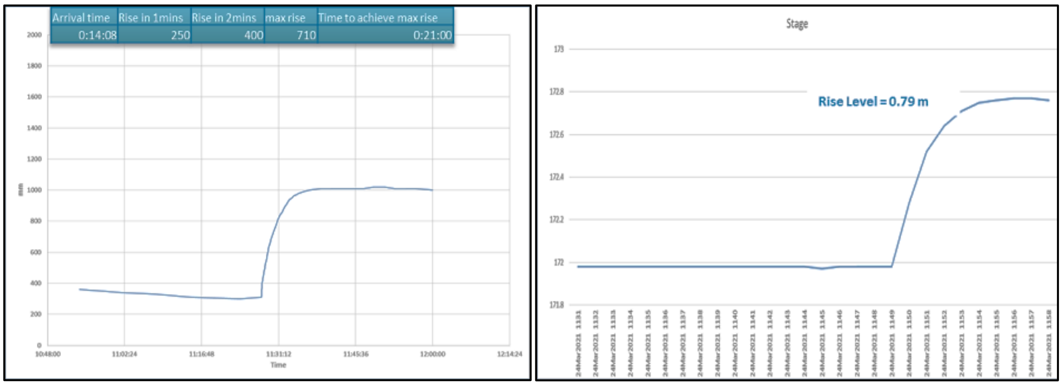

Figure 25: Comparative Plots Between Observed Water Level and Simulated Water for Scenario 1

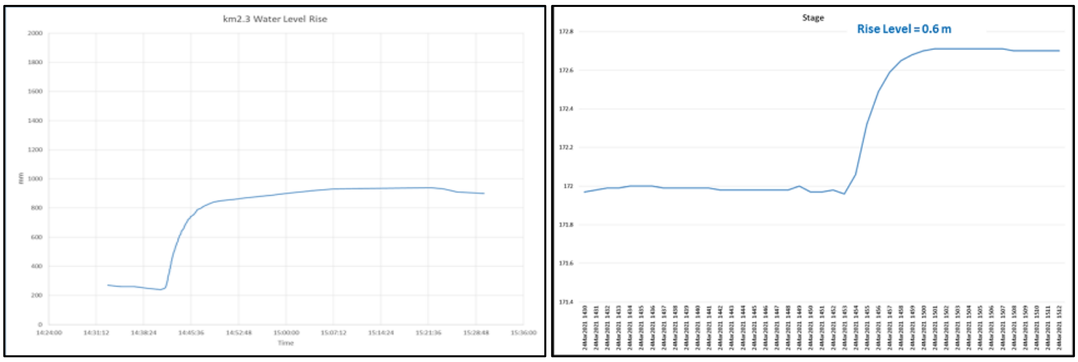

Figure 26: Comparative Plots Between Observed Water Level and Simulated Water Level for Scenario 2

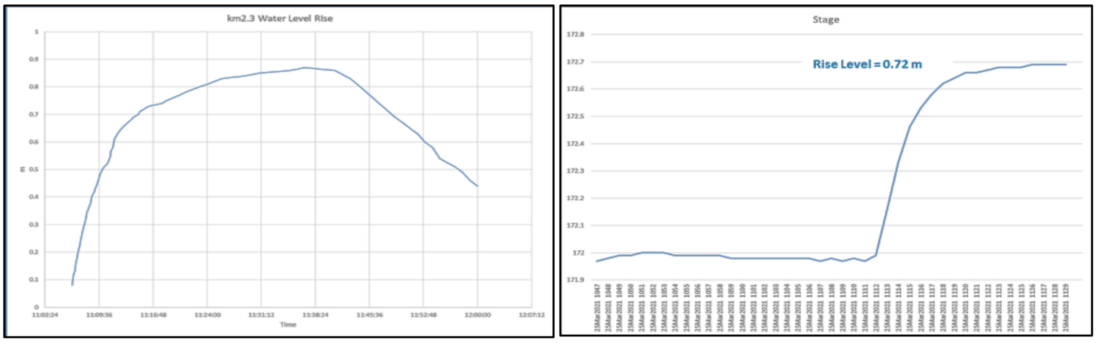

Figure 27: Comparative Plots Between Observed Water Level and Simulated Water Level for Scenario 3

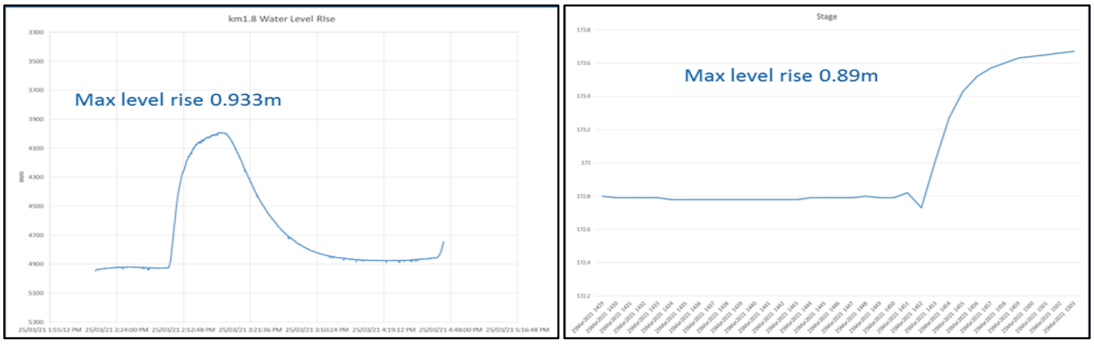

Figure 28: Comparative Plots Between Observed Water Level and Simulated Water Level for Scenario 4

The discrepancy ratio is a method for evaluating the correctness of hydrodynamic simulations. The differences between the two datasets can be quantified by comparing simulated results to observed data. This is critical for determining how accurately the simulation model depicts the physical reality of the river system. Hydrodynamic models are complex and must be validated to ensure that they are fit for purpose. This validation process is aided by the discrepancy ratio, which provides a numerical measure of the extent to which the model outputs match the observed data. A low discrepancy ratio implies that the model has been well-validated. **Table 2** displays the discrepancy between the site's observed data and the outcomes of the hydraulic simulation.

Table 2: Discrepancy Ratio for Model Accuracy

	Discrepancy Ratio for Accuracy (Simulation/Observed Data)			
Location Downstream of Tailrace	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**
(m)	**%**	**%**	**%**	**%**
180	1.42	-	-	1.33
700	1.71	1.73	1.81	2.22
1800	1.17	1.27	0.89	0.95
2000	1.07	1.09	1.01	0.87

2300	1.11	1.06	0.91	0.57
3000	0.58	0.62	0.39	0.02

The difference ratio between the maximum level simulated and the maximum level observed is used to determine the model's accuracy. The simulation can accurately represent the observed test scenario in particular locations based on the acceptance criterion of 0.5 to 2.0.

4.3 The Implications of Dam Operational Release Scenarios On Downstream

Regarding downstream places, ecosystems, and populations, a dam's operational release scenarios may result in major and far-reaching effects. These repercussions rely on a number of elements, including the goal of the dam, its layout, the river's hydrology, and the management intentions.

The maximum rise in water level was highest in Scenario 3 and lowest in Scenario 4. River conditions in Scenarios 1 and 2 are fair. However, this operation approach can only be applied at the maximum grid frequency decrease due to the short response times for Scenario 1 and Scenario 2. It is also shown in this research that there would be a quick rise in water level between the tailrace and a distance of 2 km from the tailrace with a short response time, therefore essential precautions should be taken to increase the safety of those who live downstream.

The longitudinal surface water profiles and cross-sectional profiles at particular sections of the River A reach, with peak dam releases as stated in the dam operational release scenarios, are shown in **Figure 29** and **Figure 30**, respectively. Furthermore, the elevations of the main channels on the Right of Bank (ROB) and Left of Bank (LOB) where flooding might occur were shown respectively, in **Figure 31**.

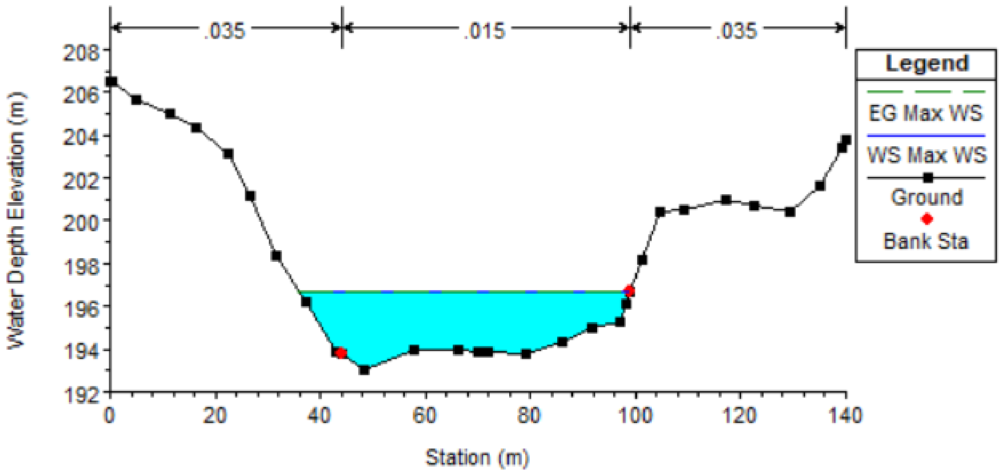

Figure 29: Cross-sectional profiles of one of the River A station in HEC-RAS

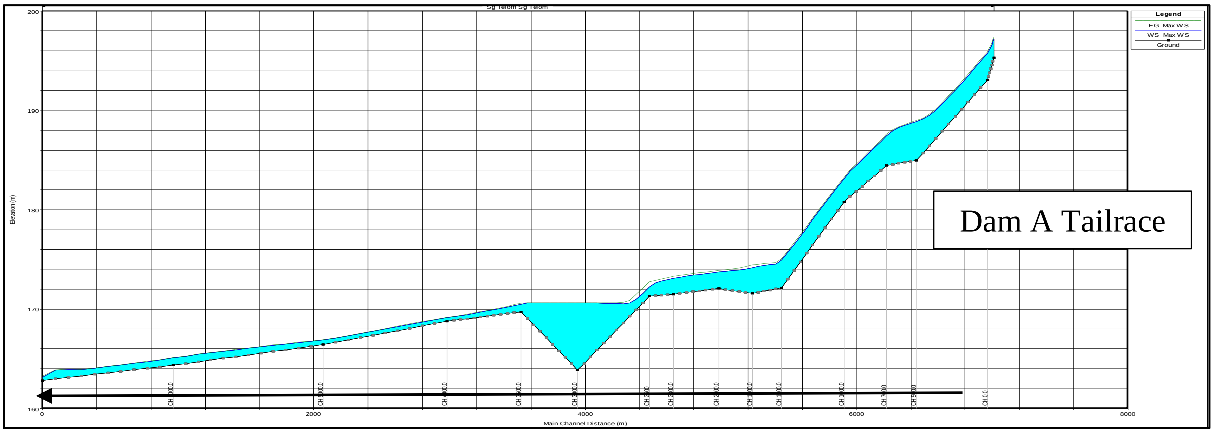

Figure 30: Longitudinal Surface Water Profile of River A from the Operational Discharge Scenario

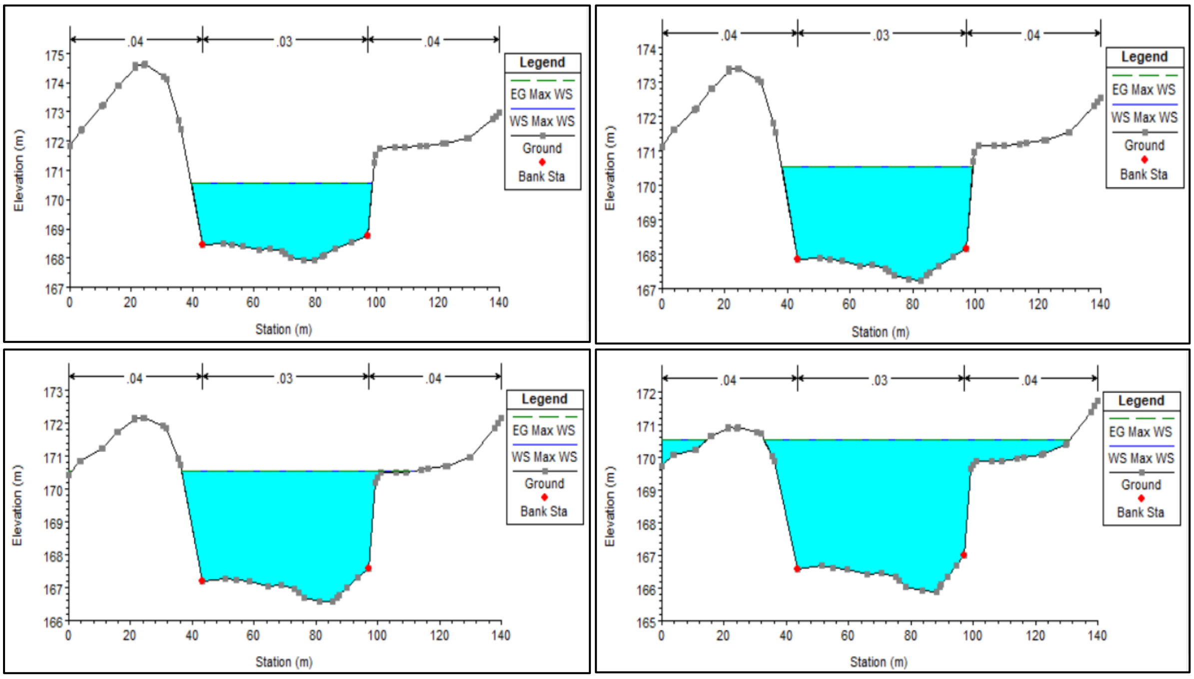

Figure 31: Cross-sectional Profiles at area where water levels exceed bank heights

5.0 Conclusion

In this study, it appears that various forms of dam discharge have a significant impact on the water elevation at the Dam A downstream, which is at 7-km River A. Based on the four (4) site measurements and model simulation analyses, Scenario 3 imposed the highest maximum rate of rise of water level while Scenario 4 has the lowest values. Besides that, Scenario 1 and Scenario 2 have the fair values for the river elevation after the operational discharge injected into the hydraulic simulation.

There are limitations in conducting 1D hydrodynamic simulation for the quantitative analysis of River A, such as to have more river survey intervals to be adopted in the RAS geometry. This might impact the hydraulic simulation computations, where there will be errors in river elevation reading. High-quality data, including as bathymetric surveys, flow data, and meteorological data, are necessary for accurate modelling. Model accuracy can be affected by a lack of data availability, particularly in remote or poorly supervised areas. The accuracy of 1D hydrodynamic models is determined by the quality and availability of calibration and validation data. Inaccurate input data or inadequate field observations may cause model projections to be inaccurate. Rivers are often represented in 1D models as a series of cross-sectional profiles. For spatial resolution, this method may miss fine-scale differences in river morphology or flow patterns. Complex meandering channels and intricate interactions with floodplains can be difficult to accurately model.

In order to acknowledge the importance of striking a balance between competing interests, from flood control to environmental conservation, it highlights the delicate relationship between dam operations and downstream water levels. This study emphasizes the significance of educated decision-making and adaptive management in the operation of dams to ensure the sustainable and equitable use of this vital natural resource as we continue to face water resource constraints in a changing climate.

Acknowledge
The authors would like to thank TNBR for supporting this project and for guidance throughout the study period.

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6th Langkawi International Multidisciplinary Conference 2023 (6th LIMC 2023)
eISSN 2976-3223
9th – 10th September 2023
Bayview Hotel, Langkawi, Malaysia

ASSESSMENT OF WEIGHTED OVERLAY CONFIGURATION PARAMETERS TOWARDS ROUTE SELECTION IDENTIFICATION

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Abstract: *Finding the route with the lowest cumulative cost is one of the critical tasks in utilities management especially in power industries. Selection of the right route is a crucial aspect for identifying the most suitable and low cost path from floating solar photovoltaic system (FSPV) to proposed infrastructure facilities (IF) area that is important to reduce the travel time. The selection process involves several environmental parameters and criteria that play essential role for this route selection. Therefore, this study using ArcGIS Spatial Analyst that offer suitable processing tool that able to deals with raster data. In order to get the suitable path, weighted overlay tool being used to generate the cost surface that later used for computing the path distance and cost distance in the route selection processing. As the purpose of this study is to evaluate how the route selected based on different scenarios, different influence factor percentage and evaluation scale were set during weighted overlay processing environment. Land use type, geological type and slope degree are the three main input used to execute weighted overlay process along with the location of the infrastructure facilities and transmission main intake building. A comparative analysis from the results obtained showed that different influence factor percentage resulting to various least costly path line. However, changing the evaluation scale for the land use data giving discourage result as even the restricted value had been assigned to several land use type, the route selection did not avoid the restricted areas. To conclude from all the findings, No Data value should be assigned to the land use type to be excluded in the scale value instead of using restricted value in order to get the best route selected that avoid the restricted areas.*

Keywords: *Route Selection, ArcGIS, Weighted Overlay, Path Distance, Cost Path*

Introduction

Solar power is becoming more accessible, affordable, environmental friendly and efficient energy source that support sustainability towards power generation. Floating solar play crucial supplementary role as this floating solar photovoltaic (FPV) system able to work about 10% efficiently than land solar power plants as it able to reduce water evaporation with the aid from water that cools the solar panels as well as avoid occupying the land. Infrastructure facility (IF) area is one of the components in floating solar system for floating solar performance monitoring in real time. This IF features with safety equipment and alerts to help tracking any environmental factors that might harm the floating solar system as well as enables swift and timely maintenance and troubleshooting thus making the operation more reliable and robust.

Route selection is an important process to perform in order to choose suitable path that able to reduce the cost for road construction as well as avoiding restricted area to be excluded in the route selection process. Modern technology in mapping enable this route selected based on required parameter thus optimize the path chosen in smart decision making. In this study, proposed route path need to be identified to optimize low cost and travelling time from transmission main intake (PMU) building which is part of floating solar photovoltaic (FPV) system to the infrastructure facilities building.

Spatial Analyst tool in ArcGIS ArcMap is an ideal tool for this route selection process as it is more effective and save time for decision making. Weighted overlay operation in spatial analyst geoprocessing tool is the most used for overlay analysis in order to solve multi criteria problems involving feature selections. Raster data is the main input criteria layers as this tool will assigned value to the cell as the output from the decision making process. Each input raster is weighted based on its importance or influence factor percentage along with the evaluation scales. A few scenarios were prepared with different influence percentage and scale values set in the environment setting. Next, path distance and cost path analysis conducted to determine the minimum cumulative travel cost from FSPV system to IF. As this study generate seven different scenarios with different percentage influence and scale value set up, the path alignment will be observing to determine relevant route to be chosen.

Literature Review

Selection Criteria for Route

The optimization for the optimal route location is based on major criteria which includes land use/ land cover, soil classification and land slope. The study had successfully applied and created slope and land use / land cover into the route selection parameter and it is analysed that these two criteria had played major role for the selection. The model able to avoid restricted land use and high slope areas that satisfy the objective of the study (Suleiman, S., Agarwal, V. C., Lal, D., & Sunusi, A, 2015). Selection criteria used as part of multi-modal for route selection system as the selection of suitable section and criteria of the route for transportation is made by comparing multiple alternatives and transportation modes. This criteria system allows unites of various criteria to time and money basis that makes the evaluation process (Bazaras et al., 2013).

Weighted Overlay Optimization in Route Selection

Weighted overlay method for route selection analysis resulting to estimate least transportation cost from proposed facilities to potential sites based on shortest results output from this process. The least cost distribution had 95% confidence level able to be demonstrated in this study (Nguyen et al., 2022). The least cost path model using weighted overlay tool successfully avoid all the elements to be avoid within the given data and criteria. It is concluding that the shortest path algorithm and environment setting embedded during early planning proved to be time saving, economic and well suited for sustainable route design. The ability of this tool able to provide several alternatives as well avoid many location problems and such alternatives will give benefit to the decision maker (Effat & Hassan, 2013).

Study Area and Selection Criteria

Study Area

The study area is located at the southern part of Chenderoh Lake, Perak with elevation of 70m above sea level. It is a natural lake in Kuala Kangsar District that is popular as major and oldest hydroelectric dam in Malaysia situated which is Chenderoh Power Station. The lake was covered mostly by swampy forest that becomes major habitat for flora and fauna. Chenderoh Lake is one of the eco-tourism spot as many activities available such as boat trip, lotus seed harvesting and many more. The location of the study area, infrastructure facilities area and FSPV as shown in Figure 1.

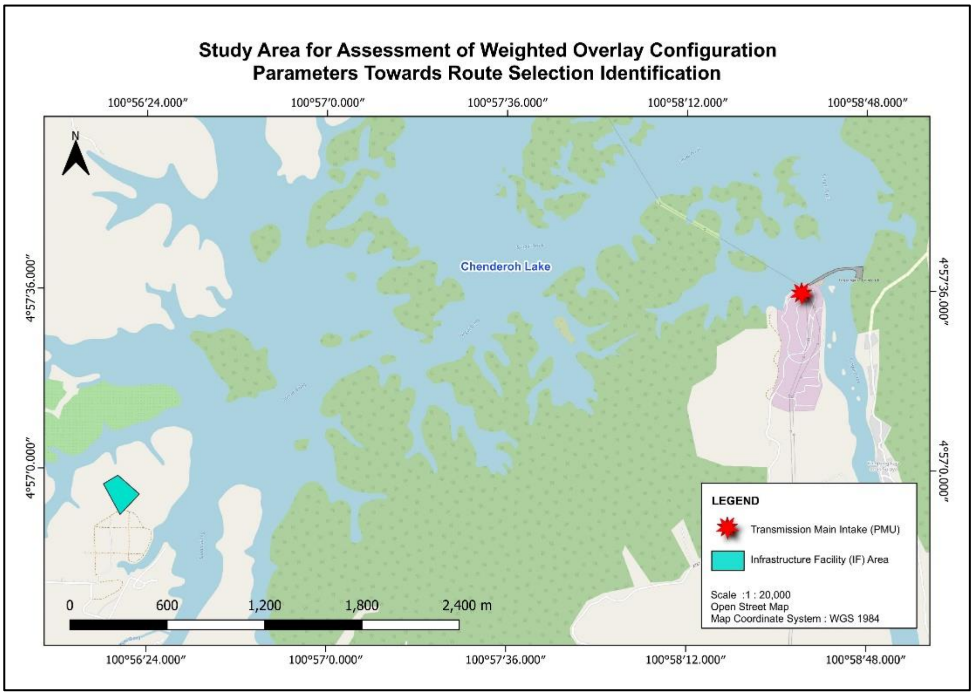

Figure 1: Location of Study Area

Selection Criteria

There were three major criteria considered for route selection process. First, the slope must be gradual as steep slope required earthworks for route construction. Next, the suitability of land use is important as landed and bare area were preferable than water bodies and restricted area as it is costlier to construct route. Last, the geological type must within volcanic rocks lithology as it is more stable for route construction.

Methodology

Data

All the data input for weighted overlay process was in raster data format and had been reclassify into desire ranking.

Slope

Slope data was originally generated from Digital Terrain Model (DEM) with cell size of 30m X 30m obtained downloaded from earth explorer (earthexplorer.usgs.gov). The slope data reclassifies into seven ranks according to the steepness of the terrain. The least steep terrain ranks as top priority and steepest slope ranks with higher value.

Land Use

Land use data is based on existing land use shapefile updated on 2015. This data was converted into raster where the ranking field is the value for the raster data. The ranking of the land use as below depends on the ground condition of the study area. Open area and accessible area were on top ranking while restricted and water bodies area rank higher.

Geology

Geology data obtained from updated geology map provided by Department of Mineral and Geoscience Malaysia. All the lithology rank into its suitability for route structure and ground stability. Igneous rocks type was at the top ranks while sedimentary rocks ranks the least suitable.

Vector data also used for path distance and cost path process. The data consist of location of transmission main intake (PMU) and infrastructure facility area.

Data Processing

Before starting the processing, it is important to ensure all raster and vector have the same coordinate system. For this study, Kertau RSO Malaya (Meters) has been used as permanent projection. There were three spatial analyst tools that will be used in order to determine the best route selection.

Weighted Overlay

The first step for route selection is to generate cost surface based on the criteria that have been set. The slope, land use and geology data set as the main input for this process. For this study, percentage influence and scale value will be varying as few scenarios will be develop. The seven scenarios were as follows,

- Scenario 1: 50% slope + 35% land use + 15% geology
- Scenario 2: 15% slope + 50% land use + 35% geology
- Scenario 3: 35% slope + 15% land use + 50% geology
- Scenario 4: 33% slope + 34% land use + 33% geology with restricted scale value for water bodies
- Scenario 5: 33% slope + 34% land use + 33% geology with no data scale value for water bodies
- Scenario 6: 33% slope + 34% land use + 33% geology with higher scale value for water bodies
- Scenario 7: 33% slope + 34% land use + 33% geology with higher scale value for restricted area and restricted value for water bodies

Path Distance

After the cost surface had obtained, this process will identify the least accumulative cost distance over the cost surface to the proposed infrastructure facility (IF) area while taking account the surface distance. The result from this process will generate distance and backlink raster to be used for the next step.

Cost Path

This tool will generate recording of the least-cost paths from IF to PMU location within the accumulative cost surface. Backlink raster will be used as input to determine the pattern or alignment of the path according to the least cost distance surface. This raster also determines the direction to travel on the cell with the accumulative cost path returning to the source point.

Selection of Best Route

All the seven results will be compared according to the selection criteria. In order to get a better path alignment visualized, all the results from cost path analysis were converted into polyline. After all, route with less complexity, shortest route and avoiding water bodies will be the top priorities in selecting the best route.

Result and Discussion

Result

Based on the result obtained from the route selection process with different parameters for influence percentage and scale value set during environment setting, there were various route alignment generated by the process. Figure 2 shows the result for all the seven scenarios generated.

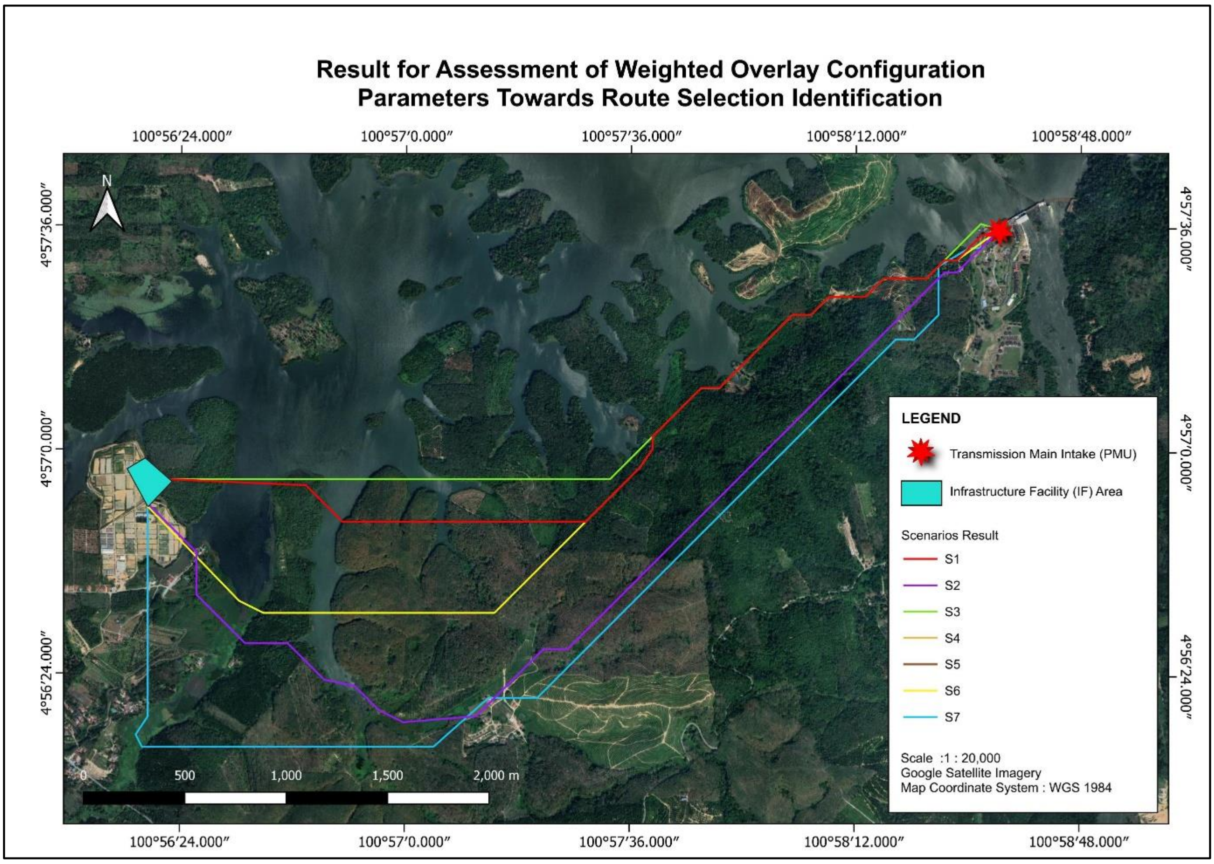

Figure 2: Result of Route Selection Process

Analysis for the result based on the scenarios created is explained as follows:

1. Scenario 1: This scenario indicates higher percentage influence for slope layer. The result shown in red line specify that the route constructed on gradual and low steep slope but crossing the lake area.
2. Scenario 2: This scenario indicates higher percentage influence for land use layer without changing the scale value. The result shown in purple line specify that the route constructed trying to avoid the lake area but still passing through swampy area.
3. Scenario 3: This scenario indicates higher percentage influence for geology layer. The result shown in green line specify that the route constructed on the lowest elevation ground and crossing the lake area.
4. Scenario 4: This scenario indicates same percentage for all layer but using "Restricted" scale value for water bodies and restricted land use. The result obtained unable to create any route path.
5. Scenario 5: This scenario indicates same percentage for all layer but using "No Data" scale value for water bodies and restricted land use. The result obtained unable to create any route path same with Scenario 4.
6. Scenario 6: This scenario indicates same percentage for all layer but using higher scale value for water bodies and restricted land use. The result shown in yellow line specify that the route constructed crossing the lake and swampy area.
7. Scenario 7: This scenario indicates same percentage for all layer but using higher scale value for restricted land use and "Restricted" scale value for water bodies. The result shown in blue line specify that the route constructed did not crossing the lake and swampy area.

Discussion

The route selected based on different scenarios constructed in various path alignments. It is the best to choose the route that meet the criteria especially for the land use type. This is because the route must be less cost to be construct. If the route crossing any water bodies area, the route is unsafe to be constructed. From all the seven scenarios, five scenarios successfully construct the route even with different alignment. Path from scenarios 7 and 2 is longer than others but these two path successfully meet the criteria for this study. Even shortest route might reduce the time travel, the cost for the route construction may be higher as bridges need to be constructed to cross lake and swampy areas. From scenarios 4, 5, 6 and 7, land use scale value been changed in order to find the route that able to avoid water bodies area. After all, the results from all the scenarios were ranked to select the best route with suitable parameters. Table 1 shows the ranking for the route selection.

Table 1: Route Selection Ranking

Scenario	Water Bodies Avoidance	Ranking
1	No	4
2	Yes	2
3	No	5
4	No	6
5	No	7
6	No	3
7	Yes	1

Conclusion and Recommendations

Conclusion

As the conclusion, this study had successfully carried out assessment based on various scenarios by using different percentage influence and scale value for route selection. From the analysis of result, it is compulsory to avoid any water bodies area in order to reduce the cost for route construction. The longer the route may increase the distance and time travel from the two location but it is the best to avoid this condition. For Chenderoh lake area is famous with its biodiversity and became major habitat for flora and fauna. Environmental need to be conserved even the route need to be constructed at any path alignment. Plus, restricting water bodies in scenario 7 is a good decision as the route alignment had avoided lake and swampy area. The use of "Restricted" and "No Data" scale value need to wisely determine as it will result to unpleasant behaviours towards path generation. "Restricted" scale value assign to the cell is the minimum value of the scale evaluation thus all the area need to be avoided will be chosen as it had assigned with low cost path. Instead, use "No Data" for the avoided area but ensuring there were none no data value in the raster used.

Recommendations

In the future, this study may be extending to different criteria set for the environment setting in weighted overlay process. For example, soil category, Environmental Sensitive Area (ESA), wildlife conservation and water flow element able to play major parts in selecting suitable route. Besides that, evaluation scale may be set differently for each element instead of setting the percentage influence to monitor how the path alignment will be generating from the route selection process. Last, comparison between "Restricted" and "No Data" scale value need to be analysed to identify how this scale type influence the route selection result.

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6th Langkawi International Multidisciplinary Conference 2023 (6th LIMC 2023)
eISSN 2976-3223
9th – 10th September 2023
Bayview Hotel, Langkawi, Malaysia

SUPPLY CHAIN MANAGEMENT: A CASE OF TAN LONG TRADING AND SERVICE TECHNOLOGY COMPANY LIMITED

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Abstract: *The supplying of raw materials and products plays an extremely vital role in meeting demands and goals of an enterprise, especially keeping a balance between products production and consumption. If a company knows how to manage its supply chain, it will help develop sustainability and easily compete with competitors, thereby rocketing profits tremendously and serve consumers wholeheartedly. Vietnamese businesses in the international market recognize the significance of the supply chain in creating competitive advantages and boosting companies' performance. This analysis delves into the knowledge and practices of supply chain management in Vietnam, by using qualitative research methods such as observing input processes of supply chains. Also, in-depth interviews will identify key factors causing current issues in management activities of Tan Long Trading and Service Technology Company. After demonstrating the present state and ways to manage its supply chain, this research proposes some valuable reference solutions to save costs, enhance customer service and optimize profits for similar businesses in the market.*

Keywords: *Customer Service, Profit Optimization, Supply Chain Management, Tan Long Trading and Service Technology Company Limited*

1. Introduction

The supply chain is a well-organized system that involves people, activities, information, and resources to move products or services from suppliers to consumers. The recent emergence and growth of retail supermarket chains by domestic and foreign businesses in the Vietnamese market have intensified the level of competition. In order to compete in this environment, manufacturing, construction, and business companies must pay attention to every step of the flow of raw materials to finished products and delivery to customers. Moreover, as the supply chain and management operations are critical to the overall business operation, departments and units within the company can be linked into a unified chain with an optimized plan to minimize costs, especially when market competition is high, and prices are strictly managed.

2. Literature review

2.1. Concept of Supply Chain and Supply Chain Management

The supply chain is perceived as a process that originates from raw material processing and extends to the end-consumer of finished products, with interconnections among stakeholders such as manufacturers, suppliers, and consumers. The supply chain can be divided into three levels: the direct supply chain, the extended supply chain, and the ultimate supply chain (Lummus & Vokurka, 1999; Mentzer et al., 2001).

Supply chain management is a comprehensive strategic system that vertically manages and connects the core activities of a business through logistics operations, creating forward or reverse flows, to distribute products at the right time, right place, and right quality, in order to increase input efficiency, minimize inventory costs and operating costs, while still meeting customer service requirements (Felea & Albăstroiu, 2013).

2.2. Components of The Supply Chain

Components of the supply chain include the manufacturer who produces goods; the distributor who is an intermediary that procures goods in large quantities; the retailer who stores and sells products to customers in smaller; the customer or end-consumer purchases and uses the products; and the service provider (such as transportation, warehousing, etc.) is a specialized entity with expertise and skills. A complex and extended supply chain may involve more participants, as illustrated in the diagram:

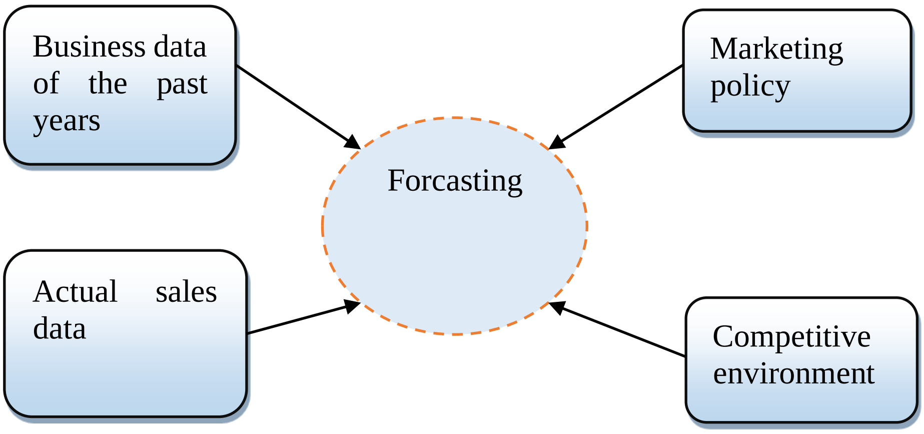

Figure 32. Components of Forcasting In Supply Chain Management
(Source: Proposed by the authors)

2.3. Functions and Roles of Supply Chain

Supply chain has many functions for all logistics activities, in which the key function is not only to optimize inventory management but also to minimize inventory costs (Lummus, Krumwiede, & Vokurka, 2001). In addition, supply chain also manages profits and commissions to help businesses negotiate with suppliers on discount rates, commission policies, and other obligations more effectively (Giannakis & Croom, 2004; Nguyễn Kim Anh, 2006, p.23).

Businesses can effectively control their entire process and manage their entire network from suppliers, manufacturing plants, warehouses, to distribution channels. Supply chain activities also help businesses better organize its production and distribution issues to minimize shortages that may result in delays (Min et al., 2019). Therefore, without a supply chain, procurement, production, and distribution activities would never occur, and as a result, businesses would not be able to exist.

2.4. Supply Chain Operations According to The SCOR Model

2.4.1. Plan
Planning is an important part and the first step in SCM. It forecasts consumer demand and is directly related to inventory management and procurement in the next step. A business must know how to plan based on different benefits such as producing products or sourcing materials domestically or internationally by the following methods: Make-to-Stock (MTS), Make-to-Order (MTO), Assemble-to-Order (ATO), Configure-to-Order (CTO), or Engineer-to-Order (ETO).

2.4.2. Source
From a specific need or requirement, the procurement department will establish a standard table that clearly outlines the requirements (characteristics, technical specifications, physical or chemical properties, etc.). Then, a Request for Proposal (RFP) or Request for Quotation (RFQ) will be prepared and sent to suppliers. Upon receiving quotations, the procurement department will review and select the best supplier (based on price, value, and quality of goods) to place an order and create a transaction contract. Upon receiving the goods, this department will cross-check the purchase orders with the documents to verify the received goods before making payment to the supplier.

2.4.3. Make
Manufacturing is the process of producing products to meet customer requirements. To create quality products and deliver them on time and in the right quantity, a reasonable production plan that balances resources (labor, machinery, raw materials, quality requirements, productivity, etc.) is needed, along with flexible contingency planning.

2.4.4. Delivery
Delivery is the distribution of goods from the manufacturing plant to warehouses or distributors for further distribution to customers. The distribution companies must ensure efficient order management, delivering products to customers in the shortest possible time with the best quality, and having specific return policies to satisfy customers and contribute to strong business development. If the business does not want to handle delivery internally, it can hire a third-party logistics company (with more expertise and experience in transportation) to handle the delivery.

3. Method
The article uses a situational research method and secondary data analysis. The subject of the article is a business in Vietnam. The article investigates the situation at Tan Long Company in order to propose solutions to improve the supply chain operations of this company and potentially serve as a lesson learned for companies with similar characteristics and contexts.

3.1. Company Overview
3.1.1. Formation and Development Process
Tan Long Trading and Service Technology Company Limited officially commenced operations on April 6, 2002, with business license number 4102048924 issued by the Ho Chi Minh City Department of Planning and Investment. The representative offices are located in Hanoi, Da Nang, and the trade promotion office is located in Toa Payoh Industrial Park, Singapore. The company is a legal entity with independent accounting, with a charter capital

of 12,000,000,000 VND, specializing in trading medical equipment, kitchen equipment, industrial laundry equipment for hospitals, hotels, restaurants, resorts, companies, factories, and laundries. With the aim of legitimate enrichment and development of the Vietnamese economy, Tan Long has established a solid position in the market, as evidenced by the increasing number of traditional customers and new customers.

3.1.2. Function, Responsibilities, Administrative Organizational Structure, And Personnel

Function: Tan Long Company is responsible for multiple functions related to industrialization (consulting, buying, selling, or leasing, warranty, maintenance, installation of interior decoration, household items; repairing, industrial washing, pressing, drying equipment, boilers, textile and garment machinery, equipment, medical instruments), selling processed agricultural and food products, coffee beans, coffee, raw materials for food and beverage, fresh cream, raw materials for fresh cream. The company also deals in domestic tourism (ecotourism, standard hotels and restaurants), souvenirs, and handicrafts.

Responsibilities: The basic responsibilities of Tan Long Company are to seek markets for product consumption, sign business contracts based on mutually beneficial agreements with domestic and international business entities, conduct economic accounting, and be responsible for production and business results. The company also has the task of complying with laws, policies, and economic management regulations of the State regarding import and export management, Vietnam's foreign trade policies, fulfilling tax obligations to the State, protecting the environment, and maintaining social order.

Administrative organizational structure, and personnel: The organizational structure of Tan Long Trading and Service Technology Company Limited consists of a Board of Directors and top executives such as Deputy Director of Sales Department and Deputy Director of Administrative Department. Deputy Director of Sales Department who is in charge of customer service department, sales department and planning & procurement department. Deputy Director of Administrative Department will be responsible for supervising accounting department, human resource department and import and export department. Furthermore, medical equipment department and kitchen will belong to the sales department (Human Resource Department – Tan Long Trading and Service Technology Company Limited, 2019).

3.2. Current Status Of Supply Chain Operations At Tan Long Trading And Service Technology Company Limited

3.2.1. The Company's Business Performance In The Period Of 2017-2019

Table 1. The Company's Business Performance In The Period Of 2017-2019 (Unit : VND)

Target	2017	2018	2019
Revenue	65.887.327.398	67.320.568.749	94.723.873.849
Cost	62.574.678.848	65.536.415.174	83.456.816.213
Profit	3.312.648.550	1.784.153.575	11.267.057.636

(Source : Financial statements – Accounting Department – Tan Long Trading and Service Technology Company Limited, 2019)

In 2019, the revenue increased by 40.70%, expenses increased by 27.34%, and profits increased by 531.50% compared to 2018. Vietnam's economy is attracting investment in the restaurant and hotel industry, and the company has opened additional branches and restaurants. The company also focuses on investing in high-end restaurants, hotels, resorts, and leisure projects to achieve clear efficiency.

3.2.2. Comprehensive Planning

Departments at Tan Long Company are operating independently, lacking cohesion, and have not been given the appropriate level of attention. Production and inventory planning is inaccurate and only prepared for short-term goals. Tan Long Company is facing issues with supply planning due to a lack of long-term demand forecasting. The raw material planning department only relies on the demand of the closest month in order to plan for the following months. It does not meet the actual demand and can easily result in a shortage or excess of production materials.

3.2.3. Procurement and Purchasing

The current strategy is to expand market share, so Tan Long focuses on meeting customer demand. In addition, the company does not pay much attention to inventory control and prioritizes purchasing with the lowest cost (without controlling inventory which leads to wasting space).

Table 2. Value Of Inventory Over The Years (Unit : VND)

No	Year	Value	Difference
1	2017	9.724.865.214	
2	2018	12.265.125.655	2.540.260.441
3	2019	11.365.842.655	-899.283.000

(Source: Annual report over the years of Tan Long)

According to Table 2, the inventory value in 2018 compared to 2017 increased by about VND 2.5 billion. The value of inventory in 2019 compared to 2018 decreased by about VND 899 million. Numbers show that the company has made efforts to reduce the value of inventory to increase cash volume and save costs.

Table 3. Some of Tan Long Company's Main Suppliers

No	Materials	Suppliers	Origins
1	Ice Maker	Hoshizaki Singapore PTE LTD	Singapore
2	Ice Maker	Shumazi Lubake LTD	Malaysia
3	Natural wood	Specialty Ingredient Management	Malaysia
4	Microwave oven	Specialty Ingredient Management	France

5	Medical equipment	BioPharmGuy	USA
6	Hybrid hobs	Specialty Ingredient Management	Singapore
7	Packaging, cartons	Saigon Culture Printing Company, Liksin….	Viet Nam
8	Capolex anti-sticking agents	Far East Kontor Ltd	Denmark

(Source: Collected from Purchasing Division, 2019)

All of the suppliers mentioned are companies that have signed purchase contracts with reputable suppliers of raw materials and kitchen equipment to stabilize their sources and prices. The company is also actively seeking new suppliers with rich, quality, and competitively priced raw materials. For specialty items that only have one supplier which satisfies the standard, the company has to sign a contract to ensure product quality.

Tan Long focuses on supplying products on orders and must proactively secure its supplies and store its appropriate quantity in the inventory. The time from ordering from international suppliers to delivery of goods at Tân Long's warehouse takes more than a week, plus 4-5 days for procedures. To reduce costs, the company usually waits until the items in the warehouse are all sold out before placing new orders, resulting in delayed product supply. This delay is shown in [Table 4] as follows:

Table 4. Delivery Rate of Suppliers

No	Material	On-time Delivery Rate (%)	Late Delivery Rate (%)
1	Wooden equipment	85%	15%
2	Medical equipment, other materials	88%	12%

(Source: Collected from Purchasing Division, 2019)

According to the collected data table, the late delivery rate of wooden furniture is 15%, while that of medical equipment and other materials is 12%. Usually, this is due to returned goods not meeting quality standards, or bad weather, complicated transportation network, difficulties at customs, and slow payment for goods to suppliers.

Therefore, if the company manages orders through the ERP (Enterprise Resource Planning) system Oracle E-Business Suite Release, it will help increase management efficiency, exchange information, and limit late deliveries.

3.2.4. Logistics Activities

In the company's logistics activities, there are several reasons leading to late deliveries, such as delayed transportation, slow warehouse stocking, out-of-stock items, and rearrangement of inventory. [See Table 5].

Table 5. Statistical Table of Causes of Late Delivery

Cause	Number of order	Rate (%)	Accumulation frequency (%)
Late delivery	732	86%	79%
Warehouses arrange goods slowly	95	11%	90%
Out-of-stock items	15	2%	93%
Rearranged inventory	12	1%	95%
Total	854		

(Source: Collected from Customer and Service Division, 2019)

The company previously had its own fleet of vehicles to transport supplies, raw materials and finished products. But to minimize the problem of late deliveries, the company has contracted trucks to drivers to save repair and fleet management costs. [See Table 6].

Table 6. Number of Means of Transport Currently in Operation

No	Name of carrier	Quantity of cars
1	Ha Nam	10
2	Thuy Vân	5
3	Contracted company car	6
Total		21

(Source: Dispatch Department – Customer Service Division, 2019)

Lead time is important for customers to choose suppliers. Managers need to eliminate slack time to reduce lead times, including time spent on materials being processed, and time wasted due to waiting or delivery. We have the order fulfillment cycle timetable as follows in [Table 7].

Table 7. Order Fulfillment Cycle Timetable (Unit: Minutes)

Time indicator	2017	2018	2019	∆% 2018/2017	∆% 2019/2018
From receiving orders to processing it	45	30	20	33,33%	33,33%
From receiving orders to manufacturing goods	750	630	500	16,00%	20,63%
From selecting goods to queueing up on trucks	140	120	100	14,29%	16,67%
Distribution to delivery	5.578	4.582	3.524	17,86%	23,09%
Total	**6.513**	**5.362**	**4.144**		
	(4,5 days)	(3,7 days)	(2,9 days)		

(Source: Collected from Customer and Service Division)

According to the collected data, the order processing and lead time of Tan Long has decreased each year, taking only about 4,144 minutes to process an order in 2019. The company has tried to improve its distribution process to meet the market demand quickly. However, last-minute changes to orders due to disagreements between sales staff and customers also affect delivery.

4. Some Solutions to Improve the Supply Chain Operations at The Company

4.1. Proposed Planning Solutions

The Forecasting and Planning department needs to closely connect with other departments to obtain accurate data for demand forecasting. The Planning department will plan for timely procurement of raw materials and production. To ensure effective forecasting, the author proposes the following forecasting model. [See Figure 2].

(Source: Proposed by the authors)

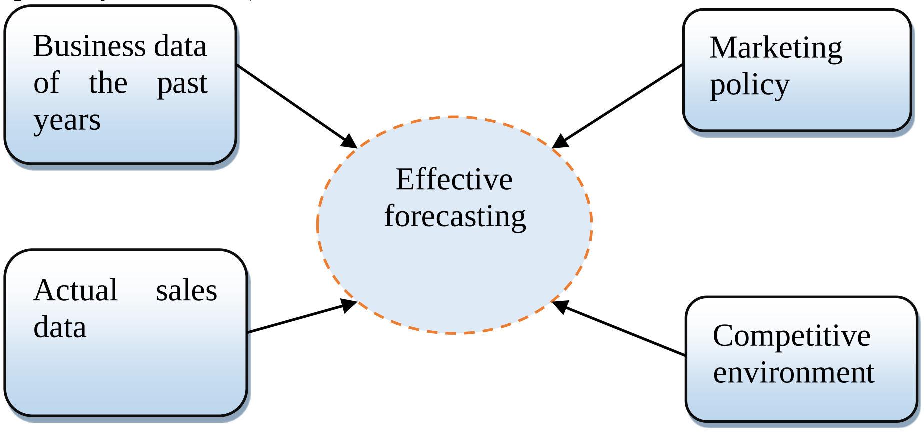

Figure 33. Effective Forecasting Model

Close coordination between the Customer Service Dividion, Marketing Dividion, and Sales Dividion is necessary to receive and forecast data. Past data and marketing activities such as promotions, discounts, displays, and advertisements along with factors affecting sales volume need to be considered. The company will rely on past sales data and forecasts from sales staffs to come up with the final result.

4.2. Proposals for Sourcing Goods

4.2.1. Create Incentive Policies for Suppliers Having Well-Performed And Long-Term Operating Processes

The establishment of enduring agreements with suppliers possessing strong capabilities and expertise in the realm of goods and services is crucial for the company to fortify its connections and economize its procurement expenses. The company should maintain frequent communication with suppliers to stay abreast of changes in demand for goods and identify domestic suppliers to manufacture products locally and expedite delivery times.

4.2.2. Continue to Seek and Develop New Partners To Create Healthy Competition

Searching and developing new suppliers is also necessary to create healthy competition between suppliers, and avoid monopolies, pricing, etc. However, the company needs to carefully research new partners' profiles, legal status, sales figures, and the market they operate in. Selecting new partners also depends on each type of goods, equipment, or service that the company needs to purchase.

4.2.3. Establish Core Product Groups to Develop Potential Suppliers

Developing the relationship with potential suppliers helps the company to obtain various benefits such as prices, delivery times, and quality. Steps to be taken include identifying a group of materials to be developed, identifying suppliers, evaluating the contract process, selecting the best suppliers, and monitoring the manufacturing process to draw lessons for the next period. An evaluation form for suppliers of raw materials and accessories is proposed as in [Table 8].

Table 8. Evaluation Form for Suppliers of Raw Materials and Accessories

Coefficient	Items to consider				Evaluation		
	Price	Delivery	Ability to meet quality standards	Cooperation level	Total score	Continue to purchase goods	Stop purchasing goods
	3	2	4	1	10		
Suppliers							
A							
B							
…							

(Source: Proposed by the authors)

The company needs to consider many other important criteria to measure the effectiveness of suppliers, including sending accurate documents, timely notification of batch status, meeting product specifications and packaging requirements, defective rate, achieving goals and cost-effectiveness, accurate and timely invoices, conflict resolution and positive response. The company should evaluate these criteria every six months to eliminate unqualified suppliers.

4.3. Proposals for Distribution Operations

4.3.1. Solutions for Arranging Goods and Warehouses

Arranging goods and warehouses are crucial in the distribution process to save costs and time in finding goods. The company needs to develop a warehouse diagram and computerize warehouse management operations to control the type and location of inventory, facilitating quick arrangement of goods.

4.3.2. Solutions for Delivery Operations

Tan Long Company needs to carefully consider its plans of schedule, delivery routes, and cargo capacity to optimize total costs. The dispact division needs to closely coordinate with warehouses to better manage orders. When combining batchs on the same route, the company has to meet customer needs and minimize delivery costs. The company can create schedules and notify customers to place orders on common routes with other customers. When packaging, employees should use company logo adhesive tape to avoid loss of goods. The company needs to provide additional loading and unloading personnel to improve the quality of customer service and link departments to monitor accurate delivery progress and provide feedback on delivery schedules.

4.3.3. Solutions for Evaluating Transportation Service Providers

Currently, the company tracks the progress of customers' shipment but has not fully evaluated the quality of transportation services. To improve quality, the author proposes an evaluation form as follows. [See Table 9].

Table 9. Evaluation Form for Transportation Services

No.	Customer	Order number	Actual delivery (%)			Customer service attitude		Ealuate
			On time	Fulfilled	Condition of goods	Good	Not good	
1								
2								
3								

(Source: Proposed by the authors)

Evaluation should be conducted at the end of each month and serve as a basis for determining each party's responsibilities.

4.3.4. Understanding Customers, Establishing A Customer Database

Establishing a customer database is not an easy task, but if done well, it can be a first step toward success. The database usually relies on factors such as "Who?", "What?", and "How?" to analyze the purchase history and activities of customers. The company should follow four basic types of data to build a customer database, including campaigns to attract loyal customers, multi-level marketing databases, customer support databases, and customer feedback.

5. Discussion and Conclusion

After nearly 20 years of establishment and development, along with changes in organizational structure, and despite objective and subjective difficulties that must be faced, Tan Long Trading and Service Technology Company Limited always strives to maintain its position. The company has also achieved certain successes in the market. However, in order to achieve higher efficiency and live up to its potential, the company can consider some proposed measures to overcome existing limitations and leverage its strengths. With the keenness of the leadership and the professional, knowledgable, skilled, and continuous learning staff and workers, Tan Long Technical Trading and Services Technology Company Limited will continue to develop steadily in the future.

Acknowledgments

This research is fully funded by University of Economics Ho Chi Minh City, Vietnam.

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SMART TOURISM STRATEGY FOR VIETRAVEL IN THE NEW NORMAL

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Abstract: *The Covid-19 pandemic has greatly impacted the global economy and politics since late 2019 to early 2020. Vietnam has been recognized for its excellent efforts in preventing and controlling the spread of the virus. However, safety has been prioritized over economic benefits, resulting in challenges for companies such as Vietravel due to restrictions on international and domestic tourism, as well as people's reluctance to travel during the pandemic. The author proposes a "smart tourism 4.0 strategy for Vietravel in the new normal" to assess the pandemic's impact on Vietravel's business efficiency and propose business strategies in the current conditions. Qualitative research methods will be used, including discussions with Vietravel's experts and customers, to gather opinions and evaluate factors affecting Vietravel's adaptive strategy. The research results will propose measures to enhance Vietravel's adaptive strategy in the new normal conditions.*

Keywords: *Adaptive Strategy; COVID-19; New Normal; Smart Tourism; Vietravel*
JEL codes: L83, O14, O32, O33, D22

1. Introduction

The COVID-19 pandemic is a global outbreak that causes severe acute respiratory syndrome on a worldwide scale. It was first reported in Wuhan, China in December 2019 and confirmed as a global pandemic by the World Health Organization in March 2020. Vietnam was one of the first countries to confirm cases of COVID-19 infection but responded promptly and effectively, resulting in a total of 1046 cases, including 35 deaths and 755 recoveries. In 2020, the COVID-19 pandemic caused significant damage to the global tourism industry, with a decrease in international tourist numbers of 20-30% and losses of 30-50 billion USD. Travel restrictions have been imposed in many countries and regions to contain the spread of the virus, causing a sharp decline in tourism, especially in China and other destinations in Asia and Europe such as Italy.

1.1 Impact of Covid-19 pandemic on Vietnam Tourism

The number of international visitors to Vietnam in December 2018 was estimated at 1,374,235 arrivals, which is a 5.6% increase compared to November 2018 and a 7.7% increase over the same period in 2017. For the entire year of 2018, the number of visitors reached 15,497,791, an increase of 19.9% compared to the same period in 2017, according to the General Department of Tourism and General Statistics Office.

In December 2019, the number of international visitors to Vietnam was estimated at 1,710,168 arrivals, which is a decrease of 5.5% compared to November 2019 and an increase of 24.4%

over the same period in 2018. For the whole year of 2019, the number of visitors reached 18,008,591, an increase of 16.2% compared to the same period in 2018.

However, in March 2020, the number of international visitors to Vietnam was estimated at 449,923 arrivals, which is a significant decrease of 63.8% compared to February 2020 and a decrease of 68.1% over the same period in 2019. For the first three months of 2020, the number of visitors was estimated at 3,686,779, which is an overall decrease of 18.1% compared to the same period in 2019.

Based on this data, the author draws conclusions that are presented in Figure 1:

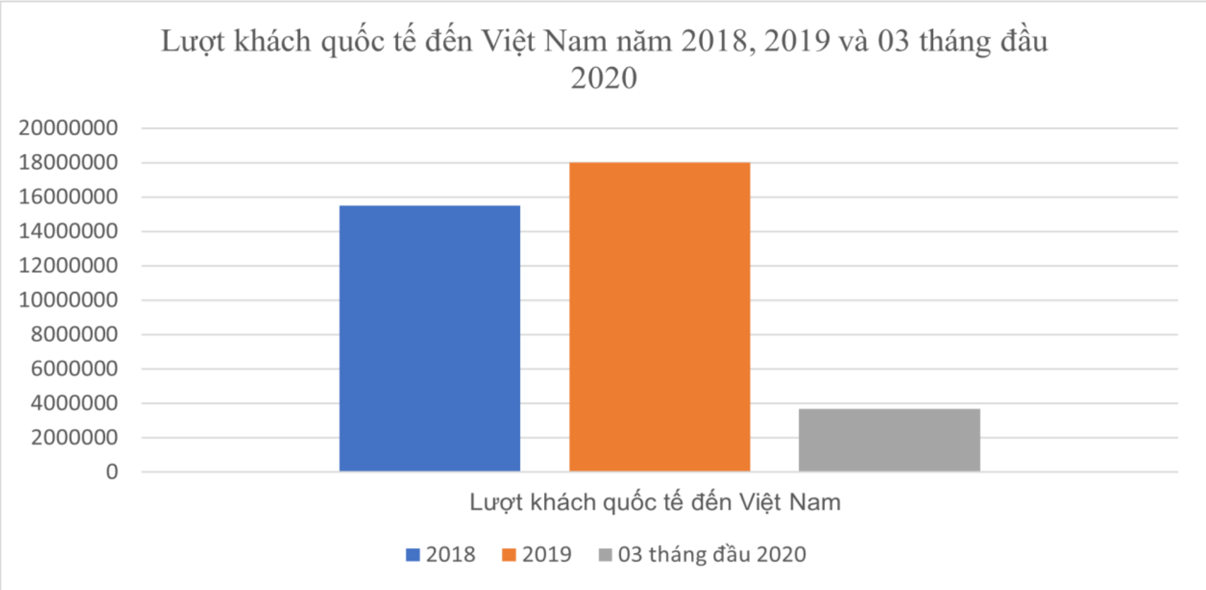

Figure 1. Chart Of International Arrivals To Vietnam From 2018 To March 2020 (Source: Compiled By The Authors)

1.2 Business Activities

The factors that affect business operations can originate from both internal and external sources. Internal factors are the core activities within a business, including marketing, finance and accounting, production, and human resources. Marketing activities help businesses reach customers, while financial and accounting activities ensure that the financial status of the business is accurately reflected. Production activities transform raw materials into finished products, and production capacity needs to be controlled to ensure timely delivery and high-quality products. Human resources policies need to be in place to ensure the effective use and management of labor.

On the other hand, external factors refer to the business environment, which includes various factors such as the physical environment, demographics, economics, politics and legal systems, technology, competitors, and customers, as well as input and output markets. These external factors can have a significant impact on a business's operations and must be taken into account when making decisions.

1.3 The Need For Respond Strategy

The adaptation model is often seen as a solution for managing dynamic and ever-changing environments. Highly adaptable organizations are always open to learning and improving their operational efficiency, as well as seizing new opportunities as they arise. Large hierarchical organizations and long-term planning were effective in the more stable postwar decades, but they face increasing challenges when it comes to quickly adapting to environmental changes and unforeseen organizational requirements.

Upton (1995) argues that adaptation in production organizations refers to the ability of a factory to switch from producing one product to another. Cascio (1989) suggests that organizational adaptation promotes the ability to provide high-quality goods and services, which is crucial for business performance. This includes sensing the market, making informed decisions, and taking flexible actions to adapt to changing circumstances (Pavlou & Sawy, 2010; Park, 2011; Wageeh, 2016). These factors often determine around 80% of a company's direction and development. Therefore, in order to make the right decisions and policies, leaders must be able to effectively perceive, make decisions, and organize implementation.

1.4 Overview Of Vietnam Tourism Market

Tourism is a crucial economic sector for Vietnam, with abundant and diverse potential. In the period from 2015 to 2019, the number of international visitors to Vietnam has increased by 2.3 times from 7.9 million to 18 million, with an average growth rate of 22.7% per year. However, the tourism industry in Vietnam still faces limitations, such as a low rate of return visitors, low spending by international tourists, and a lack of diversity in tourism products. Despite these challenges, Vietnam is a country with rich and varied tourism potential, featuring unique heritage sites, breathtaking landscapes, vibrant culture, and delicious cuisine.

1.4.1 Heritage In Vietnam

Vietnam boasts more than 40,000 landmarks and landscapes, with over 3,000 of them being ranked as national relics and 5,000 ranked at the provincial level. The country also has eight UNESCO-recognized heritage sites, including Thang Long Imperial Citadel, Hoi An, Trang An, Hue, Ho Dynasty Citadel, My Son, Phong Nha - Ke Bang, and Ha Long Bay. This remarkable collection of cultural and natural treasures is one of Vietnam’s key tourism assets and attracts visitors from all over the world.

1.4.2 Scenic Spots

The country of Vietnam is home to 11 world biosphere reserves that have been recognized by UNESCO, including the Red River Delta, Cat Ba, Tay Nghe An, Dong Nai, Cu Lao Cham, Can Gio mangrove forest, Ca Mau Cape, Kien Sea Giang, Lang Biang (Da Lat), Nui Chua (Ninh Thuan), and Kon Ha Nung (Gia Lai), according to BNG (September 16, 2021). Vietnam has significant potential for developing sea tourism due to its unique geography. The plains, mountains, and midlands of the country offer countless beautiful landscapes. During the summer months, there is an increased demand for cool bathing activities, while autumn, winter, and spring in mountainous regions such as the Northwest and Central Highlands attract visitors with their stunning flower seasons and romantic atmosphere.

1.4.3 Culture and Cuisine

Culture and cuisine are two of Vietnam's key tourism assets that require preservation and development. The country is home to 54 ethnic groups, each with its own unique cultural identity, customs, and way of life. Vietnam also boasts several famous intangible cultural heritages, such as Hue royal court music, the Central Highlands gong cultural space, ca tru, quan ho, Xoan singing, Giong festival, and Hung King worship (which takes place on the third lunar month). Vietnamese cuisine is also renowned for its richness and diversity, with many popular dishes such as pho, banh mi, and Hue beef noodle soup being beloved by international visitors.

1.5 Human Factors In Service Business

The human factor plays a crucial role in the success of a company in the service industry. This factor includes both employees and customers. The role of edge liaison is essential in connecting the organization with its environment, and it requires individuals with high levels of professional skills. The human factor also contributes to identifying potential issues with tourism products and services, and developing customer care systems in order to create product differentiation. Therefore, it is essential to invest in employee training and education programs in order to ensure that they are adequately equipped to meet the needs of customers.

In general, customers are more likely to overlook shortcomings in customer service if they are satisfied with the product they receive. However, if suppliers do not provide good customer service, it can lead to customer dissatisfaction and result in financial losses. For this reason, human issues are important in every aspect of the service business.

2. Business Situation in 2020 - 2021 of Vietravel Company

2.1 Introduction about Vietravel

Vietravel, founded on December 20, 1995, is a prominent travel company in Vietnam. On January 1, 2014, the company underwent a transformation and became the Vietnam Tourism and Transportation Marketing Joint Stock Company. In 2019, Vietravel expanded its operations by listing the company on the stock exchange and establishing numerous domestic and foreign branches. The company is dedicated to providing professional and emotional travel experiences that add value to customers' lives. Vietravel is renowned for its leadership and innovation in the tourism industry, delivering exceptional service and unforgettable experiences to its customers.

2.2 Research Methods

2.2.1 Research Process

In order to evaluate the company's strategy in light of the Covid-19 pandemic, I conducted interviews with experts and loyal customers of the business via phone and email. The selection criteria for the participants can be found in section 2.2.2. Due to the limited number of survey samples, the results were analyzed through critical thinking, synthesis, comparison, and conclusion.

2.2.2 Criteria For Selecting Experts And Customers

The chosen customers are partners who have been associated with Vietravel for a minimum of five years and have generated revenue that meets the company's platinum card criteria (exceeding 120 million VND per year for five years). The selected experts hold a university degree or higher, possess over a decade of experience working with Vietravel, and have in-depth knowledge and understanding of the tourism market and Vietravel's position within it.

2.2.3 Methods Of Data Collection And Processing

A total of five clients and five specialists will receive questionnaires via email to complete. The author will then follow up with a phone interview to gather more detailed information. The questionnaires will be sent on June 25, 2021, and the interviews will be conducted and completed by July 15, 2021.

2.2.4 Results Of Discussion With Experts And Customers

As per the insights shared by five Vietravel experts, it is evident that the Covid-19 pandemic has had a significant impact on Vietnam's tourism industry, and the fourth outbreak has severely affected Vietravel's business. Hence, the crucial factors that influence the company's strategy in the new normal are flexible adaptation to circumstances, agility in restructuring human resources based on reality, sensitivity in understanding customer needs and modifying products accordingly, and flexible financial arrangements.

On the other hand, from the customer's perspective, they are not entirely satisfied with Vietravel's service quality, and they believe that Vietravel should be more sensitive in understanding their needs and altering their products accordingly.

2.3 Vietravel's Current Situation from The Beginning Of 2020 To 2021

2.3.1 Business Market Share

Based on the author's data compiled from Vietravel in 2019, the primary source of revenue and profits for Vietravel was the number of Vietnamese tourists traveling abroad. On the other hand, the domestic market had several competitors, resulting in low revenue and profits. Prior to the emergence of Covid-19, the tourism industry presented numerous opportunities for development and investment. However, when Covid-19 surfaced in early 2020, the company had to cancel all tours and halt domestic trips to prevent the spread of the virus. Additionally, the government imposed restrictions on foreign visitors to Vietnam, causing Vietravel to lose its foreign market share and rely solely on the domestic market share of Vietnamese tourists.

2.3.2 Personnel

Due to a significant drop in business, Vietravel had to decrease its staff load to ensure the operational costs. This had a negative impact on the employees' psychology, income, and career orientation, leading many to seek new opportunities elsewhere. During the quarantine period, only 20% of the core staff remains, and the company is providing unpaid leave to the remaining employees to reduce costs. This decision is subject to change based on the evolving epidemic situation.

2.3.3 Vietravel's Service Package

Vietravel previously categorized its service packages based on the target audience, which included domestic tours, foreign tours, and tours within Vietnam for Vietnamese guests. The company also had product and price policies in place, but did not take into account the factor of epidemics. However, with the emergence of the Covid-19 pandemic, only Vietnamese tourists are able to travel within Vietnam. As a result, the retail combo products, such as air tickets, hotels, and local entertainment services, have seen more development.

2.3.4 Customer Psychology

The Covid-19 pandemic has significantly impacted customers' income and psychology, leading to a decrease in travel demand. Customers are also cautious about the risk of Covid-19 infection, and the government has recommended limiting movement to prevent the spread of the virus. Additionally, social distancing measures have resulted in customers postponing their trips, requesting refunds for tour costs, and causing difficulties for Vietravel.

2.3.5 Analysis Of Business Situation In 2017 - 2020

Based on Vietravel's business performance chart from 2017 to 2020 (Figure 2) along with interview results. Show us the following:

Trước Sau	2017	2018	2019	2020	Tăng trưởng
1. Doanh thu bán hàng và cung cấp dịch vụ	**6,189,389,314,510**	**7,238,653,667,719**	**7,438,383,023,154**	**1,522,670,933,256**	
2. Các khoản giảm trừ doanh thu	**4,774,534,557**	**5,486,020,924**	**6,507,331,917**	**5,104,075,917**	
3. Doanh thu thuần về bán hàng và cung cấp dịch vụ	**6,184,614,779,953**	**7,233,167,646,795**	**7,431,875,691,237**	**1,517,566,857,339**	
4. Giá vốn hàng bán	5,786,872,769,893	6,764,204,258,865	6,944,690,819,707	1,365,174,828,849	
5. Lợi nhuận gộp về bán hàng và cung cấp dịch vụ	**397,742,010,060**	**468,963,387,930**	**487,184,871,530**	**152,392,028,490**	
6. Doanh thu hoạt động tài chính	1,937,839,350	4,445,458,798	25,651,737,876	69,208,036,727	
7. Chi phí tài chính	4,644,164,605	9,457,183,646	36,292,149,231	98,058,806,908	
- Trong đó: Chi phí lãi vay	*2,746,298,652*	*7,408,726,283*	*31,487,343,718*	*83,202,193,974*	
8. Phần lãi lỗ hoặc lỗ trong công ty liên doanh, liên kết	-341,124,707	145,737	-344,760,842	-180,744,955	
9. Chi phí bán hàng	34,195,114,500	42,022,809,733	65,941,363,620	26,028,649,293	
10. Chi phí quản lý doanh nghiệp	315,682,813,050	373,846,624,261	371,226,921,500	208,602,980,999	
11. Lợi nhuận thuần từ hoạt động kinh doanh	**44,816,632,548**	**48,082,374,825**	**39,031,414,213**	**-111,271,116,938**	
12. Thu nhập khác	12,718,668,465	30,232,784,435	31,268,462,310	16,484,162,647	
13. Chi phí khác	9,071,700,872	6,910,250,162	10,020,423,885	3,033,285,224	
14. Lợi nhuận khác	**3,646,967,593**	**23,322,534,273**	**21,248,038,425**	**13,450,877,423**	
15. Tổng lợi nhuận kế toán trước thuế	**48,463,600,141**	**71,404,909,098**	**60,279,452,638**	**-97,820,239,515**	
16. Chi phí thuế TNDN hiện hành	11,231,849,847	13,400,248,806	16,024,044,661	1,007,800,419	
17. Chi phí thuế TNDN hoãn lại				120,862,500	
18. Lợi nhuận sau thuế thu nhập doanh nghiệp	**37,231,750,294**	**58,004,660,292**	**44,255,407,977**	**-98,948,902,434**	
18.1 Lợi ích của cổ đông thiểu số	506,097,333	1,739,040,120	-1,059,079,682	-802,008,897	
18.2 Lợi nhuận sau thuế của công ty mẹ	**36,725,652,961**	**56,265,620,172**	**45,314,487,659**	**-98,146,893,537**	
19. Lãi cơ bản trên cổ phiếu	4,478	6,131	2,924	-7,027	
20. Lãi suy giảm trên cổ phiếu	3,809	5,150	2,659	-7,027	
21. Cổ tức					

Figure 2. Financial statements 2017 - 2020

(Source: Vietravel, 2020)

Vietravel experienced a significant decline in revenue and profits in 2020 compared to previous years. Revenue decreased by over 6,000 billion VND in comparison to 2019, while the net profit from business activities was negative. Financing activities were also inefficient, with interest expenses exceeding the income from financing activities. As a result, Vietravel is at risk of facing liquidity loss and potential bad debt.

The ROA[2] and ROE[3] indices can be used to assess the business situation of an enterprise. A higher ROA indicates a more efficient use of assets. However, in 2020, the ROA dropped significantly below the negative level, indicating that there was no profit after tax, and the business had to cover losses, leading to a decrease in business assets. The ROE also dropped to a negative level, indicating that equity did not generate profit, and the capital and business were not efficient. (See Figure 3).

Figure 3. Business performance 2017 - 2020

(Source: Vietravel, 2020)

2.4 SWOT Analysis

At this point, we can analyze Vietravel's strengths, weaknesses, opportunities and threats (SWOT) as follows:

[2] ROA = Profit after tax (Earnings) / Assets (Assets) * 100%. In which: Earning is profit after tax. This is the net profit used primarily for common stocks. Assets is the average total assets. This is the total assets that the business has. 100%: ROA is calculated in % units

[3] ROE = Net profit after tax this period/Total equity at the beginning of the period *100%. The ROE ratio reflects both the profit target, which is shown on the income statement and the average equity ratio, on the balance sheet.

Strengths (S): Vietravel has a complete ecosystem, agile leadership team, timely decisions, adaptive strategy, ability to quickly restructure in the Covid-19 situation, regularly updates Update products and apply technology in management and business. The company also has a large, high-quality workforce, creating youthfulness and seeing business opportunities in difficult times.

Weakness (W): The company is facing many difficulties with an ineffective operating system, cash flow has decreased sharply due to the impact of the epidemic, leading to slow refunds and loss of reputation. To solve this situation, the company has reduced staffing by nearly 90%, cut salaries and benefits. However, the business market share is still shrinking, losing foreign tourists and Vietnamese tourists traveling abroad. The application of 4.0 technology is still limited and has not been applied effectively. In addition, there still exists 5% of employees who do not have the spirit of solidarity, support and cooperation. The company is also having problems with imbalance in personnel, especially the female gender. The generation born from 1990 onwards also lacks understanding, sympathy and enthusiasm.

Opportunity (O): The natural environment can create opportunities for Vietravel to improve its reputation. For example, the company can handle emergency situations and build trust with customers by providing quality services and ensuring customer safety. Many tourism businesses have withdrawn from the industry, this creates an opportunity for Vietravel to focus on business and create more profits. In addition, Vietravel has good relationships with major agencies and partners, helping the company receive practical support and information, thereby making decisions appropriate to the market.

Challenge (T): The natural environment can cause force majeure situations and leave serious consequences for Vietravel. Competitors are gradually decreasing, creating opportunities but there are still challenges from niche market and e-commerce operators. However, the pandemic has weakened the economy and reduced travel demand, leading to Vietravel being unable to organize tours. To resolve this situation, Vietravel needs to actively seek new opportunities, focus on domestic tourism products and use new technologies to develop business. In addition, the company also needs to maintain good relationships with partners and old customers, thereby enhancing its reputation and retaining customers.

Through SWOT analysis, the author proposes strategies to provide solutions for businesses as presented in Chapter 3.

3. Proposed Solutions

Vietravel is facing challenges and risks due to the Covid-19 pandemic, which has seriously affected the service and tourism industries. The business had a plan to go out into the world before the pandemic, but now has to restart to adapt to the new normal. However, the author has proposed solutions and recommendations to the governing body and the state to support the development of the industry.

3.1 Solutions from SWOT Analysis

From SWOT analysis, strategies to provide solutions for businesses are proposed as follows:

S - O combination solution: Vietravel needs to redefine customers and customer needs, thereby orienting product development and proposing business plans, resetting profit and revenue goals.

S - T combination solution: Vietravel needs to apply digital technology in management, business, and human resources, while enhancing human resources to improve work efficiency.

W - O combined solution: Vietravel needs to reposition its position in the Vietnamese and international markets when governments of countries determine to live with the pandemic, thereby devising appropriate business strategies.

W - T combined solution: Vietravel should always prepare mentally and scenarios for force majeure situations because future epidemics may be even more severe than this Covid-19 pandemic.

3.2 Implementing Technology 4.0

Based on the results of discussions with experts and customers. Proposed technology application solutions.

Technology helps save time and eliminate cumbersome procedures in the communication process between customers and employees. To optimize operations, businesses can build management, training and human resource control systems in a spirit of self-awareness, and apply technology to reduce the use of paperwork. Activities such as signing online labor contracts, managing employee personal profiles from recruitment to work process and job orientation can also be done online.

To increase efficiency in customer data management, businesses can build a professional management system and store customer records to analyze their needs and desires using artificial intelligence. Systems or AI can also help classify and identify customers to serve many analysis needs and provide solutions such as products to sell or advertising plans. However, storing large amounts of customer information and ensuring security needs to be taken seriously and seriously researched for implementation at this time.

To provide timely support and prevent risks during the tour, the radar system should be utilized to locate vehicles moving on the tour route. This system can also help find customers easily when they get lost or have an accident, and save evidence to evaluate, investigate and learn from incidents that have occurred. In addition, to avoid staff having to wait for time zone differences and ensure regular work, building a smart system with the function of linking domestic and foreign regions should also be considered by businesses.

With population growth in Vietnam and around the world, the young generation will access information technology faster and aim to become global citizens. Therefore, it is urgent that businesses should soon access, grasp and apply technology to know how to prevent risks such as information theft and system monitoring. This requires a strict protection system to detect and prevent hacker attacks, and help protect the system from serious losses.

4.0 Conclusion

The Covid-19 pandemic has affected the tourism industry, including Vietravel Group. Business in 2020 was not as effective as expected, development goals and achieving the revenue target of 10 trillion VND were delayed. Vietravel must pivot to adapt to the situation. The author hopes his proposal can help Vietravel resolve limitations in the new normal context and develop the tourism market in the future.

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6th Langkawi International Multidisciplinary Conference 2023 (6th LIMC 2023)
eISSN 2976-3223
9th – 10th September 2023
Bayview Hotel, Langkawi, Malaysia

STRUCTURAL MODIFICATION OF A RECUMBENT BIKE AND ELECTRIFYING THE DRIVE SYSTEM OF THE RECUMBENT BIKE

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Abstract: *This article presents the structural modification and electrification of a recumbent bike. The recumbent bike's original structure was modified by adding an electric drive system, which consisted of a motor, battery, and controller. The electric drive system along with twin foldable footrests was integrated into the recumbent bike's existing frame to enhance efficiency and comfort. Using CATIA, structural analysis was conducted on twin foldable footrests to ensure they met the strength and stiffness requirements. CATIA was again used to analyze the impact of the added weight and forces on the frame and ensure its structural integrity. The results of the structural analysis showed that the modified recumbent bike's frame could handle the additional weight and forces generated by the electrified drive system. The electrified recumbent bike offers an eco-friendly, efficient, and comfortable mode of transportation, suitable for a wide range of users. This project demonstrates the importance of using advanced design software like CATIA for structural analysis to ensure the safety and reliability of modified products.*

Keywords: *Twin Foldable Footrest, Recumbent Bike, Electric Drive System, Structural Analysis, Transportation*

Introduction

In the world of cycling, recumbent bikes have emerged as a unique and increasingly popular alternative to traditional upright bicycles. With their laid-back and reclined seating position, recumbent bikes offer a comfortable and efficient way to enjoy the thrill of cycling while providing numerous benefits for riders of all ages and fitness levels.

Unlike conventional bikes, which require riders to sit upright and place weight on their hands and wrists, recumbent bikes position riders in a relaxed, ergonomic seat with their legs extended forward. This design distributes the rider's weight more evenly over a larger surface area, reducing strain on the neck, back, and buttocks. The low impact on the joints and spine makes recumbent biking an appealing choice for individuals with pre-existing conditions, injuries, or limited mobility.

One of the primary advantages of recumbent bikes is their exceptional comfort. The supportive seat with a backrest allows riders to sit in a natural and relaxed position, reducing the risk of numbness and pain associated with extended rides on upright bikes. The ergonomic design also minimizes stress on the hands and wrists, making recumbent biking a comfortable option for those who experience discomfort or fatigue in these areas.

In addition to enhanced comfort, recumbent bikes offer excellent aerodynamics and improved stability. The reclined position of the rider reduces wind resistance, allowing for greater speed with less effort. This makes recumbent bikes an excellent choice for long-distance rides or touring, where efficiency and endurance are crucial. The stability provided by the low center of gravity and a wider wheelbase also enhances control and balance, offering riders a sense of security and confidence on the road.

Recumbent bikes are suitable for a wide range of cyclists, from casual riders seeking leisurely outings to avid enthusiasts looking for high-performance machines. They come in various configurations, including two-wheeled models, tricycles, and even hand-cranked versions for riders with limited or no use of their legs. Some recumbent bikes also feature advanced features such as adjustable seats, suspension systems, and integrated storage compartments, further enhancing their versatility and utility.

Even with all these advantages, an existing recumbent bike still needs to use a man-powered to operate. So, for someone who has difficulty producing that energy, they will find it hard to ride this bike. Cycling drains your energy, damages your muscles, and weakens your muscles. This causes you to either perform poorly or experience significantly more leg fatigue during strenuous cycling attempts if there isn't adequate recovery time in between [5]. So, this project decided to convert the drive system of the recumbent bike to a fully electrical one. The paddle where required for mechanical purposes will be removed and changed to a twin foldable footrest. This project surely can give a lot of advantages to society and the environment.

Methodology

In doing design and fabrication of the new structure for the recumbent bike, it adopts the Finite Element Analysis approach which starts with the structure modeling, and analysis, where all results are obtained by using CAD software, and finally, the fabrication process that includes quality control and testing stage.

Structure Modelling

In this stage, the original design and proposed design for the recumbent bike were designed in CATIA. This model will serve as the basis for the finite element mesh. Then the CATIA file was imported into the ANSYS where the meshing process occurred. The type of element, size of the element, and the material assigned are determined in this process.

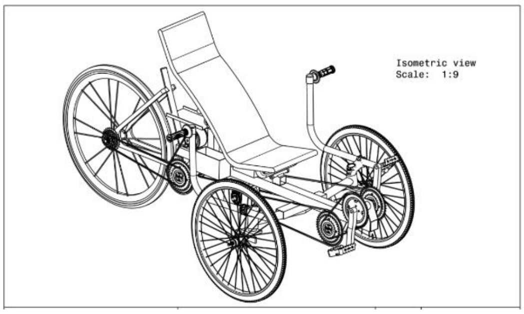

Figure 34: Original Design

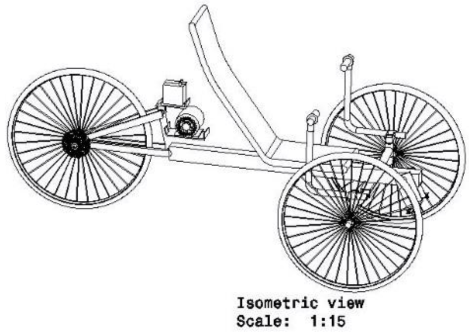

Figure 35: Proposed Design

There were numerous parts of this bike that need to be removed first before the assembly process. There was also the new part that is attached to the bike which is a foldable footrest. This footrest is a functional accessory designed to provide support and comfort to the feet while seated. It is commonly used in various settings such as offices, homes, and travel environments. The primary function of a foldable footrest is to elevate the feet, promoting better posture and reducing strain on the lower back and legs.

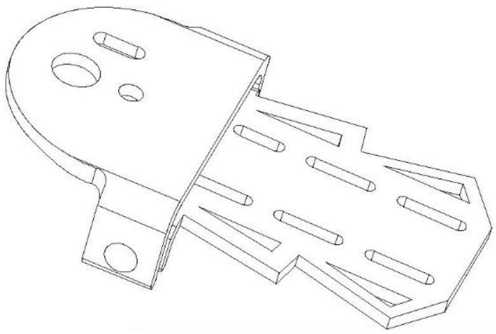

Figure 36: Foldable Footrest

Analysis

The next stage is very crucial because it will determine the internal actions and the support reactions of a structure subjected to mechanical loads. Finite Element Analysis is the tool used to analyse the structure. The material assigned for this bike is steel as shown in the figure below.

Figure 37: Structure Shade in Material

For the foldable footrest, analysis had been done by estimating the maximum loads exerted by our leg is 20KG and that's around 200 Newton. This load is classified as distributed force and the force is facing downward as shown in the figure below. By the end of this stage, the maximum displacement, deformation, and Von Mises Stress values are obtained.

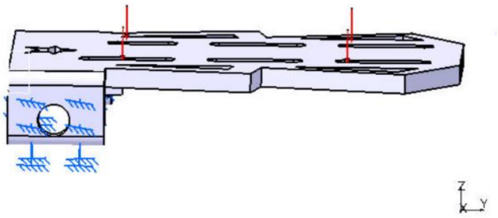

Figure 38: Force Distribution

MESH:

Entity	Size
Nodes	3149
Elements	9718

ELEMENT TYPE:

Connectivity	Statistics
TE4	9718 (100.00%)

ELEMENT QUALITY:

Criterion	Good	Poor	Bad	Worst	Average
Stretch	9718 (100.00%)	0 (0.00%)	0 (0.00%)	0.347	0.653
Aspect Ratio	9564 (98.42%)	154 (1.58%)	0 (0.00%)	4.587	1.823

Mesh.1

Figure 39: Meshing Report

Fabrication

The fabrication process involves transforming raw materials into finished products through a series of manufacturing operations. There were various techniques and steps done according to their complexity. The first part is support for foldable footrests. This part required multiple steps to make it such as using a cutting machine and grinder. Cutting machines were used to cut a big mild steel plate into a small one. This small plate then will be cut again using a grinder because grinders can access hard-to-reach areas or confined spaces where other cutting tools may have difficulty reaching.

Before going to the welding process, the existing recumbent bike also needs to be disassembled for the process to carry it around to become easier. Basic and special tools are required to disassemble the bike. Special tools are needed during the crank extraction process.


Figure 40: Basic Tool (left) and Special Tool for Crank Set (right)

Next is welding. The welding process was done by using MIG welding machines. This machine uses a continuous solid wire electrode that is fed through a welding gun. This welding is to connect the mild steel plate and the frame of the recumbent bike. The mild steel plate was first spot weld on one side, then after getting the same angle for both plates on both sides, only then begin full weld.

Result and Discussion

The only part that has been analyzed is the foldable footrest because it will experience great force acting and the reactions also will be significant.

Footrest

As for the footrest, the estimated maximum force exerted on the footrest is 20 Kg, which is around 200N. Based on the analysis done, the footrest did undergo deformation and the maximum displacement for the footrest is only 1.79mm and it is within the acceptable range. Based on the analysis again, the place with the most deformation is on the right side of the footrest due to its far from the support.

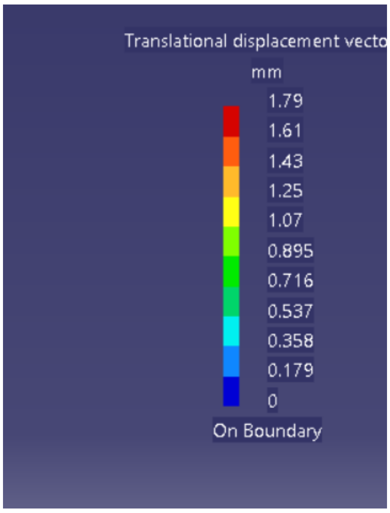

Figure 8: Displacement Value

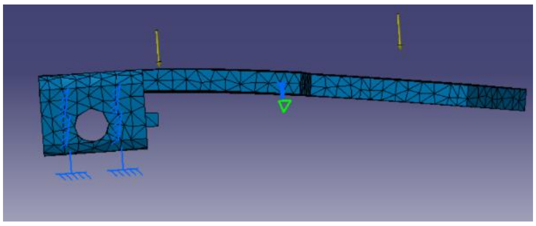

Figure 9: Deformation

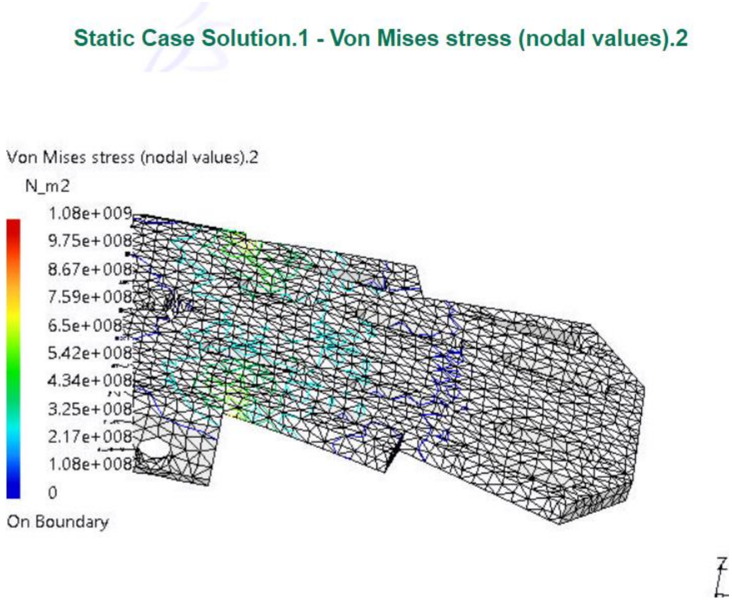

Figure 410: Von Mises Stress

Table 1. Material Load Parameters

Materials	Loads(kg)	Force (N)	Min. Von Mises Stress (Pa)	Max Von Mises Sress (Pa)
Steel	20	200	1.08e+07	1.08e+08

The material chosen for this foldable footrest is steel because it has high strength and durability [13]. Steel is sustainable and is the most recycled material on Earth. As a non-combustible material, it provides long-term safety benefits to occupants. By taking the value of the maximum von Mises stress, the factor of safety was calculated. The foldable footrest is proved to be considerably stronger and safer for this project.

Table 2. Material Properties.

Material	Steel
Young's Modulus	2e+011N_m2
Poisson's Ratio	0.266

Density	7860kg_m3
Coefficient of thermal expansion	1.17e-005_Kdeg
Yield Strength	2.5e+008N_m2

$$\text{Factor of Safety} = \frac{\text{Yield stress}}{\text{Maximum Von Mises stress}}$$

$$\text{Factor of Safety} = \frac{2.5 \times 10^8\text{Pa}}{1.08 \times 10^8\text{Pa}} = 2.31$$

Motor Performance

Below are the DC motor specifications.

Table 3. DC Motor Specifications

BRUSH LESS DC MOTOR (BLDC)	
Type	**Brushed Gear Motor**
Rated Power	500W
Rated Current	0.6A
Rated Voltage	24V
Rated Speed	2500RPM

Based on the data given by the manufacturer, the value of rated torque produced by the DC motor can be calculated using below equation:

$$\text{Torque} = \frac{\text{Power}}{\text{Angular Speed}}$$

$$\text{Torque} = \frac{500\text{W}}{(2\pi/60 \times 2500\text{RPM})\ 1/\text{s}} = 1.91\text{N.m}$$

Figure 11: Drivetrain System

The electric motor needs to be positioned in a way that aligns with the drivetrain and chain system. The DC motor is typically mounted near the rear wheel hub or within the frame's structure. Then mounting brackets or adapters are used to securely attach the motor to the frame.

Product Testing

After reassembly, of all the parts again, the recumbent bike is tested to hold my weight, and it goes very well. The seating posture for the user is also comfortable especially for the legs because the footrest is installed. The footrest contributes to the rider's balance and control of the bike. By resting their feet on the footrest, the rider can maintain a stable and balanced position, especially when coasting or riding at slower speeds.

Figure 12: Leg Position

Figure 423: Seating Posture

The drive system for the recumbent bike also had been changed into a fully electrical drive system. DC motor is connected to a gear and drives a bottom sprocket and the sprocket will drive the bike. All this rotational torque involved in this system is transferred through a drivetrain system which is the chain.

Power Supply

Power was supplied by two 12V batteries. This battery is connected in a series connection instead of parallel because the motor-rated voltage is 24V. The battery-rated current is 7Ah and a rechargeable Sealed Lead Acid (SLA) battery. The capacity of the battery, often measured in ampere-hours (Ah), determines how much energy the battery can store and deliver over time.

Figure 14. SLA 12V Batteries Connected in Series

Table 4. Battery Specifications

Type	**Sealed Lead Acid (SLA)**
Rated current	7Ah
Rated voltage	12V

By taking all these specifications that is provided by manufacturer, we can determine how long these two batteries which are connected in series can operate the 24V 500W DC motor used in this project. The total capacity of the battery bank, when connected in series, remains the same (7Ah) because the voltage doubles to 24V. The energy stored in the batteries can be calculated using the formula:

$$\text{Energy (Wh)} = \text{Voltage (V)} \times \text{Capacity (Ah)}.$$
$$\text{Energy} = 24\text{V} \times 7\text{Ah} = 168 \text{ Wh}$$

Then, power (W) is the rate at which energy is consumed by the motor, and time (hours) can be calculated using the formula:

$$\text{Time (h)} = \text{Energy (Wh)} / \text{Power (W)}$$
$$\text{Time} = 168 \text{ Wh} / 500 \text{ W} = 0.336 \text{ hours}$$
$$\text{Time (minutes)} = \text{Time (hours)} \times 60 = 0.336 \text{ hours} \times 60 = 20.16 \text{ minutes}$$

Conclusion and Recommendation

The analysis and study carried out have successfully met the goals of this project which is to design a new structural design of the recumbent bike by installing a foldable footrest, modifying the drive system, and making it fully electric.

The usage of a footrest made of mild steel is right because it has high strength compared to the plastic one. The mild steel plate that acts as the support for the footrest has also been in great shape. If the plate is longer, the structure tends to bend more because the welding as the connecter is far from the tip.

Based on all the analysis done, the structure of the recumbent bike is very strong, and it is far from a failure. The analysis is yielding positive indications, demonstrating the soundness of the structure design.

Then for fabrication, it involved translating the design specifications into a tangible product, utilizing various techniques such as welding and machining depending on the project requirements. This stage required meticulous attention to detail, precision, and adherence to established fabrication standards. By effectively executing the fabrication process, the project has brought the design from concept to reality, showcasing the application of engineering principles in a tangible form.

Lastly, for the recommendation, sustainability considerations can be included in this project. The incorporation of sustainability considerations into the project entails evaluating the environmental impact of the fabrication process and the lifecycle of the final product. Opportunities to use eco-friendly materials, reduce waste, and optimize energy consumption wherever possible can be explored.

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6th Langkawi International Multidisciplinary Conference 2023 (6th LIMC 2023)
eISSN 2976-3223
9th – 10th September 2023
Bayview Hotel, Langkawi, Malaysia

THE IMPACT OF STRATEGY DIFFUSION ON ORGANISATIONAL PERFORMANCE OF PROJECT-BASED ORGANISATIONS: A STRUCTURAL EQUATION MODELLING APPROACH

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Abstract: *This study investigating the utilization of top-down and bottom-up techniques in spreading an organisation's strategy and getting back the performance. As well as the possibility of employing one of diffusion theories (e.g., Rogers' Theory of Innovation Diffusion) within strategy or project contexts in project-based organisations that may not yet explored. Thus, the need to understand and apply a strategy diffusion (top-down) and report its performance (bottom-up) was urgent and necessary within project-based organisations; to fulfil the complete drive of the strategy and raise the competitive advantage of businesses.*

In this study, there was a comprehensive review of strategic management, diffusion theory, and project management facets, where the strategy spreading practices were based on the five well-known skills of Rogers' diffusion theory; to diffuse the strategy (top-down) and reveal performance results (bottom-up) to feed each level of the project-based organisation hierarchy structure, taking the advantage of the interrelationships that exist amongst the strategy, the portfolio, the program, and the project levels. Moreover, mediation effects were taken into consideration for the organisational culture that related to the four organisational levels during the relationship's investigation between all the research variables; since it is known that organisational culture have huge influence on business outcomes. Accordingly, the research framework was adopted and designed.

A questionnaire was designed and administered to strategy, portfolio, program and project professionals and data was analysed by using structural equation modelling (SEM) to evaluate the strength of the relationship between the strategy diffusion (top-down) variables, performance feedback (bottom-up) variables at all project-based organizational levels and the organizational performance variables, as well as, considering the mediation effects of the organizational culture. In addition, the direct and indirect causal influence of strategy diffusion influencing factors at all the levels of strategy, portfolio, program, and project and the organizational performance were evaluated.

The findings indicate that strategy diffusion has a strong impact on organizational performance within project-based organisations. Whereas significant positive influences on the relationships were found between the research variables.

In recent years, many studies have examined topics about relationships amongst strategy management, portfolio management, program management, and project management. However, those studies investigating the traditional one-way cascading of the organizational strategy. In addition, some few studies investigating the use of top-down and bottom-up *techniques to spread an organisation's strategy and getting back the performance. Moreover, the possibility of employing one of diffusion theories (e.g., Rogers' Theory of Innovation Diffusion) within strategy or project contexts in project-based organisations may not yet explored. Consequently, this study added value in terms of the usage of Structural Equation Modeling (SEM); to understand and apply a strategy diffusion (top-down) and report its performance (bottom-up) within project based organizations.*

Keywords: *Diffusion Theory, Portfolio Management, Program Management, Project Management, Strategy Management*

Introduction

Despite the important role of the strategy diffusion process in strategic management, empirical research focusing on project-based organisations in the area of strategy diffusion has been limited. This study seeks to delve deeper to understand the impact of strategy diffusion on organisational performance within project-based organisations.

The organisational strategy needs to be understood by all staff at all levels of governance within the organisations very well, in order to implement their daily business in a way that contributes to the success of that strategy (Kaplan & Norton 2001).

Strategy management classically uses top-down perception to make sense of the collaborations amongst portfolios, programs, and projects (Clegg et al. 2018). But several scholars have criticized the common top-down, one-dimensional standpoints of strategy in the project-management literature (Lowstedt, Raisanen & Leiringer 2018), as the traditional (top-down) approach in project management focuses on rational structural aspects of strategizing, which leads to losing the focus on the fundamental practices and processes that are initiated by the strategy and how these practices and processes frame strategy implementation (Clegg et al. 2018).

Thus, the emergence of using a diffusion strategy (top-down) and (bottom-up) is imperative, so that the diffusion process can be significantly accelerated, and the organisational strategy will be translated, improvised and made sensible. This will also fulfil the complete drive of strategy (Clegg et al. 2018; Lowstedt, Raisanen & Leiringer, 2018), especially as the professional strategy diffusion is the right method to help practitioners to enhance their tasks and activities, contribute more to their organisational strategic objectives, and enhance their organisational outcomes (Köhler & Zerfass 2019). Similarly, project management levels should know about their corporate aspect of their projects to know how to deal with it, in order to support their top strategy, understand the corporate needs; ultimately, this will lead to customer satisfaction and achieving business success (Meskendahl 2010; Patanakul & Shenhar 2012). Thus, a bi-directional link between strategy, projects, and project portfolio management is suggested in the literature on the practicing of strategy over projects, and the ability of project portfolio and project actions and processes to update the strategy (Killen et al. 2012). Furthermore, it will build on continuous mixes of bottom-up learning from projects-to-organisation and top-down strategic decision-making from organisation-to-projects (Lowstedt, Raisanen & Leiringer 2018).

The aim of this study is to investigate the effects of strategy diffusion on organisational performance in projects-based organisations. This can be done through developing an appropriate model that can ensure diffusing of the organisational strategy considering the presence of organisational involvement culture dimensions. This is in order to embed, translate and contribute that strategy in the organisation daily activities at all levels, as well as to confirm reporting back all performance and lessons learnt at all levels; for better decision-making and adjustment of the strategy, which ultimately will lead to enhanced and increased organisational performance (including financial, product market, shareholder return and stakeholder satisfaction) in project-based organisations (Clegg et al. 2018; Lowstedt, Raisanen & Leiringer, 2018; Köhler & Zerfass 2019).

In sum, a strategy concept with diffusion may help in bridging the gap related to the above argument about the utilisation of the strategy diffusion practice as a top-down approach. This can spread the organisational strategy and support reporting performance bottom-up, to learn the lessons and to make decisions accordingly, which will lead confidently to increase all organisational performance indicators. This research seeks to better model the relationships among strategy diffusion top-down, performance reporting bottom-up, and firm performance.

Rogers' Diffusion Theory and David's Strategic Management Model Integration

There was evidence by Kenny (2003) for the utilisation of Rogers' diffusion theory in the context of strategy and project management for educational innovation projects, where the strategy implementation often results in the change of identification and innovative projects, and the certainty is also involved in this formula.

However, to confirm additional validation about the concepts similarity of innovation diffusion and strategy diffusion, thus, a thorough mapping was conducted for the five diffusion decision process that consists of knowledge, persuasion, decision, implementation, and adaptation stages, which are adopted from Rogers' diffusion theory, with the strategic management three phases that consist of formulation, implementation, and evaluation that taken from David's strategic management model at each of the project-based organisation hieratical levels for strategy, portfolio, program and project levels as a top-down perspective.

In addition, it is shown below the similarity of the meaning for the four innovation diffusion elements (innovation, communication channels, time and social system) in Rogers' diffusion theory and David's strategy management model. After that, it will also provided the characteristics' meanings of compatibility, relative advantage, complexity, observability and trialability in Rogers' innovation diffusion theory and the parallel characteristics' meanings (consistency, advantage, clarity, visibility consonance and feasibility) in David's strategic management model. These have different terminologies but the same meanings.

Strategic Management and The Four Main Elements of Rogers' Diffusion Theory

Rogers (2003, p. 5) defined diffusion as "the process in which an innovation is communicated thorough certain channels over time among the members of a social system". Therefore, as mentioned in this statement the four key elements of the diffusion are innovation, communication channels, time, and social system.

Innovation: for Rogers (2003), innovation definition is “an idea, practice, or project that is perceived as new by an individual or other unit of adoption” (Rogers 2003, p. 12). The idea, practice, or project terms in strategic management are synonym to objectives, products, goals, and initiatives terms (David 2011). Thus, it is clear that strategic decision to “adopt an innovation” happens only when a “shared vision” is approved over a mixture of top-down and bottom-up courses (Kenny 2003).

Communication channels: Rogers (2003, p. 5) defined communication as “a process in which participants create and share information with one another in order to reach a mutual understanding,” with two ways of communication; mass communication and interpersonal communication (Sahin 2006). Likewise, in the setting of strategic management, in order to support a firm main role as a competitive team, communication and interaction adaptation between managers and employees across hierarchical levels are a must. This is because boosted communication provides deeper understanding of the strategies, which leads to higher commitment as a consequence, offering effective outcomes. Therefore, communication is crucial to successful strategic management. Moreover, top-down flow of communication is important to encourage and develop bottom-up support (Foreman & Argenti 2005; Hallahan et al. 2007; David 2011; Hume & Leonard 2014).

Time: The innovation-diffusion process, rate of adoptions, and adopter categorization all contain a time aspect (Sahin 2006). Furthermore, in strategic management there is a long-term objective, where the time frame should be reliable, usually from two to five years. In addition, there are short-term objectives, and the time frame for those objectives are less. Equally, in the strategy implementation stage the time aspect is crucial for deploying the strategic initiatives or projects. Moreover, the time dimension also must be considered for the monitoring, controlling, and measuring performance in the strategy evaluation stage (David 2011).

Social system: Rogers (2003, p.23) defined the social system as “a set of interrelated units engaged in joint problem solving to accomplish a common goal.” Similarly, in the strategic management field, strategy formulation, implementation, and evaluation events happen at three hierarchical levels in a large organisation: enterprise, divisional or strategic business unit, and functional, sharing the same challenges to be solved and same objective to be achieved within targeted time (David 2011).

Strategic Management and The Five Characteristics of Rogers’ Diffusion Theory

As per Rogers (2003, p. 232), the process of innovation-diffusion is “an uncertainty reduction process”, and he recommended number of attributes of innovations that could support in reducing the innovation uncertainty. Attributes of innovations consist of five characteristics of innovations: compatibility, relative advantage, complexity, observability, and trialability. Moreover, Rogers (2003, p. 219) indicated that “individuals’ perceptions of these characteristics predict the rate of adoption of innovations”.

In Rogers’ (2003, p. 229) diffusion theory relative advantage is defined as “the degree to which an innovation is perceived as being better than the idea it supersedes.” Compatibility is defined as “the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters” (p. 15). Complexity is defined as “the degree to which an innovation is perceived as relatively difficult to understand and use" (p. 15). Trialability is defined as "the degree to which an innovation may be experimented with on a limited basis" (p. 16). Moreover, observability is defined as "the degree to which the results of an innovation are visible to others" (p. 16).

On the other hand, the same characteristics can be found in strategic management features as indicated by Rumelt (1998), which are: advantage, consistency, consonance, clarity, feasibility, and visibility. Advantage means that strategy must deliver for the foundation and up keeping of a competitive advantage in the chosen area of activity. Consistency in strategy means to provide consistent goals and policies. In consonance, the strategy must show an adaptive reaction to the exterior environment and to the serious modifications happening inside it. Moreover, strategy mission, vision and objectives should be clear to have the right foundation for all strategic planning, implantation and evaluation undertakings, as well as to have same direction, achieve support, synergy, clarity, and gain higher performance among all levels of company. Additionally, feasibility of the strategy must provide the right resources availability and avoid forming unsolvable sub complications. Therefore, over-all, strategic objectives should be challenging, consistent measurable, clear and realistic (David 2011).

All of the above support and confirm the possibility of the study proposed concept of utilising Rogers' diffusion theory for strategy diffusion within project context as top-down method in a project-based organisation.

Review of Strategy Diffusion (Top-Down) And Performance (Bottom-Up) In Project-Based Organizations

Strategy Diffusion (Top-Down) Alignment

More studies have confirmed that it is very important that the firms know correctly their business management framework and the location of their portfolio, program and projects management within it (Morris & Jamieson 2005). A number of scholars (Artto & Dietrich 2004; Morris & Jamieson 2005; Thiry & Deguire 2007; Deloitte 2015; EY 2015; Walter, Lechner & Kellermanns 2016) outlined many practices and processes for governing the strategic, portfolio, program, and project connections in multi-project settings.

Traditionally, a pyramidal structure has been seen in project-based organisations, where management debating converted to project discussion. By the time, the practical implementation was renewed in such a way that supported in appearance of the top-down style within project management organisations, where, the style suggested a cascading arrangement from the top management down to a single project, going through the portfolios and programs. In addition, the board of directors in the company can control the portfolio environment, classify programs, and accept projects for improvement. In figure 1, there is an individual portfolio, a minor quantity of programs inside the portfolio, and some projects contained by each program, where a synergy is formed amongst the projects (Thiry & Deguire 2007).

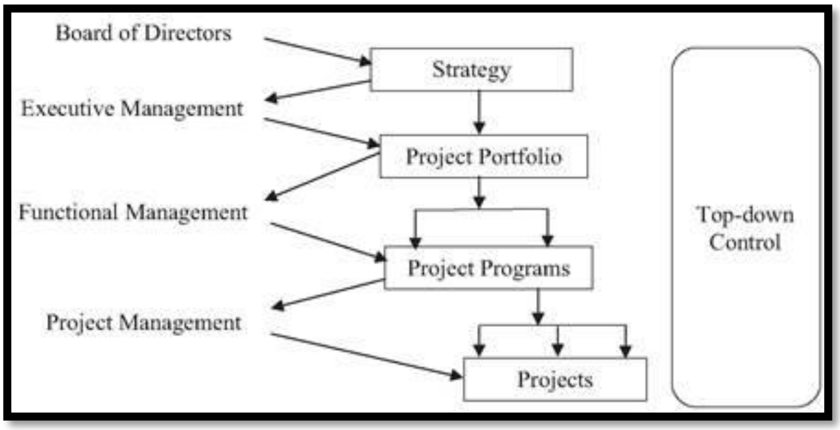

Figure 1: The Pyramid Structure of A Project-Based Organisation
Source: (Thiry and Deguire 2007)

Additionally, according to Morris and Jamieson (2005) a hierarchy of objectives, strategies and strategic initiatives can usually be created as an output of a planning strategy phase; which can strongly affect the means of configuring, strategy managing and communicating it to the association. As shown in figure 2, the cascading process is proposed to show how organisations locate business strategy, portfolios, programs, and projects to accomplish their objectives and goals. As a result of these literatures suggestions, the equivalent top-down model has been adapted in this research.

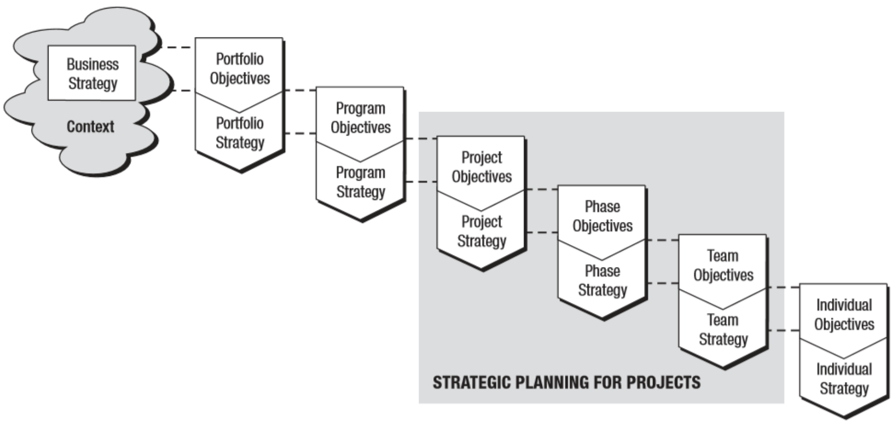

Figure 2: Linking Corporate and Project Strategy
Source: (Morris & Jamieson 2005)

Performance (Bottom-Up) Alignment

The strategy top-down and bottom-up mechanisms roles are diverse based on the organisation. This has also been explored in prior studies (e.g., Artto & Dietrich 2007; Killen *et al.* 2012; Kim *et al.* 2014). For instance, see figure 3 representing the model of the process of decision-making divided at three organisational levels, which highlights communication and data sharing amongst those levels. The communication and information flows are very important for the entire decision-oriented procedure for the multiple projects' strategic management. The arrows show communication and information flows, which considered as essential inputs and outputs for particular decision options (Artto & Dietrich 2007).

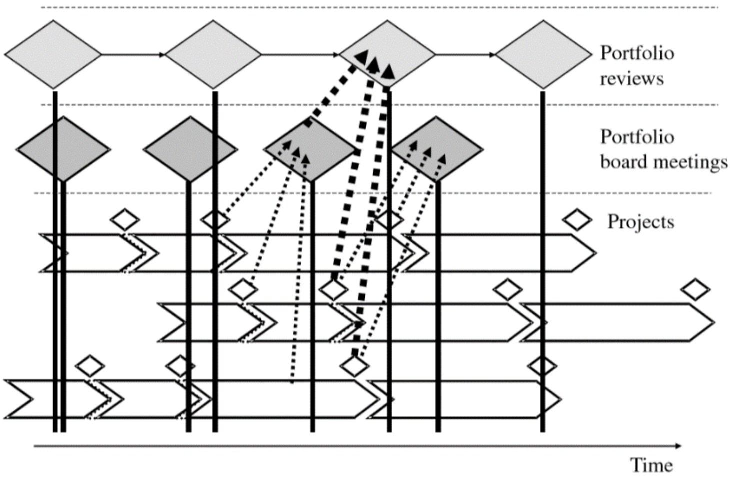

Figure 3: Bottom-Up Method for Information and Communication Flows Within The Organisational Levels
Source: (Artto & Dietrich 2007)

A bottom-up approach can be developed as an unplanned outline of activities and possibly will realize outcomes not originally proposed by top management. Therefore, bottom-up can shape objectives and action of the operations strategy, at least partially through the knowledge and lessons learnt from its day-to-day activities. According to the initial outcomes, top management strengthens or adjusts its plans as applicable (Kim et al. 2014).

Furthermore, a study by Serra and Kunc (2015) provided a conceptual example about benefits realisation, launching from projects and ending with the accomplishment of business objectives, as shown in figure 4. Theoretically, the process initiates on project results allowing direct delivery of intermediate benefits or business changes. In addition, as a strategic viewpoint, effective projects deliver the predictable benefits, then generate strategic value to the organisation. Hence, a good project management ensures the delivery of outputs, which enables outcomes, and then in turn facilitates the right benefits realisation.

As highlighted by EY (2015) that despite the importance of portfolio, programs and projects should work coherently although they have different objectives, however, in order to deliver the organisational objectives effectively. For example, project management focuses on providing a concrete output, and to do the things right. On the other hand, program management is the intermediary level that focuses on the provision of business benefits and realising the benefits. Portfolio management focuses on doing the right things via the decision-making process about which projects and/or programs should be implemented, based on their association with the organisational strategic key objectives and goals (see figure 5).

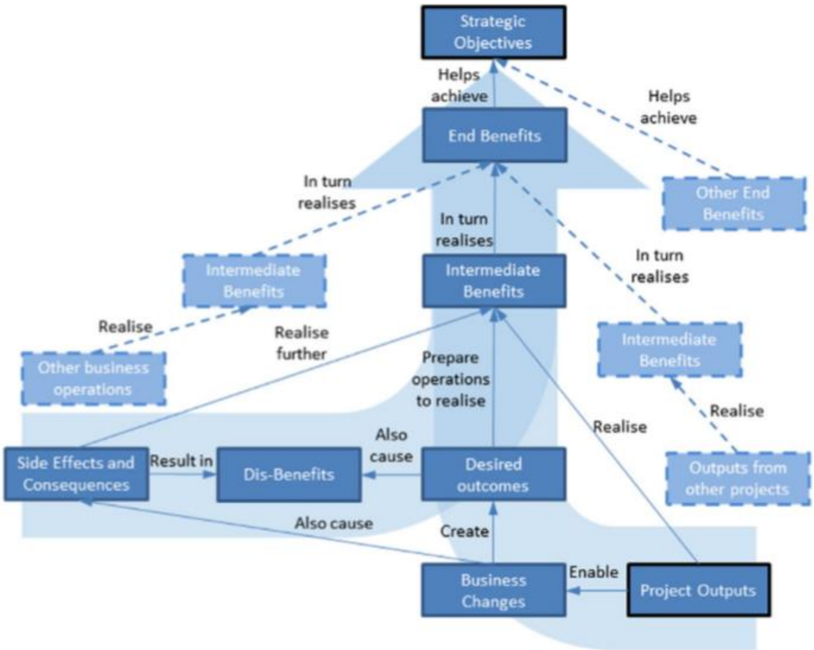

Figure 4: Benefits Realization Process
Source: (Serra & Kunc 2015)

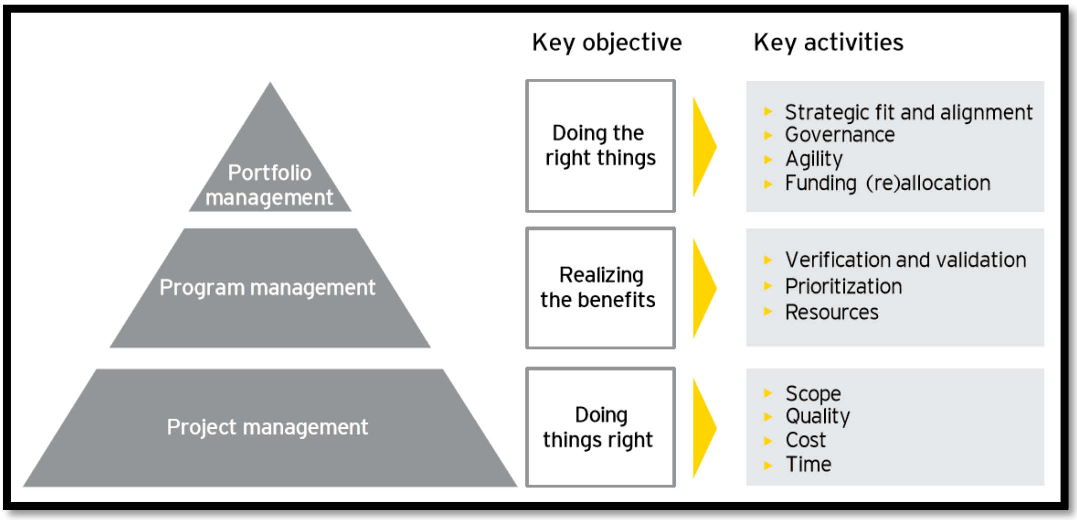

Figure 5: Portfolio, Program and Project Management Objectives and Activities
Source: (EY 2015)

In sum, from the above reviews top-down and bottom-up links between strategy, projects, and project portfolio management was explained in detail. Rogers's diffusion theory showed a perfect integration with strategic management phases at each level of the project-based organisation in a top-down manner. After that, the performance reporting method demonstrated a perfect alignment between project to program to portfolio reaching to strategic levels in a bottom-up method. All that paved the way for the established research conceptual framework.

Theoretical Framework

The research objective required a review of existing strategic management theories and aligning them with business strategy and organisational project management levels. Thus, this section was intended to select a proper and effective strategic management style that can work for this research. Based on Muogbo (2013), David's strategic management model was a proper framework to utilise for this research as it is a mixture of strategy formulation, implementation and evaluation, which is effective for all types of organisations specially for project management.

Likewise, since Rogers' diffusion theory is the most popular theory in diffusing and spreading practiced and shows its effectiveness within a quite good number of different fields. Furthermore, Rogers' diffusion theory offers a useful theoretical model to support the planning and implementation of any new improvement (Doyle, Garrett & Currie 2014). It is aligned with the research objective to appraise diffusion theories and assess the suitability of the selected theory for strategy diffusion in project-based organisations. Therefore, Rogers' diffusion model has been used to be imbedded in the suggested system for this study.

Finally, in regard to project management, several literature reviews have been studied in order to define portfolio, program, and project management, to understand more about their main roles, and to explore more about their linkages amongst the portfolio, program, and project terms and the corporate direction. Accordingly, another objective for this study was settled through checking existing project management theories for the appropriate viewpoints of diffusing or spreading the strategy, which is the utilisation of the (top-down and bottom-up) approaches.

In summary, there will be an effort for this research to plan a relative structure of business layers (strategic level, business unit level including portfolio level, then program and project level), and all the intended levels are intersected with the three strategic phases from formulation, implementation, to evaluation. Moreover, for all top-down strategy phases, Rogers' diffusion theory will be utilised to diffuse the strategy from a top-down approach. To be more specific, it is suggested that for the (top-down) approach, the strategic "initiatives" will be spread by adopting Rogers' diffusion theory within each strategy phase, starting from the enterprise level to business unit project portfolio management, reaching to program and project levels. Then, for the bottom-up part, "performance" will be reported to higher levels, as the data will be going upward to the next level above it and so on until it reaches the organisational top level. See figure 6 for more explanation about the proposed research outline, where the strategy initiatives have been diffused from top levels to down levels, so that each level knows their links to the organisational strategy and to know their precise roles and activities. It is then required to identify the outputs and outcomes (performance) at each level, which are to be reported to the levels above. Finally, and as an ultimate goal for doing so, is to improve the organisational performance for the project-based firms, considering the culture of the organisation and how this influences the overall system.

Therefore, the conceptual framework of this study suggests that organisational performance can be improved through the strategy diffusion (top-down) practices, performance (bottom-up) drivers, and organisational culture driver and their associations directly or indirectly with the organisational performance.

This model suggests that organisational performance is dependent on strategy diffusion (top-down) practices drawn from strategy initiative diffusion practice, portfolio initiative diffusion practice, program initiative diffusion practice, and project initiative diffusion practice.
It also suggests that organisational performance is dependent on strategy diffusion (top-down) practices mentioned with the presence of the mediation roles of the performance (bottom-up) aspects counting strategy performance, portfolios performance, programs performance, and projects performance.

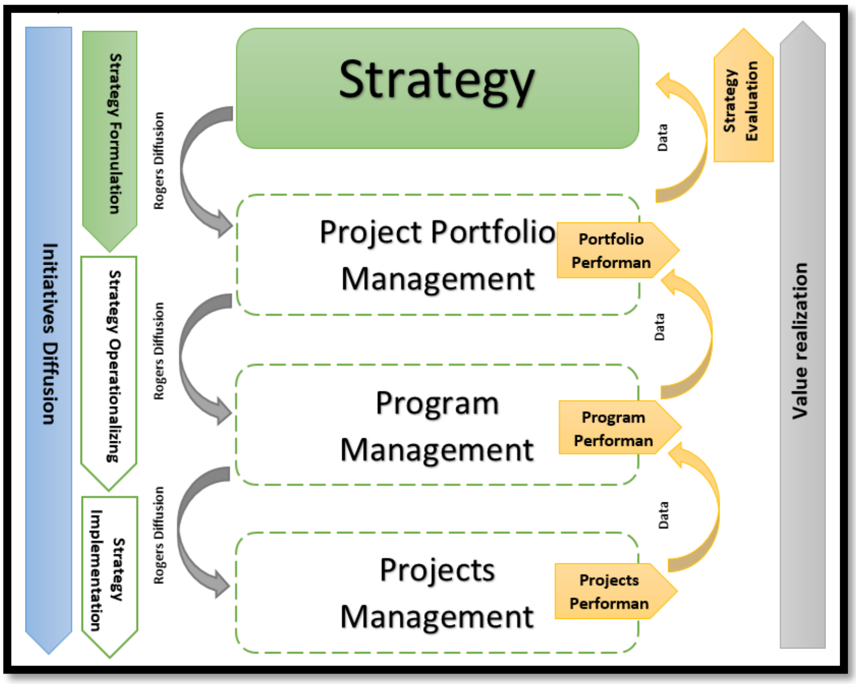

Figure 6: Research Proposed Outline

Moreover, the model suggests that organisational performance is dependent on strategy diffusion (top-down) practices with the occurrence of the mediation role of the organisational culture driver.

Furthermore, the framework proposes that there are top-down links amongst strategy diffusion from the strategy level, to portfolio, then to program and project levels, similar to studies (e.g., Ligetvári 2013). These relationships between strategy diffusion (top-down) practices at each level of a project-based organisation including the strategy, portfolio, program, and project levels will be explained, based on PMI (2017).

Furthermore, the model suggests that there are bottom-up links between performance reporter, means reporting from the project level as the bottom level of the organisation to the program level, then to the portfolio, and finally to the top level, which is the strategy level of the organisation, within project-based organisations based on PMI (2017).

Using this framework of factors and dimensions of strategy diffusion, a hypothetical diagram of the structural model is presented in figure 7. The arrow represents the direction of hypothesised influences in the structural model.

The corresponding hypotheses are as follows:

- Strategy Diffusion (Top-Down) Hypotheses

H5a: There is a significant relationship between strategy initiatives diffusion practice and portfolio initiatives diffusion practice in the project-based organisations.
H5b: There is a significant relationship between portfolio initiatives diffusion practice and program initiatives diffusion practice in the project-based organisations.
H5c: There is a significant relationship between program initiatives diffusion practice and project initiatives diffusion practice in the project-based organisations.

- Performance (bottom-up) hypotheses

H6a: There is a significant relationship between project performance and program performance in the project-based organisations.
H6b: There is a significant relationship between program performance and portfolio performance in the project-based organisations.
H6c: There is a significant relationship between portfolio performance and strategy performance in the project-based organisations.

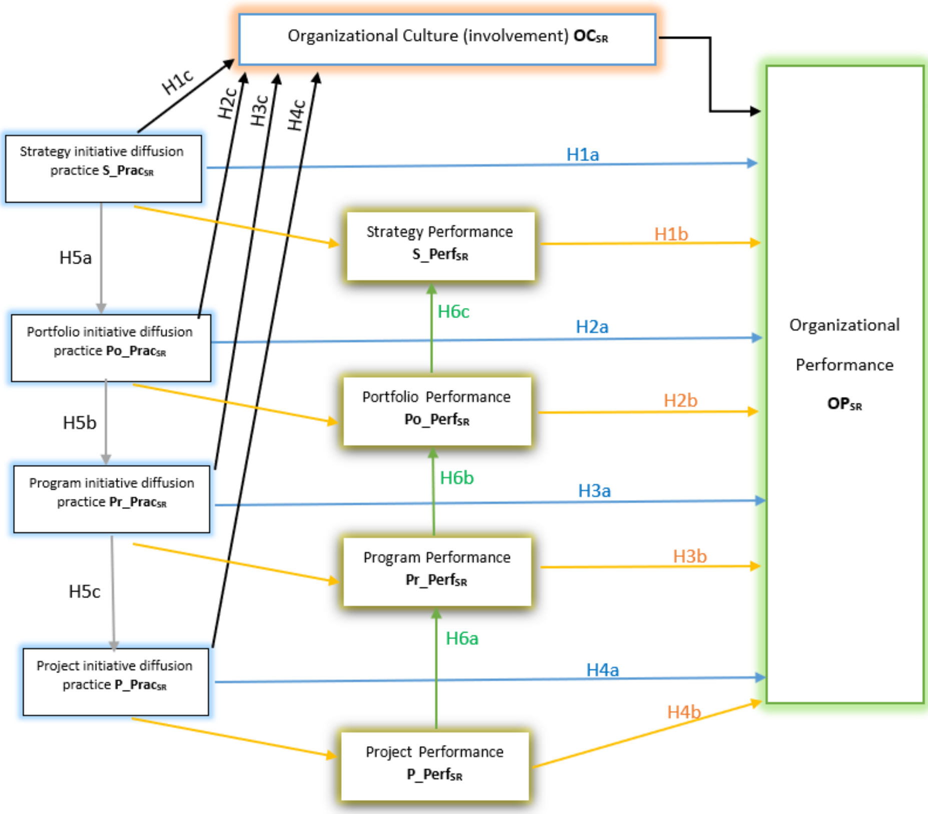

Figure 7: Proposed Research Hypothesised Model (Top-Down) And (Bottom-Up)

- Strategy level hypotheses
- ❖ Strategy initiative diffusion practice

H1a: There is a significant relationship between strategy initiatives diffusion practice and the organisational performance in the project-based organisations.

- ❖ Strategy performance as mediator

H1b: There is a significant relationship between strategy initiatives diffusion practice and the organisational performance mediated by strategy performance in the project-based organisations.

- ❖ Organisational culture as mediator at the strategy level

H1c: There is a significant relationship between strategy initiatives diffusion practice and the organisational performance mediated by organisational culture in the project-based organisations.

- Portfolio level hypotheses
- ❖ Portfolio initiative diffusion practice

H2a: There is a significant relationship between portfolio initiatives diffusion practice and the organisational performance in the project-based organisations.

- ❖ Portfolio performance as mediator

H2b: There is a significant relationship between portfolio initiatives diffusion practice and the organisational performance mediated by portfolio performance in the project-based organisations.

- ❖ Organisational culture as mediator at the portfolio level

H2c: There is a significant relationship between portfolio initiatives diffusion practice and the organisational performance mediated by organisational culture in the project-based organisations.

- Program level hypotheses
- ❖ Program initiative diffusion practice

H3a: There is a significant relationship between program initiatives diffusion practice and the organisational performance in the project-based organisations.

- ❖ Program performance as mediator

H3b: There is a significant relationship between program initiatives diffusion practice and the organisational performance mediated by program performance in the project-based organisations.

- ❖ Organisational culture as mediator at the program level

H3c: There is a significant relationship between program initiatives diffusion practice and the organisational performance mediated by organisational culture in the project-based organisations.

- Project level hypotheses
- ❖ Project initiative diffusion practice

H4a: There is a significant relationship between project initiatives diffusion practice and the organisational performance in the project-based organisations.

- Project performance as mediator

H4b: There is a significant relationship between project initiatives diffusion practice and the organisational performance mediated by project performance in the project-based organisations.

- Organisational culture as mediator at the project level

H4c: There is a significant relationship between project initiatives diffusion practice and the organisational performance mediated by organisational culture in the project-based organisations.

Research Methodology

The research method was a quantitative data collection method and the research technique for data collection was a survey method in which a structured seven-point Likert scale was utilized to test the hypotheses. A sample of the questionnaire is shown in Appendix A. And a simple random sampling (SRS) technique was proposed for generalization and the estimated targeted sample were from the fields of strategy, portfolio, program and project within the relative companies and utilities needed for this study numbered 3000. The responded to the survey were 567 with the rate of 19% from the estimated targeted sample. And the final valid sample applicable for the study was 373.

Regression analysis was conducted, to examine the relationships between the outcome variable and the predicted variables with the presence of mediator variables. Especially, that the influence of strategy diffusion drivers in strategy, portfolio, program and project levels on organisational performance development in project-based organisations needs to be evaluated. Furthermore, the mediating roles of performance (bottom-up) drivers in strategy, portfolio, program and project levels among strategy diffusion drivers and organisational performance in project-based organisations needs to be appraised.

The meditating role of the organisational culture driver in strategy, portfolio, program and project levels among strategy diffusion drivers and organisational performance in project-based organisations needs to be appraised.

According to Bacon and Bacon (2001), Byrne (2001), Chenini and Khemiri (2009) AMOS can be used to fit the kinds of factor analysis or regression models. AMOS has a graphical interface easy and effective to use and represent complicated models. It allows drawing the models according to researcher convenience, and it can make path diagrams for robust reporting, all those and more are important characteristics for software that researcher needs to use. Furthermore, AMOS is used to represent and examine the in-depth (the direct and indirect) effects of the identified independent, dependent, and moderator variables, which are equivalent to linear and multi regression analyses in SPSS software.

Therefore, the regression test was done via path analysis (causal model), to get the structural equation model (SEM). There was a model establishing process through adopting an initial model, then modifying the model, till getting the best fit model (final model) for the study that compliance the model fitness required criteria; in order to accomplish the research aim and objectives.

Accordingly, the coming sections will present the modelling, findings/results of the path analysis Structural Equation Model (SEM) performed on data through Amos statistical package software.

Modelling

At first, AMOS software with Maximum likelihood parameter estimation is used to assess the degree to which the predictor variables (Strategy Initiative Diffusion Practice (S_PracSR), Portfolio Initiative Diffusion Practice (Po_PracSR), Program Initiative Diffusion Practice (Pr_PracSR), and Project Initiative Diffusion Practice (P_PracSR)) related to the outcome variable Organisational Performance (OPSR). Furthermore, Amos software is used to check the degree in which Organisational Culture (OCSR) related to Organisational Performance (OPSR).

Then, Amos is used to check the huge mediation role of Organisational Culture (OCSR) between the independent variables (Strategy Initiative Diffusion Practice (S_PracSR), Portfolio Initiative Diffusion Practice (Po_PracSR), Program Initiative Diffusion Practice (Pr_PracSR), Project Initiative Diffusion Practice (P_PracSR)), and the dependent variable Organisational Performance (OPSR).

The opening stage of modelling the association is to test whether performance can be predicted from the strategy diffusion (top-down). The tested initial model is shown in table 1 and figure 8. The results from the testing show that strategy diffusion (top-down) is not a good predictor of the organisational performance (RMSEA = 0.689). Precisely, the results also indicate that S_PracSR and P_PracSR only have significant predictors of the organisational performance with $p<0.001$, however the other two predictors Po_PracSR and Pr_PracSR also can be accepted with $p<0.5$. Thus, this initial model supports and accepts all the hypotheses: **H1a, H2a, H3a and H4a.**

Table 1: Regression Weights: (Group Number 1 - Default Model)

Outcome	Path	Predictor	Standardized Estimates (Beta)	S.E.	C.R.	P
OP_SR	<---	S_Prac_SR	,249	,061	4,063	***
OP_SR	<---	P_Prac_SR	,294	,048	6,077	***
OP_SR	<---	Po_Prac_SR	,051	,075	,680	,497
OP_SR	<---	Pr_Prac_SR	,096	,065	1,468	,142

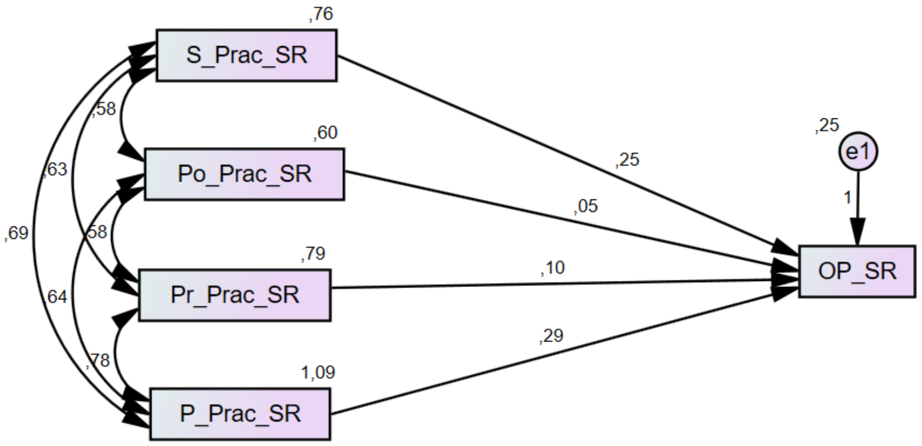

Figure 8: Research Initial Model With Standardized Estimates

The next analysis is to introduce OC_{SR} as mediator, to check whether it will have an influence on the associations between organisational performance and strategy diffusion (top-down). Thus, in order to make sure of these assessments, model 1 has been created. See the graphical model figure 9, for more explanation of model 1 with the mediation of Organisational Culture (OC_{SR}) role. The graphical model illustrates the Standardised Estimates, and all estimated path coefficients were statistically positive.

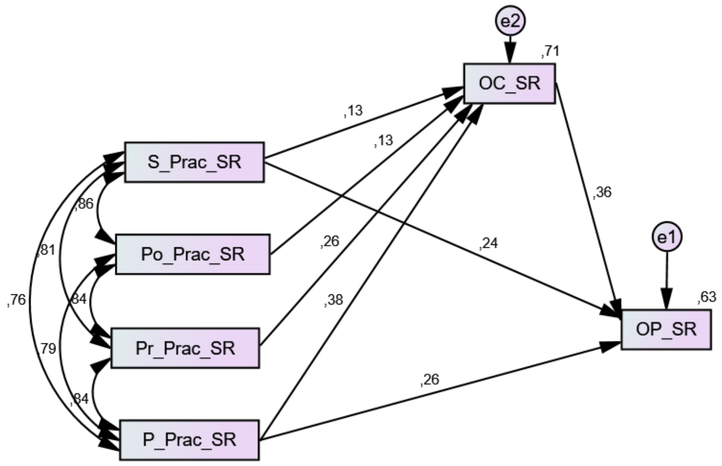

Figure 9: Research (Model 1) With Standardised Estimates With OCSR Mediation Role

Model fit analysis summary (model 1) in case of the presence of OCSR mediation role

It is very essential to evaluate the model fitness before starting the data analysis of the model. The model fitness includes the following (as shown in table 2):

- The absolute fit indicator CMIN = 0.056 at ($p < 0.972$) an insignificant level,
- And the normal CMIN/DF = 0.028 is an excellent fit.

In addition, TLI = 1.006 indicates an excellent fit, CFI = 1.000 indicates an excellent fit, and RMSEA = 0.000 is less than 0.06 which is an excellent value. Overall, the theoretical model fit is considered to be in an excellent fit range, based on Cut-off Criteria table 3.

Table 2: Model Fitness Analysis Summary (Model 1)

Measures of Fit	Estimate Value	Indications of Model Fit	Interpretation
Chi-Square (CMIN)	0.056	-	-
DF	2	-	-
P	0.972	A value is greater than 0.05 indicates a close fit.	Acceptable fit
CMIN/DF	0.028	A value less than 1 indicates an over-fit of the model.	Acceptable fit
GFI	1.000	A value close to 1 indicates a perfect fit.	Excellent fit
TLI	1.006	A value greater than 1 indicates an over-fit of the model.	Excellent fit
CFI	1.000	A value close to 1 indicates a very good fit.	Excellent fit
NFI	1.000	A value close to 1 indicates a very good fit.	Excellent fit
RMSEA	0.000	A value of 0.0 indicates the exact fit of the model.	Excellent fit

Table 3: Cut-Off Criteria

Measure	Terrible	Acceptable	Excellent
CMIN/DF	>5	>3	>1
CFI	<0.90	<0.95	>0.95
SRMR	>0.10	>0.08	<0.08
RMSEA	>0.08	>0.06	<0.06
P Close	<0.01	<0.05	>0.05

Source: (Hu & Bentler 1999)

Global Framework's Hypotheses (Model 2) Testing Results

For further examination for global framework's hypothesis testing, a final and revised model (Model 2) has been constructed with additional paths that are linked to the company performance data reporting part, which basically representing the research proposed bottom-up method. Those additional paths are the independent mediation variables (Strategy Performance (S_PerfSR), Portfolio Performance (Po_PerfSR), Program Performance (Pr_PerfSR), and Project Performance (P_PerfSR)) that also could influence the organisational performance.

Therefore, Amos software with Maximum likelihood parameter estimation is used to assess in (Model 2) again the updated degree to which the predictor variables (Strategy Initiative Diffusion Practice (S_PracSR), Portfolio Initiative Diffusion Practice (Po_PracSR), Program Diffusion Practice (Pr_PracSR), and Project Initiative Diffusion Practice (P_PracSR)) are related to the outcome variable Organisational Performance (OPSR). Furthermore, Amos software is used to check the updated degree to which Organisational Culture (OCSR) was related to Organisational Performance (OPSR).

Then, Amos is used to check the huge mediation roles of Organisational Culture (OCSR), Strategy Performance (S_PerfSR), Portfolio Performance (Po_PerfSR), Program Performance (Pr_PerfSR), and Project Performance (P_PerfSR) between the independent predictor variables (Strategy Initiative Diffusion Practice (S_PracSR), Portfolio Initiative Diffusion Practice (Po_PracSR), Program Initiative Diffusion Practice (Pr_PracSR), and Project Initiative Diffusion Practice (P_PracSR)). The dependent variable Organisational Performance (OPSR) connections. See figure 10, the final and revised model (model 2) with the mediation of Organisational Culture (OCSR), Strategy Performance (S_PerfSR), Portfolio Performance (Po_PerfSR), Program Performance (Pr_PerfSR), and Project Performance (P_PerfSR). The graphical model below is illustrated with Standardised Estimates, and all estimated paths coefficients are statistically positive as seen.

The absolute fit indicator CMIN = 65.209 ($p < 0.001$) has reached a significant level, and the normal CMIN/DF = 3.260 is within the reasonable range of acceptance. In addition, TLI = 0.977 indicates a very good fit, CFI = 0.990 indicates a very good fit, and RMSEA = 0.078 is a barely acceptable standard value. Overall, the theoretical model fit is considered to be in the acceptable range. See table 4.

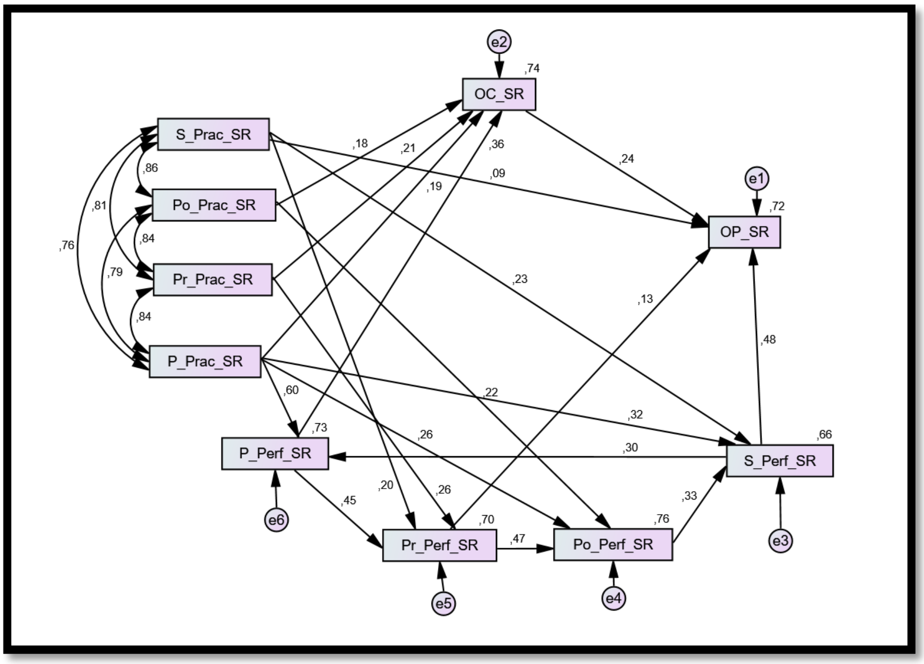

Figure 10: Research Final Revised Model (Model 2) With Standardized Estimates With OCSR And Performance Mediation Variables Roles

Table 4: Final Revised Model Fit Analysis Summary (Model 2)

Measures of Fit	Estimate Value	Indications of Model Fit	Interpretation
Chi-Square (CMIN)	65.209	-	-
DF	20	-	-
P	0.000	A value is less than 0.01 indicates a Terrible fit.	Excellent fit
CMIN/DF	3.260	As beginning to be reasonable.	Acceptable fit
GFI	0.967	A value close to 1 indicates a perfect fit.	Excellent fit
TLI	0.977	A value close to 1 indicates a very good fit.	Excellent fit
CFI	0.999	A value close to 1 indicates a very good fit.	Excellent fit
NFI	0.985	A value close to 1 indicates a very good fit.	Excellent fit
RMSEA	0.078	A value of about 0.08 or less indicates a reasonable error of Approximation.	Acceptable fit

Results of SEM

Path Analysis Results In (Model 1)

The standardised regression weights are used since they allow the researcher to compare directly the relative effect of each independent variable on the dependent variable. Table 5 presents the standardised regression estimates allowing us to examine the direct association between the study constructs. It is noted that the level of significance is based on the critical ratio (CR) of the regression estimate, Where all CR values are greater than or equate to 2.58, indicating a 99 percent level of significance, except for the paths amongst (S_Prac$_{SR}$ and OC$_{SR}$) and amongst (Po_Prac$_{SR}$ and OC$_{SR}$).

Table 5: (Model 1) Regression Weights: (Group Number 1 - Default Model)

Path			Standardized Estimates	S.E.	C.R.	P
Outcome		Predictor	(Beta)			
OC_SR	<---	S_Prac_SR	,127	,060	2,216	,027
OC_SR	<---	Po_Prac_SR	,131	,074	2,092	,036
OC_SR	<---	Pr_Prac_SR	,261	,064	4,205	***
OC_SR	<---	P_Prac_SR	,383	,048	7,034	***
OP_SR	**<---**	**S_Prac_SR**	**,238**	**,047**	**4,614**	***
OP_SR	**<---**	**P_Prac_SR**	**,262**	**,044**	**4,519**	***
OP_SR	<---	OC_SR	,361	,048	6,401	***

Significance of Correlations: *** p < 0.001, ** p < 0.01, * p < 0.05, p < 0.1

Summary Of (Top-Down) Hypotheses Testing Results (Model 1)

In summary, Strategy Initiatives Diffusion Practice (S_PracSR) and Project Initiative Diffusion Practice (P_Prac$_{SR}$) will all lead to an increase in the Organisational Performance (OP$_{SR}$) in the public project-based organisations directly.

The influence of OCSR as a mediator on the relationships between the predictor variables (S_PracSR, Po_Prac_{SR}, Pr_Prac_{SR}, and P_Prac_{SR}) and the outcome variable Organisational Performance (OP_{SR}) has shown that the path coefficients of Program Initiative Diffusion Practice (Pr_PracSR) and Project Initiative Diffusion Practice (P_Prac_{SR}) are statistically significant at $p < 0.001$ level and associated positively. However, the paths between Strategy Initiative Diffusion Practice (S_Prac_{SR}) and Organisational Culture (OC_{SR}), as well as between Portfolio Initiative Diffusion Practice (Po_Prac_{SR}) and Organisational Culture (OC_{SR}), are statistically positive and significant at $P<0.05$ level. The path which is between Organisational Culture (OC_{SR}) and organisational performance (OP_{SR}) is statistically significant at $p < 0.001$ level as below table, which means that the organisational culture mediation role are more effective for Portfolio Initiatives Diffusion Practice (Po_PracSR), Program Initiative Diffusion Practice (Pr_PracSR) and Project Initiative Diffusion Practice (P_Prac_{SR}) on Organisational Performance (OPSR).

Based on the Beta coefficient calculation shown in table 6 below, and as per the total, direct and indirect effects matrix, the best ways to emerging the organisation performance within project-based organisations are through:

The direct influence of strategy diffusion practice and project diffusion practice.
The indirect influences of portfolio diffusion practice and program diffusion practice, which is caused by the mediation effect of organisational performance.

Table 6: (Model 1) Standardised Specific Indirect Path Effects Calculation

Path	Direct Effect (X→Y)	Indirect Effect (X→ M → Y)	Result
S_Prac_{SR} → OC_{SR} → OP_{SR}	0.24***	0.13*0.36 = 0.0468*	Partial Mediation
Po_Prac_{SR} → OC_{SR} → OP_{SR}	0	0.13*0.36 = 0.0468*	Full Mediation
Pr_Prac_{SR} → OC_{SR} → OP_{SR}	0	0.26*0.36 = 0.0936***	Full Mediation
P_Prac_{SR} → OC_{SR} → OP_{SR}	0.26***	0.38*0.36 = 0.1368***	Partial Mediation

*****p<0.001; **p<0.01; *p<0.05; p<0.1; ns= "not significant"**

Although, all the diffusion practices show a strong impact on increasing the organisational performance when carrying out the mediation of organisational culture, the organisational culture plays a huge role in mediating between all the diffusion practices at the Strategy, Portfolio, Project, and Project levels and the organisational performance.

Moreover, it is confirmed from the associations' findings through positive and significant correlations at 0.001 level found for all the diffusion practice independent variables (Strategy, Portfolio, Project, and Project), leading to an important conclusion that the strategy initiatives diffusion using top-down approach of this research is supported and endorsed. Therefore, the strategy diffusion occurs from the strategy to portfolio, then to program, and finally to project levels within project-based organisations.

Path Analysis Results In (Model 2)

AMOS software is used to assess again the degree to which (Strategy Initiative Diffusion Practice (S_PracSR), Portfolio Initiative Diffusion Practice (Po_PracSR), Program Initiative Diffusion Practice (Pr_PracSR), and Project Initiative Diffusion Practice (P_PracSR)) variables, and Strategy Performance (S_PerfSR), Portfolio Performance (Po_PerfSR), Program Performance (Pr_PerfSR), and Project Performance (P_PerfSR)) variables are related to Organisational Performance (OPSR) and Organisational Culture (OCSR). Furthermore, the degree to which Organisational Culture (OCSR) relating to Organisational Performance (OPSR) is also assessed again using AMOS software.

Table 7 below presents the standardised regression estimates for Model 2 and has allowed us to examine the direct association between the study constructs. The researcher notes that the level of significance is based on the critical ratio (CR) of the regression estimate. Thus, all CR values are greater than or equate to 2.58, except for the path between S_PracSR and OPSR which is = 1.942.

The Global Framework's Hypotheses (Model 2) Testing Results Summary

In summary, from Model 2 the Strategy Initiatives Diffusion Practice (P_PracSR) will lead directly to an increase in the Organisational Performance (OPSR) in the public project-based organisations. But it does not lead to increasing the Organisational Performance (OPSR) through using the influence of the Organisational Culture (OCSR).

Table 7: (Model 2) Regression Weights: (Group Number 1 - Default Model)

Path			Standardized Estimates (Beta)	S.E.	C.R.	P
Outcome		**Predictor**				
Po_Perf_SR	<---	Po_Prac_SR	,222	,038	5,178	***
Pr_Perf_SR	<---	Pr_Prac_SR	,258	,033	4,910	***
P_Perf_SR	<---	P_Prac_SR	,599	,031	14,536	***
S_Perf_SR	<---	P_Prac_SR	,316	,029	5,766	***
Po_Perf_SR	<---	P_Prac_SR	,257	,030	5,587	***
Pr_Perf_SR	<---	S_Prac_SR	,204	,032	4,141	***
S_Perf_SR	<---	S_Prac_SR	,233	,031	4,762	***
OC_SR	<---	Po_Prac_SR	,184	,059	3,627	***
OC_SR	<---	Pr_Prac_SR	,211	,059	3,688	***
OC_SR	<---	P_Prac_SR	,192	,054	3,092	,002**
OC_SR	<---	P_Perf_SR	,355	,055	7,568	***
OP_SR	<---	S_Prac_SR	,087	,040	1,942	,052
OP_SR	<---	OC_SR	,240	,038	5,458	***
OP_SR	<---	S_Perf_SR	,484	,063	10,879	***
OP_SR	<---	Pr_Perf_SR	,133	,063	2,917	,004**
Po_Perf_SR	<---	Pr_Perf_SR	,469	,049	11,799	***
Pr_Perf_SR	<---	P_Perf_SR	,454	,030	10,835	***
S_Perf_SR	<---	Po_Perf_SR	,327	,042	6,231	***
P_Perf_SR	<---	S_Perf_SR	,300	,059	7,202	***

Significance of Correlations: *** p < 0.001, ** p < 0.01, * p < 0.05, p < 0.1

In Model 2 the influence of Organisational Culture (OCSR) as a mediator on the relationships between the predictor variables (Po_PracSR, Pr_PracSR, and P_PracSR) and the outcome variable Organisational Performance (OPSR) has shown very good path coefficients being statistically significant at p < 0.001 and p < 0.01 levels and associated positively. This means that the organisational culture mediation role is effective for Portfolio Initiatives Diffusion Practice (Po_PracSR), Program Initiative Diffusion Practice (Pr_PracSR) and Project Initiative Diffusion Practice (P_PracSR) on Organisational Performance (OPSR).

Furthermore, in Model 2 the influence of S_PerfSR, Po_PerfSR, Pr_PerfSR, and P_PerfSR as a mediator on the relationships between the predictor variables (S_PracSR, Po_PracSR, Pr_PracSR, and P_PracSR) and the outcome variable Organisational Performance (OPSR) has shown very good path coefficients being statistically significant at p < 0.001 level and only on path as p < 0.1 level and associated positively. This means that the performance variables as a mediation role is effective for Strategy Initiatives Diffusion Practice (S_PracSR), Portfolio Initiatives Diffusion Practice (Po_PracSR), Program Initiative Diffusion Practice (Pr_PracSR) and Project Initiative Diffusion Practice (P_PracSR) on Organisational Performance (OPSR), which supports the hypotheses H1b, H2b, H3b and H4b.

From Model 1, the huge influence of the predictor variables (S_PracSR, Po_PracSR, Pr_PracSR), and P_PracSR on the outcome variable OPSR is tested, but only S_PracSR and P_PracSR has statistically positive and significant direct effect, which supports the hypotheses H1a and H4a, but not the hypotheses H2a and H3a.

In addition, from Model 1 and Model 2, the huge influence of the mediation role for organisational culture is very obvious in the relations between all the predictor variables (S_PracSR, Po_PracSR, Pr_PracSR), and P_PracSR and the outcome variable OPSR, as they have statistically positive and significant effects, which supports the hypotheses H1c, H2c, H3c and H4c.

When testing the effect of (S_PerfSR, Po_PerfSR, Pr_PerfSR), and P_PerfSR variables amongst each other from Model 1 and Model 2, there is statistically significant and positive effect at 0.001 level and one effect only at 0.052 level found in the path coefficient between Pr_PerfSR and P_PerfSR; Po_PerfSR and Pr_PerfSR; S_PerfSR and Po_PerfSR; and between S_PerfSR and P_PerfSR, which supports the hypotheses H6a, H6b and H6c. Thus, this leads to increasing of Strategy Performance (S_PerfSR), and/or Portfolio Performance (Po_PerfSR), and/or Program Performance (Pr_PerfSR), and/or Project Performance (P_PerfSR) will lead to increasing the growth of OPSR in the public project-based organisations.

Moreover, it is confirmed from the correlations results a positive and significant associations at $p < 0.001$ level found for all the diffusion practice independent variables (Strategy, Portfolio, Project, and Project), leading to an important conclusion that the strategy initiatives diffusion using top-down approach of this research is supported. Therefore, the strategy initiatives spread from strategy to portfolio, then to program, and finally to project levels within project-based organisations, which totally support the hypotheses: H5a, H5b, and H5c.

As per the Beta coefficient and the total, direct and indirect effects matrix in Model 1 the best ways to emerging the organisation performance within project-based organisations are through:

- The direct influence of strategy diffusion practice and project diffusion practice as (Model 1).
- The indirect influences of strategy diffusion practice, portfolio diffusion practice, program diffusion practice, and project diffusion practice, which are caused by the mediation effect of organisational culture as (Model 1).

However, according to the Beta coefficient and the total, direct and indirect effects matrix in Model 2, the best ways to emerging the organisation performance within project based organisations are through:

- The direct influence of strategy diffusion practice only as Model 2.
- The indirect influences of portfolio diffusion practice, program diffusion practice, and project diffusion practice, which are caused by the mediation effect of organisational culture as Model 2.
- The indirect influences of strategy diffusion practice, portfolio diffusion practice, program diffusion practice, and project diffusion practice, which are caused by the

mediation effect of the strategy performance, portfolio performance, program performance, and project performance as Model 2.

In public project-based companies, embedding OCSR as a causal effect at the organisation structural levels of Strategy, Portfolio, Program, and Project will lead to increase the development of organisation performance. Therefore, the organisational culture plays a huge role in mediating between all the diffusion practices at the Strategy, Portfolio, Project, and Project levels and the organisational performance. Furthermore, embedding S_PerfSR, Po_PerfSR, Pr_PerfSR and P_PerfSR as a causal effect at the organisation structural levels of Strategy, Portfolio, Program, and Project levels, will also lead to increasing the development of organisation performance. Therefore, the performance management for each level (Strategy, Portfolio, Program, and Project) plays a huge role in mediating between all the diffusion practices at the Strategy, Portfolio, Project, and Project levels and the organisational performance.

Similar closing indicates the necessity of having the OCSR as a mediator of strategy diffusion practices that spreads the top-down strategic initiatives and decision-making from the company till the Project level and then bottom-up learning and reporting the performance data from the project to the organisation.

Conclusion

The main findings of the study that there are clear significant relationships between the independent variables, mediator's variable with dependent variable, and the findings approved that the proposed framework is workable and can act as the basis of the strategy diffusion within PBOs.

The research questions led to the development several hypotheses that were: (18 Nos) tested and (14 Nos) accepted, in which (4 Nos) only conditionally accepted, where:

- 3 (direct) relationships between for strategy diffusion practices at (Portfolio, Program, Project) levels toward (OP) were conditionally accepted; the impact is more effective (indirectly) when there is (an organizational culture) involvement to support the strategy spreading during the implementation of the strategy diffusion (top-down), rather that their direct effects.
- One of the proposed relationship mediated by OC between (S-Pract) at strategy level and (OP), was conditionally accepted supported by study data; as its supported theoretically.
- All (indirect) relationships that mediated by OC or/and Performances are strongly justified by study data and theoretically.
- All relationships (between the levels): top-down & bottom-up indicates that strategy management within PBOs can't stand alone (strongly supported by study data and previous studies).

In sum, the final acceptance of the hypotheses and their assignment within the study framework was confirmed the new framework with study data and previous literatures, and the mediations variables had strong impact on the diffusion processes in order to enhance the organizational performance within PBOs.

The study framework proofed to be appropriate as a scaffolding on which to build the strategy diffusion culture within PBOs. Thus, this study will develop a new practical robust platform (model) that can diffuse successfully the organisational strategy using the theory of Rogers innovation diffusion theory via practicing all the diffusion decision process stages through utilising the top-down method to each project-based organisational levels at strategy, portfolio, program and project levels and report back all the needed performance via applying the bottom-up approach from each of these levels. This is done in order to establish a proper decision-making bases and for competitive advances as indicated by Clegg et al. (2018).

As recommendation, the study new conceptual model (captures at once the bidirectional strategy diffusion top-down method and performance reporting bottom-up method with Rogers diffusion concept within project-based companies), so it is a promising framework for additional investigations.

The new model introduced novel interrelations paths beyond the scope of this research:

- Path P-Prac → P-Perf → OC → OP, means the influence of organizational culture can be extended also on all PBOs levels' performances also when reporting the data, not only on the PBOs levels' practices.
- Paths like: S-Prac → Pr-Perf → OP and P-Prac → Po-Perf or S-Perf → OP, means the impact of one level practices can be seen from to other level performance.
- Multi-Mediation effects within the new model, means for each level practice can be reported to op at any of above levels at any time.

These unforeseen paths have widened the horizon to conduct further investigations and more findings with more hypotheses can be proposed for the same constructed model.

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6th Langkawi International Multidisciplinary Conference 2023 (6th LIMC 2023)
eISSN 2976-3223
9th – 10th September 2023
Bayview Hotel, Langkawi, Malaysia

EFFECTS OF DIFFERENT COOLANT MEDIA ON THE COOLING PERFORMANCE OF INJECTION MOLD PRODUCT

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Abstract: *The injection molding process involves heating a thermoplastic polymer above its melting point and injecting it into a mold. The polymer then cools and solidifies to form the final part. The process consists of four stages: clamping, injection, cooling, and ejection. Among these stages, cooling plays a crucial role as it requires an efficient cooling system to transfer heat from the mold at a consistent rate, ensuring high-quality final products. This project specifically focuses on investigating the impact of different cooling media used in the cooling system for the mold. The aims are to compare the effectiveness of various cooling media on the cooling performance of the injection molded product. Different types of coolants, including water, oil, or other solution mixtures, have been considered for their ability to reduce or regulate the temperature of the system. The CAD modelling were prepared for the case study, together with predesigned conformal cooling channel and gating system. After conducting the simulation analysis, water emerged as the most effective coolant, demonstrating superior results compared to other coolant options. The results also demonstrate the possibility of using an alternative coolant that offer comparable cooling performance.*

Keywords: *Injection Molding; Cooling System; Cooling Media; Cooling Performance.*

Introduction

The injection molding process necessitates the use of an injection molding machine, raw plastic material, and a mold. The thermoplastic polymer is heated above its melting point in the injection molding machine, resulting in the conversion of the solid polymer to a molten fluid with a relatively low viscosity, and then injected into the mold, where it cools and solidifies into the final part. In injection molding, cooling is the majority part of the production cycle. The cooling phase of the production process accounts for around 60% of the cycle and lowering it by a modest amount will help the production processes to create more products with much less time (Poischbeg, 2019). A well-designed cooling system can significantly reduce molding cycle time, increase injection production rate, and lower costs. This includes the type of cooling channel that will be used and their design such as the size and pitch depending on the type of the mold material. Improper cooling system design will increase cooling time, intensify warping deformation of plastic products, and leads to changes in the shrinkage rate as well as the temperature of the final product (Wang & Cai, 2021)

A suitable cooling media should be focused to guarantee that a minimum cooling time is achieved. Therefore, the various types of coolants that may be used to lower or control a system's temperature need to be considered, including water, oil, and other solution mixtures. Water cooling has the benefit of quickly removing a considerable amount of heat since water has a high heat capacity and promptly turns to steam when it enters the heater coils. Since most heat-transfer oils have less than half the heat capacity of water, they are less severe cooling medium than water. More significantly, these cooling oils do not evaporate at processing temperatures, decreasing instability and energy losses (Frankland, 2012).

In this study, CAD modelling and simulation analysis were employed to investigate systems and strategies, providing an alternative to using real systems, which can be time-consuming and costly. CATIA was utilized to design a 3D model of the product, and the gating system and selected cooling system were designed in Moldflow Adviser prior to running the simulation. During the simulation analysis, different coolant media were employed to analyze their effects on the cooling performance of the injection mold product. The cooling system played a vital role in achieving optimal process cycles for injection molding. By applying cooling mediums such as water, oils, and other solution mixtures, the cooling efficiency could be effectively improved. This study aimed to explore the cooling performance of various coolant media through simulation analysis, identifying which medium offered faster cooling rates, thus enabling shorter cycle times and increased production efficiency. The findings from this study contributed to process optimization and improved productivity.

Literature Review

Injection molding is the most crucial process for manufacturing plastic parts. It is ideal for mass production because raw materials can be transformed into a molded product in a single operation (Hassan, Regnier, Bot, & Defaye, 2009). The six main phases of injection molding include clamping, injection, dwelling, cooling, mold opening, and ejection, with each step influencing the cycle time and process variables. The primary objective of injection molding is to produce parts that meet quality standards, typically characterized by mechanical performance, dimensional accuracy, and appearance (Fernandes, Pontes, Viana, & Gaspar-Cunha, 2016).

Cooling plays a pivotal role in the injection molding process, constituting nearly 60% of the total cycle time (Vashisht & Kapila, 2014). Its significance extends beyond mere cycle time reduction; it also exerts a substantial influence on both productivity and the ultimate quality of the end product. The cooling system must possess the capability to efficiently dissipate heat at a rate sufficient for the plastic part to be ejected without incurring distortion (Hassan et al., 2009).

Moreover, research efforts have delved into scrutinizing the impacts of various coolant media on the cooling efficiency and product quality of injection molds. The influence of cooling temperature and injection time on product quality concerning the injection molding machine has been analyzed through the finite element method (Pratama, Aminnudin, Pradana & Afifah, 2021). The researchers discerned that the coolant's temperature significantly affects product quality.

In a study by Hisham and Saman (2022), diverse cooling channel designs for the mold were evaluated. The conformal cooling channel design emerged as the most favourable option in terms of ejection time, average part temperature, volumetric shrinkage, and deformation. An illustration of the conformal cooling channel design is presented in Figure 1.

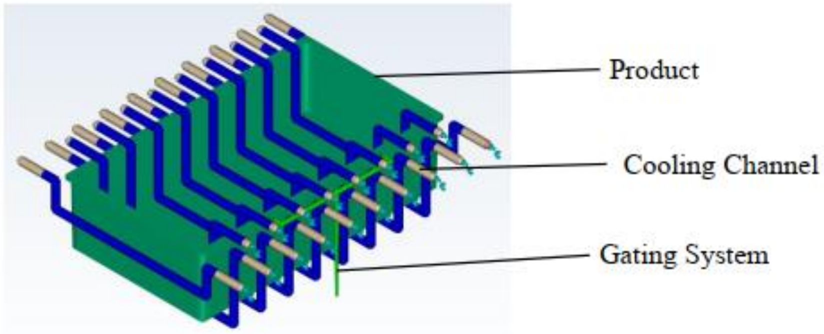

Figure 1: Conformal Cooling Channel Design

Molds can now be easily designed using numerical and theoretical methods due to the advancements in computer technology. Computational analysis software can also predict or directly simulate the results. With many such packaged software available in the market, the process can easily simulate and test various parameters and designs. All this software contributes to increased cost effectiveness, efficiency, and product quality. Vashisht & Kapila (2014) evaluated various coolants used in the conventional cooling channel and compare the results. Other researchers have used computer simulation software to achieve product quality in injection molding while considering variations in coolants to find the optimal values, as shown by Pratama et al. (2021).

Generally, in the plastic injection industry, water, oil, and ethyl glycol are commonly used as cooling media. Water is often employed for mold cooling, but its primary disadvantage lies in its tendency to induce metal corrosion (Vashisht & Kapila, 2014). Therefore, a mixture of water and ethyl glycol is also categorized as one of the best fluid combinations. Water provides cooling throughout the mold, while ethyl glycol prevents corrosion in the cooling channels at the same time.

Methodology

In this study, several coolant media have been identified and selected to be tested in order to find the best coolant for the injection molding process. Two types of software will be used to prepare the 3D model of the product by using CATIA and simulation analysis work will be proceeded using Moldflow Adviser software. In this simulation, the gating system and the cooling channel have been added. The properties of coolants to access the cooling performance such as density (g/cm3), specific heat (J/kg°C), and thermal conductivity (W/m°C) of the coolants also have been defined. The data will be collected to compare the effectiveness of different cooling media for the selected case study.

Case Study and Modelling

In this project, computer software was used to create detailed 3D models of physical objects. The case study that has been selected is plastic tray. The model of the plastic tray is as shown in Figure 2.

Table 1 shows the material, dimension and the properties of the product that has been designed in CATIA. The product design is taken into consideration for injection molding design specifications such as the thickness, radiusing, draft angle and the shrinkage allowance.

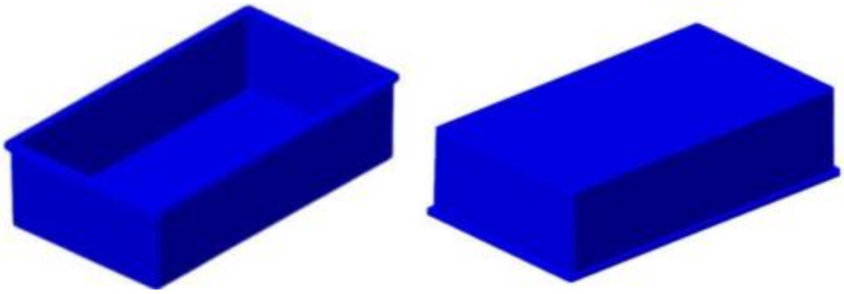

Figure 2: 3D Model of the Product

Table 1: Properties of the Product and Their Descriptions

Properties	Description
Material	Acrylonitrile Butadiene Styrene (ABS)
Overall Size	350mm x 200mm x 90mm
Wall Thickness	5mm
Radius	3mm
Draft Angle	1° draft angle per side
Shrinkage	0.9%
Melt Temperature	230℃
Mold Temperature	60℃

ABS is a commonly used thermoplastic material. It is amorphous, meaning it lacks a true melting point, but it exhibits a glass transition temperature around 105℃ (Parmar & Sharma, 2017). ABS is valued for its excellent impact resistance and toughness, which are key mechanical properties. Compared to other thermoplastics, ABS has relatively good heat resistance, allowing it to withstand moderate temperatures without significant deformation or degradation.

Design of Cooling Channel

Gating system and cooling channel have been designed by using Moldflow Adviser based on the product dimension and the material chosen. The selected cooling channel for this study is parallel conformal cooling channel with additive cooling lines. The diameter of the cooling channel used is 10mm with the channel distance (pitch) of 40mm. the depth of the cooling channel is 10mm. Coolant parameters for the cooling simulation specified such as flow rate is 20 lit/min and coolant inlet temperature is 25℃.

The sprue gate is the chosen gating system, with two injection points strategically positioned on the product's side to minimize the visibility of resulting blemishes. The gating system and the cooling channel placement is as shown in the Figure 1.

Coolants and Its Properties

Table 2 displays various coolants and their properties used in the simulation process, which directly impacts cooling performance. Eight different coolants are introduced into the cooling inlets, each undergoing a series of trials.

To facilitate the simulation, a suitable cooling channel is designed for the product. The simulation encompasses a range of selected coolants, including pure water, oil, pure ethylene glycol, a mixture of 10% ethylene glycol and 90% water, a mixture of 50% ethylene glycol and 50% water, Chevron Coolanol 25, a mixture of 25% Drowfrost fluid and 75% glycol, and a mixture of 50% Drowfrost fluid and 50% glycol. Subsequently, the results will be compared based on various aspects of the product's cooling performance, such as cooling time, ejection time, part temperature, and cooling quality.

Traditionally, ethylene glycol has been the preferred choice for cooling in plastic injection molding, offering both efficient cooling and freeze protection. Its exceptional heat transfer properties enable it to endure lower temperatures without freezing, rendering it suitable for cold weather conditions. Chevron Coolanol, developed by Chevron Lubricants, is a branded engine coolant explicitly engineered to provide efficient cooling and heat transfer in diverse cooling systems. It is available in a pre-diluted, ready-to-use form as both a coolant and antifreeze. This coolant was selected for the simulation to evaluate its effectiveness in plastic injection molding.

Drowfrost fluid is a heat transfer fluid based on propylene glycol, commonly employed in industrial applications. It offers excellent freeze protection, operating effectively below -60ºF and providing burst protection below -100ºF. The fluid contains specialized corrosion inhibitors, which prevent HVAC pipes from corroding without causing fouling

No	Coolant	Coolant Density (g/cm3)	Specific Heat (J/kg°C)	Thermal Conductivity (W/m°C)
1	Oil	0.836	2250	0.136
2	Water (Pure)	0.988	4180	0.643
3	Ethylene Glycol 10% + Water 90%	1.011	4060	0.576
4	Ethylene Glycol 50% + Water 50%	1.064	3336	0.413
5	Chevron Coolanol 25	0.875	2008	0.128
6	Drowfrost Fluid 25% + Glycol 75%	1.034	3131	0.274
7	Drowfrost Fluid 50% + Glycol 50%	1.026	3629	0.368
8	Ethylene Glycol (Pure)	1.117	2382	0.249

Table 2: Different Coolant with their Properties

Results and Discussion

The simulation of the injection moulding process with cooling channels was conducted using eight different types of coolant. In this simulation, four variants of cooling performance were assessed, including cooling quality, cooling time variance, part temperature, and the time it takes to reach ejection temperature.

The cooling quality result is the percentage of the quality product in the cooling process which the cooling has been distributed uniformly to the molded part. The result shows where heat tends to stay in a part because of existing cooling circuits, part shape and thickness. The cooling time variance in injection molding pertains to the distinction between the time required for polymer solidification in a specific section of the part and the average solidification time across the entire part.

On the other hand, the part temperature results relate to the forecasted temperature distribution within the molded component during its cooling and solidification phase. This result displays the mean temperature at the boundary of the part, situated on the part's side of the part/mold interface, throughout the entire molding cycle. Additionally, the time it takes to reach the ejection temperature signifies the elapsed time from the beginning of the filling phase to reach the temperature necessary for ejection. This interval ensures that the part has undergone sufficient cooling and stabilization to preserve its form and quality during the ejection process.

Figure 3 displays four different outcomes assessing the performance of water as a coolant. The cooling quality results are visually represented, showcasing a part with distinct regions in green, yellow, and red. The green sections signify efficient cooling, while the yellow areas represent moderate cooling, and the red portions indicate inadequate cooling. The graphical representation highlights that most of the part receives effective cooling. However, there are regions along the inner right and left walls where cooling appears less effective, likely due to an improper arrangement of the cooling channel system in those areas.

The outcome from the cooling time variance analysis reveals that four vertical edges of the part take a longer time to solidify. These specific areas are displayed in shades of red and yellow, in contrast to the predominantly blue regions on the part. This discrepancy may be attributed to the increased thickness in these regions and the influence of the cooling channel on the cooling process. Examining the part temperature results, it becomes evident that there are specific hot spot locations on the part. These hot spots are indicated by the red coloration and are notably concentrated at the four internal edges of the part. When assessing the time required to reach ejection temperature, we observe uniform freezing of the part overall. However, it is worth noting that the left and right-side walls exhibit a slightly longer cooling time.

Table 3 provides a summary of the cooling performance of eight different coolant types, showcasing the highest value achieved for each specific coolant performance parameter. This format facilitates a straightforward comparison between the coolant options.

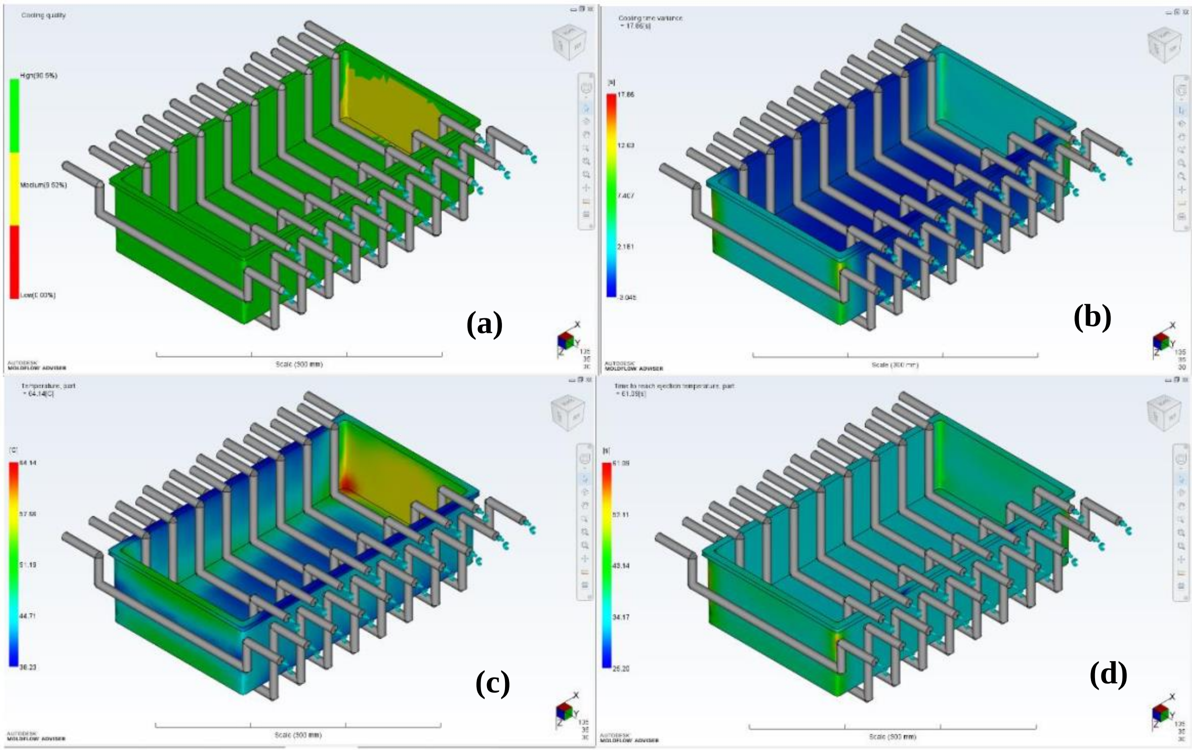

Figure 3: Cooling Performance Results (Water)
(a) Cooling Quality (b) Cooling Time Variance (c) Part Temperature
(d) Time to reach Ejection Temperature

Figure 4 displays the cooling quality results for various coolant media. Water exhibits the highest cooling quality percentage at 90.5%, followed closely by a mixture of Ethylene Glycol 10% + Water 90%, which only differs by 0.1%. A higher percentage in cooling quality signifies that the molded part achieves excellent cooling distribution, ensuring that the final product is formed perfectly and meets the required specifications. In contrast, pure ethylene glycol has the lowest cooling quality percentage at 82%. This lower percentage implies that the molded part requires a longer time to complete the injection molding cycle, potentially leading to issues such as warpage and product deformities.

Table 3: Different Coolant with their Cooling Performance

No	Coolant	Ref.	Cooling Quality (%)	Cooling Time (s)	Part Temperature (°C)	Time to Reach Ejection Temperature (s)
1	Oil	Oil	90.1	18.0	61.7	65.8
2	Water (Pure)	Water	90.5	17.9	61.1	64.1
3	Ethylene Glycol 10% + Water 90%	Glycol 10%	90.4	17.9	61.3	64.5
4	Ethylene Glycol 50% + Water 50%	Glycol 50%	89.9	18.5	62.7	67.4
5	Chevron Coolanol 25	Chevron 25	88.4	21.0	69.5	78.1
6	Drowfrost Fluid 25% + Glycol 75%	DF25-Glycol75	87.9	21.8	71.8	81.0
7	Drowfrost Fluid 50% + Glycol 50%	DF25-Glycol 75	89.6	18.9	63.9	69.5
8	Ethylene Glycol (Pure)	Glycol	82.0	88.7	190.0	106.4

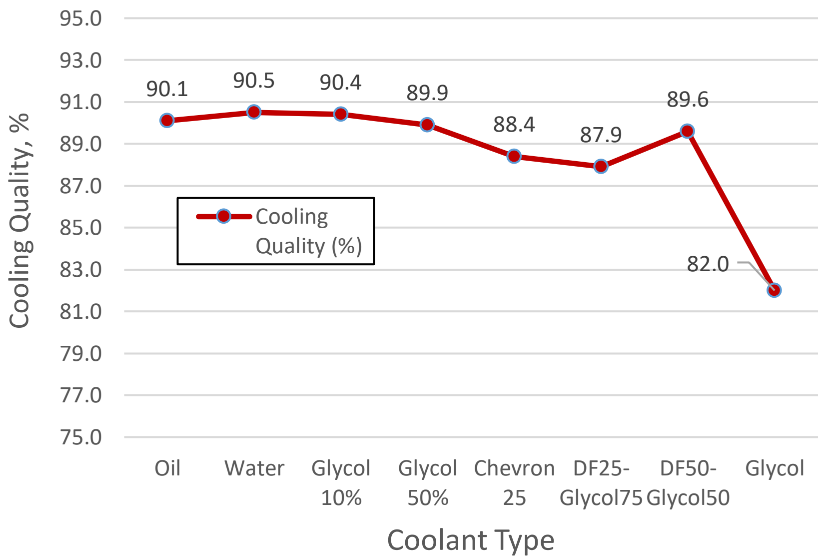

Figure 4: Cooling Quality for Varies Coolant Media

Figure 5 illustrates a comparative graph that examines the variance in cooling times and the time required to reach ejection temperature for eight different coolant types. The results indicate that pure water and a mixture comprising 10% ethylene glycol and 90% water offer the most efficient cooling, resulting in relatively shorter cooling durations. Among these coolant options, the top performers are pure water and the 10% Ethylene Glycol + 90% Water mixture, both demonstrating a commendable cooling time of 17.9 seconds. Furthermore, both pure water and the Ethylene Glycol 10% + Water 90% mixture exhibit minimal differences in the time required to reach ejection temperature, underlining their effectiveness in cooling.

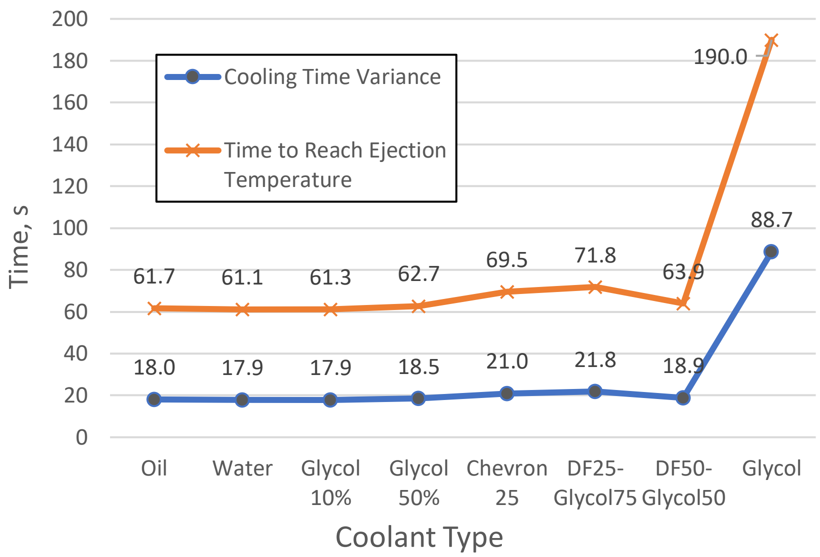

Figure 5: Cooling Time Variance and Time to Reach Ejection Temperature for Varies Coolant Media

Figure 6 presents a comparative graph of part temperatures for eight distinct coolants. Among them, the pure ethylene glycol coolant demonstrates the poorest cooling performance as it exhibits the highest part temperature in comparison to the other tested coolants. Notably, both the chevron coolanol 25 coolant and the Drowfrost Fluid 25% + Glycol 75% coolant show elevated part temperatures when contrasted with water-based coolants. Meanwhile, the Drowfrost Fluid 50% + Glycol 50 mixture displays respectable cooling performance, as depicted in Figure 6, but still registers slightly higher part temperatures than the water-based alternatives.

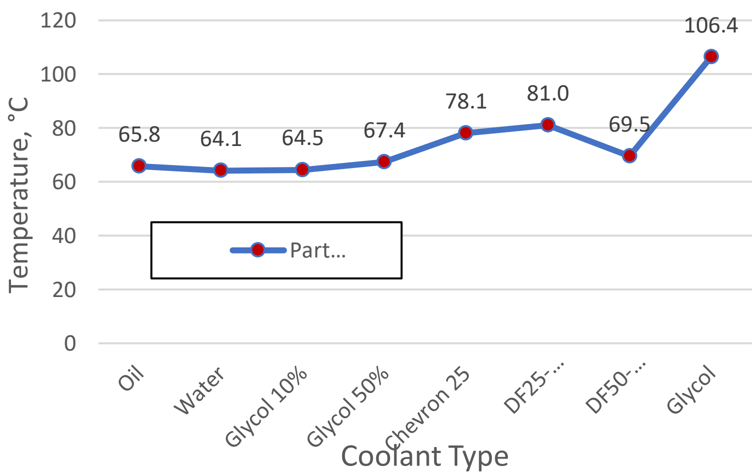

Figure 6: Part Temperature for Varies Coolant Media

The cooling performance of a coolant is determined by its properties, as indicated in Table 2. Through simulation analysis, water has been identified as the optimal coolant due to its highest thermal conductivity. This high thermal conductivity is crucial for efficient heat absorption and transfer from the mold. In addition to the mentioned coolant properties, other criteria that require emphasis include temperature control. Maintaining precise temperature control for the coolant medium is of utmost importance. This ensures consistent cooling and prevents issues such as warping or uneven shrinkage in the molded part.

Additionally, the flow rate of the coolant medium through the cooling channels in the mold also affects heat transfer efficiency. Sufficient flow rate allows the coolant to effectively carry away heat, preventing hot spots and promoting uniform cooling. In order to achieve the best cooling performance, the coolant medium should possess a high heat capacity. This allows it to absorb and store a significant amount of heat without experiencing drastic temperature fluctuations. This property enables the coolant to maintain a stable temperature and sustain the cooling process.

Compatibility with the materials being molded is another important consideration. The coolant medium should not chemically react with the materials or cause any degradation or contamination of the molded parts. Lastly, adherence to environmental regulations and guidelines, particularly regarding disposal or recycling, is crucial for the chosen coolant medium.

In summary, to optimize cooling performance in plastic injection molding, the ideal coolant should possess high thermal conductivity, the ability to maintain a controlled temperature, sufficient flow rate, high heat capacity, compatibility with materials, and compliance with environmental regulations.

Conclusion

In conclusion, this study successfully accomplished its main objective, which was to investigate the cooling efficiency of different coolant media. This exploration aimed to pinpoint the medium that provided faster cooling rates, ultimately leading to reduced cycle times and enhanced production efficiency.

Upon obtaining the results, various parameters related to cooling performance were compared, including the cooling quality of the product, cooling time variance, part temperature, and time required to reach ejection temperature. Since different coolant media exhibit distinct cooling performances, it was necessary to compare their effectiveness and identify the optimal coolant for the chosen study.

In summary, the choice of coolant within the cooling system carries significant importance as it directly influences the quality of the manufactured product. In this project, the selection of the optimal coolant was primarily based on its cooling efficiency. Following a thorough simulation analysis, water emerged as the preferred coolant, showcasing superior results when compared to other available coolant options. Furthermore, this research highlights the potential for an alternative coolant to be employed, provided it offers equivalent cooling performance to that of water. The study also illustrates the feasibility of using an alternate coolant that can provide a comparable level of cooling performance to water. For instance, a mixture of water and 10% ethylene glycol yields nearly identical performance while offering corrosion resistance characteristics.

Thus, this study contributes to our understanding of how coolant media affect cooling performance in injection moulding. Its importance is derived from its capacity to optimise cooling techniques, increase product quality, generate efficiency, and cost savings, and promote sustainability. Finally, this study enhances injection moulding practises in cooling process, which benefits manufacturers, customers, and the environment.

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6th Langkawi International Multidisciplinary Conference 2023 (6th LIMC 2023)
eISSN 2976-3223
9th – 10th September 2023
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EFFECTS OF COOLING CHANNEL DIAMETER, DISTANCE, AND PITCH IN PLASTIC INJECTION MOLDING

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Abstract: *A straight drilled or conventional cooling channel is a linear cooling pathway that circulates around the mold cavity to regulate temperature during the plastic injection molding process. The cooling phase accounts for 70% of the plastic injection molding process, making it crucial to design the cooling channel for reducing cycle time while upholding part quality. This study aims to analyze the effects of cooling channel parameters on the product cavity. The parameters under consideration are the cooling channel's diameter, pitch, and distance. Various designs of cooling channels were examined. This study employed a food container lid made from polypropylene (PP) as a product case study. A 3D model of the food container lid and Straight Drilled Cooling Channel (SDCC) was created using CATIA V5, and these models were subsequently imported into Autodesk Moldflow Insight for simulation analysis. Four results were obtained from the simulation analysis, namely time to reach ejection temperature, average temperature, volumetric shrinkage, and deflection. The results indicate that increasing the diameter and pitch of cooling channels leads to a decrease in the average part temperature and the time required to reach ejection temperature. Conversely, increasing the distance between cooling channels results in an increase in the average part temperature and the time required to reach ejection temperature.*

Keywords: *Injection Molding; Cooling System; Cooling Media; Cooling Performance.*

Introduction

Plastic injection molding, an innovative manufacturing method, is extensively employed in the production of plastic products. Raw materials, such as plastic pellets, may need to be heated and melted before they are injected into the mold [1]. The process of injection molding is analogous to administering injections with syringes. Injection molding is a method suitable for mass production, even with complex designs. Thanks to this approach, it is now possible to manufacture on a large scale within a relatively short period of time [2]. The use of a cooling system reduces cycle time, ensuring that the production process proceeds smoothly and in shorter period.

In the injection molding process, there are four phases: filling, packing, cooling, and ejection [3]. Among these phases, cooling is of paramount importance, as it can significantly influence the quality of the final product. The quality of the product is affected by various process parameters, and multiple defects may arise due to poorly designed molds or incorrectly configured machines [4]. Attributes such as mold temperature, melt temperature, and injection pressure are critical factors in plastic injection molding that impact the product's overall quality [5]. In the context of the injection molding process, the cooling stage can consume as much as 70% to 80% of the total cycle time [6]. Selecting an appropriate cooling channel design can reduce cooling time and enhance the efficiency of the molding process. Furthermore, the manufacturing process parameters continue to influence the quality of plastic products throughout production, with warping being one of the most common quality issues encountered [7].

The quality of the product, as well as the effectiveness of the manufacturing process, are both directly influenced by the temperature of the mold. It is ideal to keep the mold temperature as low as realistically possible to reduce the total time required for the molding cycle, which, in turn, can reduce production costs, as they are based on the duration of the molding cycle [8]. However, reducing the product's cooling time may lead to significant warping and shrinking [6]. To decrease the cycle time while maintaining product quality, it is necessary to employ an appropriate cooling technique.

According to the study conducted by Behrooz et al., they utilized the sequential simplex approach to minimize both warpage and shrinkage in their research. In the context of their study, "warpage" denotes the distortion or bending of a component that occurs during the injection molding process due to non-uniform contraction at various locations. Conversely, "volumetric shrinkage" refers to the overall reduction in the part's size after it has cooled [9]. Reducing these two defects leads to higher product quality. In practical mold designs, volumetric shrinkage is often considered by incorporating a coefficient of contraction. Excessive shrinkage can result in volumetric changes, leading to dimensions that fall outside the tolerance limits for the final product [9] [10]. Warpage, cycle time, and part quality represent the most common issues encountered when employing conventional cooling systems [3].

The design of the cooling channel plays a crucial role in achieving both a uniform temperature distribution and a rapid cooling rate within a short period. It is imperative to have a cooling system capable of efficiently dissipating heat at the required rate to prevent degradation of the plastic part and ensure its deformation-free ejection [11]. Moldflow Insight is simulation software designed to analyze the impact of injection molding designs and part models. By visualizing product quality issues, Moldflow Insight can conduct simulations to identify shrinkage and warping problems in the plastic injection molding process. Additionally, it allows for the detection of the causes of warping and the implementation of shrinkage compensation measures during the analysis stage [5]. Throughout the simulation, these elements can be examined and refined to enhance efficiency [4].

A conventional or straight-drilled cooling channel (SDCC) is constructed outside the mold in a linear fashion and features a significant coolant pathway within the mold itself [3]. Conventional cooling channels are produced by drilling multiple straight holes (cooling channels) into the mold core and cavity [6]. Factors such as cooling performance, mechanical strength, and coolant pressure drop must be carefully considered when calculating and selecting key design parameters for cooling channels, including size, shape, and placement. This attention to detail is essential for maintaining a uniform temperature and achieving rapid cooling, ultimately reducing the cycle time [12]. One key indicator of the suitability of a chosen cooling channel for product production is its ability to achieve ejection temperature, uniform temperature distribution, and minimal warping in a shorter cycle time [13].

This study is being conducted to analyse the effects of cooling channel parameters on the product cavity, aiming to achieve the most effective cooling and minimize defects. This will be achieved by evaluating various cooling channel parameters based on criteria such as the time required to reach injection temperature, volumetric shrinkage, the average part temperature, and the deformation observed in the simulation results obtained from Moldflow Insight.

Methodology

To achieve the study's objectives, the part model and cooling channel were designed and analyzed. The part model was developed with consideration for the requirements of the plastic injection molding process. A straight-drill cooling channel will be employed in the analysis. The parameters to be assessed for the cooling channel include diameter, pitch between the cooling channels, and the distance between the cooling channels and the part cavity. CATIA and Moldflow Plastic Insight Simulation software were utilized to create the 3D model and perform computational analysis simulations.

The research commences with the design of a lid for a food container, serving as the case study for the entire investigation. A total of 15 different combinations of cooling channel parameters will be evaluated using simulation software, each with a distinct set of parameters. The study's outcomes will consider four criteria: average part temperature, time required to reach ejection temperature, volumetric shrinkage, and deflection.

Case Study and Modelling

Figure 1 displays a 3D model of the lid of a food container, which serves as a case study throughout this research. In total, this part possesses a volume capacity of 20,018 mm^3, with the following dimensions: a length of 113 mm, a width of 74 mm, a height of 6.5 mm, and a thickness of 2 mm. Additionally, the product features a rounded corner shape with a 20 mm radius.

The lid of the food container was crafted from thermoplastic polypropylene (PP), a material well-recognized in the plastic food container industry for its unique combination of properties, including its ability to withstand high temperatures, flexibility, strength, lightweight nature, stability, resistance to moisture, and resistance to chemicals [5]. Table 1 provides an overview of the thermal and mechanical properties of polypropylene.

Figure 1: 3D Model of Food Container Lid

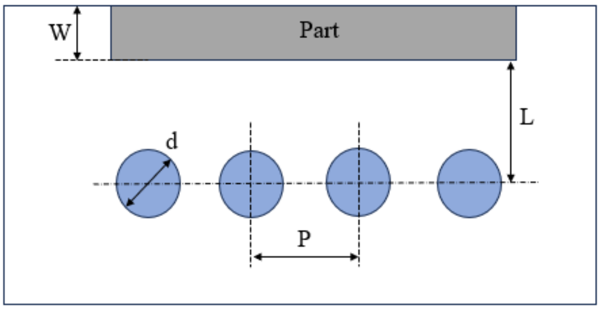
Table 1: Properties of The Material

Number	Property	Value
1	Density (g/cm3)	0.9
2	Melt temperature (°C)	210-290
3	Thermal conductivity (10-4 cal/sec cm °C)	2.8
4	Heat capacity (cal/g °C)	0.9

Design of Cooling Channel

According to the study by Chil-Chyuan Kuo and Trong-Duc Nguyen, the design of a cooling channel is based on the product's wall thickness, as illustrated in Figure 2 [15]. Since the food container's lid is 2 mm thick, the diameter of the cooling channel should range between 4 and 8 mm [15]. The distance between the centers of the channels should be approximately 1.5 to 2 times the diameter of the cooling channel. Regardless of whether it is positioned below or above the product, the center distance of the cooling channel with respect to the product should be 2 to 3 times the diameter of the cooling channel.

This study encompasses 15 conventional cooling channel designs, resulting in a total of 15 cases for simultaneous assessments, as shown in Table 2. The assessment focuses on three basic variables: diameter ranging from 4 to 8 mm, pitch variables with values of 10 and 18 mm, and distance variables between 12 to 24 mm.



Where,
d = Diameter of the cooling channel
W = Wall thickness of the part
D = Diameter of the cooling channel
P = Pitch between the cooling channels
L = Distance of the cooling channel with respect to part

Figure 2: Cooling Channel of Injection Moulding Layout

Table 1: Properties of The Material

Case Number	d (mm)	P (mm)	L (mm)
1	4	12	18
2	5	12	18
3	6	12	18
4	7	12	18
5	8	12	18
6	6	10	18
7	6	12	18
8	6	14	18
9	6	16	18
10	6	18	18
11	6	12	12
12	6	12	15
13	6	12	18
14	6	12	21
15	6	12	24

The cooling channel was designed using the computer-aided design (CAD) tool CATIA, in accordance with the parameter values specified in Tables 2. This study employed a conventional cooling channel in the shape of a straight hollow cylinder, constructed from P20 steel. The cooling channel was appropriately configured with 8 inlets and 8 outlets to facilitate the flow of the coolant fluid.

In order for the mold generation to be considered complete, the cooling channels and the feed system must be represented by underlying curves in either scenario. The length of the cooling channel was adjusted to be 30 mm longer than the product's length, which measures 143 mm. The dimensions of the mold were chosen so that the only components protruding from it were the inlet and outflow of the cooling channel. Figure 3 displays the mold generated through the mold block wizard. The mold and cooling channel were meshed prior to conducting the analysis.

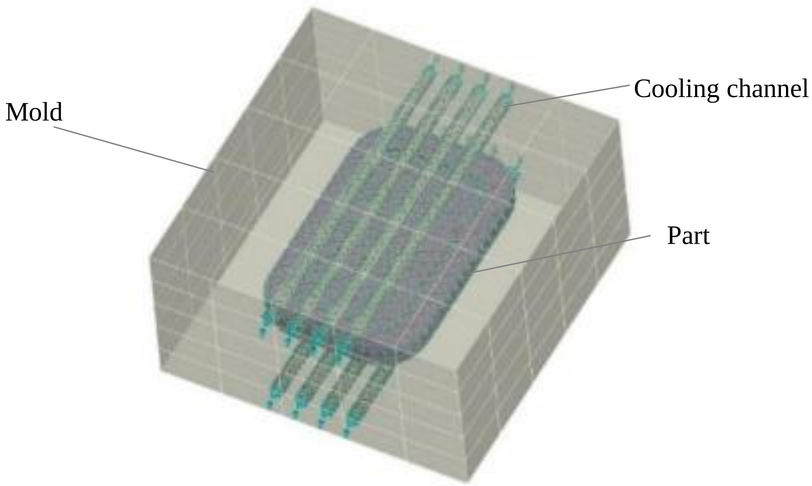


Figure 3: Cooling Channel of Injection Moulding Layout

Results and Discussion

The simulation of the injection moulding process with cooling channels was conducted using 15 different cooling channel parameters. In this analysis, four variants of simulation results were assessed, including average part temperature, time required to reach ejection temperature, volumetric shrinkage, and deflection.

The results concerning the average part temperature indicate the mean temperature across the thickness of the part, determined at the end of the cooling phase. It is crucial to maintain minimal temperature fluctuations within the part. Higher average temperatures in certain regions may be attributed to either thicker sections of the part or areas with insufficient cooling.

The outcome of the time required to reach ejection temperature reveals how long it takes to attain the ejection temperature from the initial filling. Ideally, the part should solidify uniformly, but prolonged freezing times in certain regions may suggest thicker sections or areas where heat generation occurs due to shear during the filling or packing process.

Volumetric shrinkage upon ejection represents the reduction in local volume from the end of the cooling phase until the part has cooled to the ambient reference temperature (25°C). Elevated shrinkage values might indicate the presence of sink marks or voids within the part. It is important that shrinkage values are consistent throughout the part to ensure the structural and visual integrity of the component.

The degree of deflection at each node of the part is reflected in the deflection results. Both shrinkage and the cooling system influence the part's deflection. A part with the lowest deflection value indicates better quality compared to others.

Figure 4 shows an example of the average temperature distribution for Case 11. These results were determined at t=30s after the injection of the material at 200°C. The left and right sides of the part exhibit higher average temperatures, possibly due to their greater distance from the cooling channels, resulting in reduced cooling effects from the cooling system. The temperature distribution trends are consistent across all 15 cases. To assess the impact of parameter variations, we considered the maximum values provided by the software.

Figure 5 presents a comparison of the average temperature distribution with varying diameters, pitches, and distances of the cooling channels. As the diameter and pitch of the cooling channels increase, the part temperatures decrease. However, increasing the distance between the cooling channel and the part cavity results in higher temperatures. Among these cases, Case 11 is the most favorable for achieving a minimum average part temperature, with a diameter (d) of 12mm, pitch (P) of 12mm, and distance (L) of 12mm.

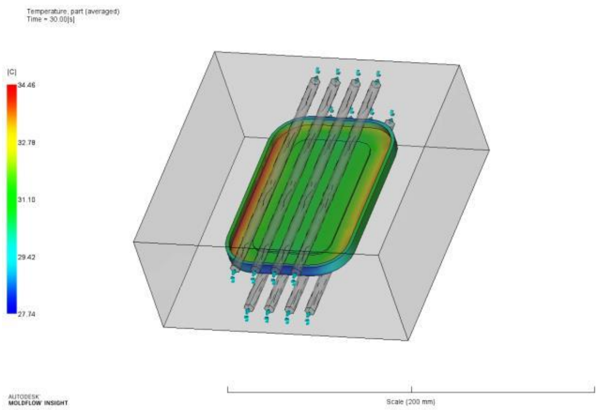


Figure 4: Temperature Part Average

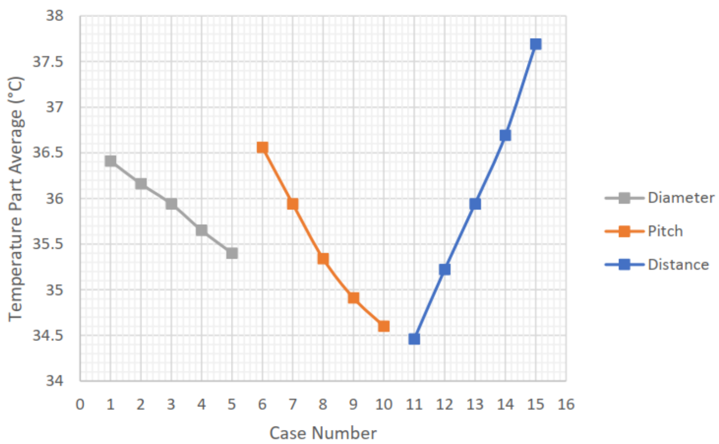


Figure 5: Comparison of The Average Temperature Distribution with Varying Parameters of The Cooling Channels

Figure 6 displays the results for the time it takes to reach the ejection temperature for case 11. The red color appearing in the middle of the product represents the longest duration required to reach the ejection temperature. This position essentially corresponds to the junction of the sprue and part, where the material flows into the cavity. The time needed to reach the injection temperature is approximately equivalent to the time required for the entire operational cycle, which begins with product filling and concludes with ejection. In terms of 3D flow, the results demonstrate the longest duration across the local thickness, with the color mapping progressing from the inside to the outside of the product. Overall, all parts of the region indicate a similar blue color, except for the central area, which signifies the average time required for solidification, sufficient cooling, and stabilization before ejection.

Figure 7 provides a comparison of the time it takes to reach the ejection temperature with varying diameters, pitches, and distances of the cooling channels. For easier understanding, we considered the maximum time for each case. As the diameter and pitch of the cooling channels increase, the time required to reach the ejection temperature decreases. However, increasing the distance between the cooling channel and the part cavity results in longer durations. Once again, Case 11 emerges as the best option for achieving a shorter time to reach the ejection temperature.

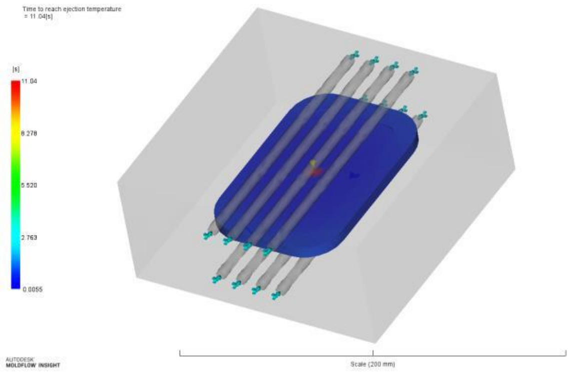


Figure 6: Time to Reach Ejection Temperature

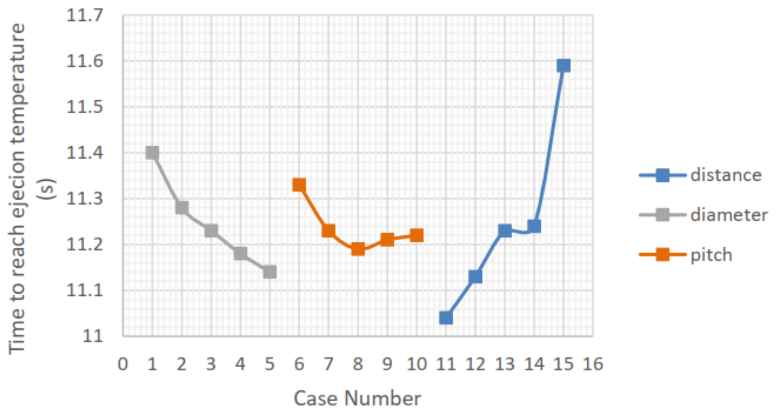


Figure 7: Comparison of Time to Reach Ejection Temperature with Varying Parameters of The Cooling Channels

Figure 8 depicts the results of volumetric shrinkage. The highest volumetric shrinkage is observed at the injection point. It is crucial for shrinkage values to remain uniform throughout the entire part. This uniformity is essential for effectively packing the material and ensuring the structural and visual integrity of the part. In general, the majority of the part area exhibits a consistent blue color, except for the central area, which indicates uniform shrinkage along the material thickness.

Figure 9 offers a comparison of volumetric shrinkage with varying diameters, pitches, and distances of the cooling channels. To enhance understanding, we considered the maximum shrinkage percentage value for each case. The results demonstrate that the volumetric shrinkage for all parameter combinations remains consistently around 9.42%. However, Figure 8 shows less than 1% volumetric shrinkage in the majority of the part area.

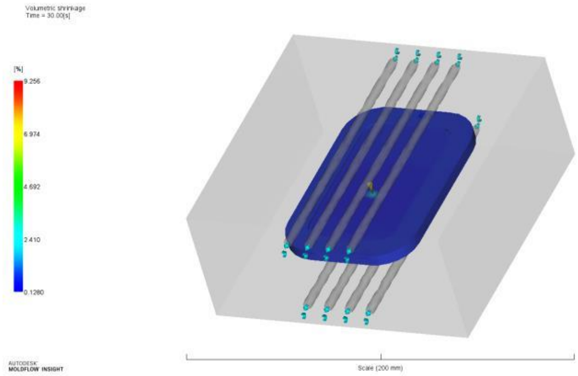


Figure 8: Volumetric Shrinkage

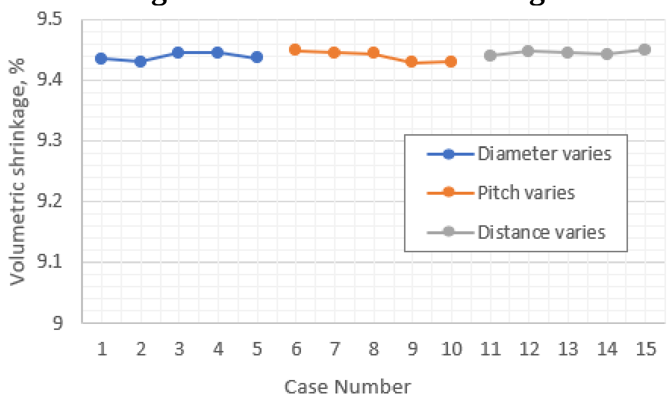


Figure 9: Comparison of Volumetric Shrinkage with Varying Parameters of The Cooling Channels

Figure 10 displays the results of part deflection during the process cycle. Both shrinkage and the cooling system have an impact on the part's deflection. Figure 10 shows that the deflection of the part ranges from 0.3 to 0.8mm, with the highest value indicated by the red color in the round corner of the part, while the lowest deflection is indicated by the blue color on the flat surface at the center of the part.

Figure 11 displays a comparison of deflection values for different combinations of cooling channel diameters, pitches, and distances. The maximum deflection value for each case, as provided by the software, is compared. The results indicate that deflection remains consistently around 0.84 mm for all parameter combinations, irrespective of the variations in cooling channel parameters.

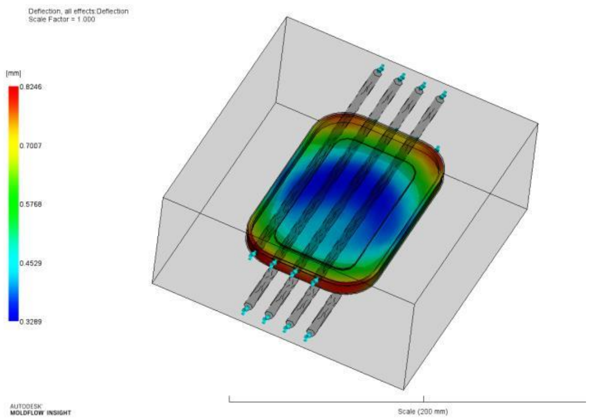


Figure 10: Part Deflection

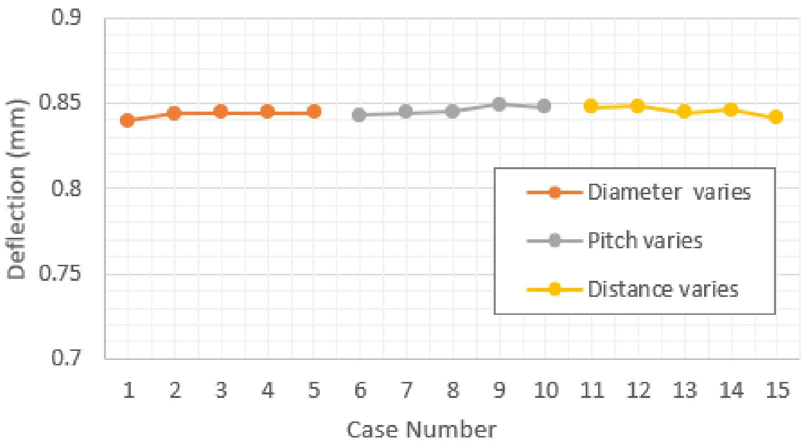


Figure 11: Comparison of Part Deflection with Varying Parameters of The Cooling Channels

Conclusion

In summary, this study has effectively achieved its primary objective, which involved the examination of how cooling channel parameters impact the product cavity. The investigation specifically focuses on four key simulation analysis outcomes: the time required to reach ejection temperature, the average temperature, volumetric shrinkage, and deflection. The study involved a comparison of various cooling channel parameters, including their diameter, pitch, and distance.

The findings suggest that increasing the diameter and pitch of cooling channels leads to a reduction in both the average part temperature and the time needed to reach ejection temperature. Conversely, enlarging the distance between cooling channels results in an elevation of both the average part temperature and the time required to reach ejection temperature. It is crucial to maintain a minimal variation in the average temperature throughout the part and ensure uniform freezing to prevent poorly cooled areas, which would extend the ejection time and consequently prolong the overall product cycle.

In conclusion, this research significantly contributes to our comprehension of how cooling channel parameters affect cooling efficiency and the occurrence of defects in injection molding. Ultimately, it enhances the practices in injection molding cooling processes, benefiting manufacturers, customers, and the environment.

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6th Langkawi International Multidisciplinary Conference 2023 (6th LIMC 2023)
eISSN 2976-3223
9th – 10th September 2023
Bayview Hotel, Langkawi, Malaysia

KESAN PENGGUNAAN FILEM TERHADAP PENINGKATAN KEMAHIRAN PEMIKIRAN SEJARAH (KPS) PELAJAR PINTAR BERBAKAT (PB)

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***Abstrak**: Era teknologi masa kini menjadikan pedagogi dalam PdPc subjek Sejarah lebih dinamik. Berdasarkan kajian yang lepas, filem dapat memainkan peranan penting khususnya dalam mendatangkan minat pelajar terhadap fakta-fakta Sejarah yang sebelum ini lebih banyak terkandung di dalam buku teks. Kajian ini dibuat bagi menilai peningkatan Kemahiran Pemikiran Sejarah (KPS) pelajar Pintar Berbakat (PB) dengan menggunakan filem terplilih oleh guru dalam PdPc bagi subjek Sejarah. Kajian dijalankan ke atas 78 orang pelajar PB Kolej GENIUS@Pintar Negara, UKM dengan menggunakan kaedah persampelan bertujuan. Analisa ujian pra dan pasca pelajar digunakan dengan menggunakan kaedah Ujian – t bagi melihat peningkatan KPS pelajar berdasarkan peratusan, median, min, dan sisihan piawai manakala ujian korelasi pula digunakan untuk menilai korelasi antara ujian pra dan pasca pelajar PB. Hasil dapatan kajian menunjukkan bahawa 73% orang pelajar suka menonton filem berunsurkan Sejarah dengan terdapat keberkesanan yang positif dari aspek peningkatan KPS pelajar PB berdasarkan ujian pra dan pasca yang dijalankan. Para guru dan pelajar harus memanfaatkan teknologi yang ada dengan memanfaatkan penggunaan filem berunsurkan Sejarah dalam PdPc. Teknologi terkini dapat memudahkan guru mahupun pelajar untuk menonton filem sungguhpun di luar kelas. Namun demikian, kaedah PdPc yang tersusun dan sistematik harus dilaksanakan oleh guru agar peningkatan KPS pelajar berlaku sesuai dengan objektif pembelajaran Sejarah.*

***Kata Kunci**: Filem, Kemahiran Pemikiran Sejarah, Pintar Berbakat, Kuantitatif*

***Abstract:** The current technological era makes pedagogy in History subject more dynamic. Based on previous studies, films can play an important role, especially in generating students' interest in History facts that were previously mostly contained in textbooks. This study is made to assess the improvement of Historical Thinking Skills (HTS) of gifted and talented (GT) students by using selected films by teachers in History class. The study was conducted on 84 students of GT at Malaysian National Gifted College, UKM by using a purposive sampling method. Pre and post-tests were used using the t-test method to see the improvement of GT* *students based on the percentage, median, min, and standard deviation while the Correlation Test was also used to assess the correlation between Pre and Post Test. The results of the study showed that 73% of the GT students liked to watch History-based movies with a positive impact on the aspect of improvement of students' HTS based on the Pre and Post tests conducted. Teachers and students should take advantage of existing technology by utilizing the use of History-based films in pedagogy. The latest technology can make it easier for teachers and students to watch movies even outside the classroom. However, a structured and systematic method of pedagogy must be implemented by teachers so that the improvement of students' HTS occurs in accordance with the objectives of History learning.*

Keywords: *Film, Historical Thinking Skills, Gifted, Quantitative*.

Pendahuluan

Pendidikan masa kini telah bergerak seiring dengan perkembangan globalisasi yang berlaku di seluruh dunia. Demi mendepani cabaran globalisasi, pelbagai inisiatif dan usaha telah dilakukan oleh Kementerian Pendidikan Malaysia (KPM) bagi membawa perubahan ke arah kemajuan dan pembangunan dalam sistem pendidikan negara. Perubahan yang dibuat bertujuan memastikan setiap pelajar dibekalkan dengan kemahiran dan nilai yang relevan dengan keperluan semasa agar setanding dengan pendidikan global. Bagi mata pelajaran Sejarah, kesepaduan elemen-elemen ini boleh diperlihatkan menerusi Kemahiran Pemikiran Sejarah (KPS) yang merupakan salah satu elemen penting bagi memupuk kemahiran berfikir di kalangan pelajar. Ianya membolehkan pelajar berfikir disebalik peristiwa yang telah berlaku dan memahami ilmu Sejarah dengan lebih mendalam serta dapat menganalisis, menilai dan berimaginasi mengenai fakta Sejarah dengan kritis. (Siti Hawa Abdullah & Aini Hassan, 2007) Terdapat 5 elemen utama yang ditekankan dalam KPS. Pertama; memahami kronologi iaitu memahami urutan waktu dan peristiwa Sejarah. Kedua; meneroka bukti yang mana melibatkan kemahiran mengenal pasti dan membuat perbandingan antara sumber primer dan sumber sekunder untuk mendapatkan maklumat Sejarah. Ketiga; membuat interpretasi iaitu membuat tafsiran terhadap sesuatu peristiwa dengan memberi ulasan berdasarkan bukti. Keempat; membuat imaginasi iaitu usaha melibatkan murid dengan sesuatu situasi dalam peristiwa Sejarah dan kelima membuat rasionalisasi yang mana melibatkan penggunaan akal fikiran dan membuat pertimbangan yang wajar dalam menyelesaikan sesuatu masalah. (KSSM: 2016) Pelajar harus digalakkan untuk menggunakan KPS disamping pengetahuan di luar kotak untuk menarik minat mereka menghayati Sejarah. (Wineburg, 2001) Menurut Nurul Hafizah Maarof et al. (2021), KPS ini dapat membuatkan pelajar PB merasai apa yang dilakukan oleh Sejarawan iaitu meneliti sesuatu perkara dengan terperinci sebelum membuat penganalisaan terhadap bukti-bukti yang sedia ada. Pembelajaran Sejarah menggunakan sumber digital seperti filem merupakan salah satu pendekatan pedagogi yang sesuai dengan era teknologi masa kini. Menurut Pusparani A/P Nagendren dan Anuar Ahmad (2021) inovasi dan strategi pembelajaran Sejarah yang tepat mampu mengubah corak pemikiran pelajar dan membantu pelajar memahami Sejarah dengan lebih baik. Justeru, pengaplikasian kepelbagaian kaedah dalam pengajaran dan pemudahcaraan (PdPc) penting kerana setiap pelajar memiliki kebolehan, pencapaian, kecenderungan dan minat yang berbeza-beza untuk menerima sesuatu pembelajaran. KPS adalah sebahagian daripada proses kemahiran berfikir yang perlu diterapkan kepada pelajar Pintar Berbakat (PB) dalam PdPc Sejarah (Lee Bih Ni & Nurul Asyikin Hassan, 2023). Pelajar dapat memikirkan tentang kepentingan, sebab dan akibat yang berlaku dan membuat tafsiran daripada filem yang ditonton. (Metzger, 2010a) Sejarah berpotensi memanusiakan kita melalui pelbagai cara yang tidak wujud dalam bidang lain kurikulum sekolah. Elemen KPS juga boleh ditingkatkan melalui tontonan filem apabila pelajar dapat melakukan interprestasi peristiwa yang lepas dan melihat implikasinya pada hari ini. (Metzger, 2010b). Penggunaan filem secara meluas di dalam kelas bukan sahaja dapat menyokong isi kandungan pembelajaran atau buku teks yang digunakan malahan ia membantu menggalakkan kemahiran berfikir aras tinggi dalam kalangan pelajar. (Wagner, 2018) Pendidikan abad ke-21 menyediakan generasi muda untuk berfikir secara kreatif dan kritis bagi menangani perubahan dunia yang pesat dan berterusan. (Jordan Maria et al., 2019)

Pendekatan pembelajaran menggunakan buku teks sebagai rujukan utama yang sebelumnya diamalkan oleh guru dalam menyampaikan fakta sememangnya tidak lagi relevan, membosankan dan tidak berjaya memupuk keupayaan berfikir dalam kalangan pelajar. Isu subjek Sejarah sebagai mata pelajaran yang membosankan tidak akan menjadi isu sekiranya pengajaran dan pembelajaran Sejarah bukan sahaja tertumpu kepada penyampaian fakta semata-mata, tetapi ia juga merangkumi kemahiran inkuiri dan pemikiran tentang KPS. (Khairunnajwa Samsudin et al., 2017) Kemajuan teknologi hari ini telah mengubah cara pandang pelajar yang mana semua maklumat lebih mudah untuk di akses dari mana-mana peranti berbanding hanya fokus apa yang disampaikan oleh guru di dalam kelas. Oleh yang demikian, guru perlu kreatif dalam menyediakan bahan pengajaran yang menarik agar pelajar tidak rasa terbeban baik dari aspek kognitif mahupun emosi. Pendidikan Sejarah yang bermakna adalah apabila guru berupaya menarik minat pelajar dengan menggunakan kaedah yang bersesuaian dengan era teknologi masa kini dalam melahirkan pelajar yang mampu berfikir seperti Sejarawan. Oleh yang demikian, kajian ini dilakukan bagi menganalisa peningkatan Kemahiran Pemikiran Sejarah melalui Filem dalam kalangan pelajar PB. Bagi membincangkan kajian ini dengan lebih terperinci dan berfokus, terdapat tiga objektif kajian antaranya:

1. Adakah pelajar gemar menonton filem yang berunsurkan Sejarah?
2. Adakah penggunaan filem dalam PdPc bagi subjek Sejarah dapat mempengaruhi peningkatan markah ujian pra dan pasca pelajar PB?
3. Adakah terdapat hubungan peningkatan KPS dengan pelajar PB yang mempunyai umur yang berlainan?

Ulasan Kajian Lepas

Filem dalam Pengajaran dan Pemudahcaraan (PdPc)
Terdapat pelbagai kajian yang mengupas mengenai pembelajaran filem dalam PdPc Sejarah namun berkaitan dengan peningkatan KPS di kalangan pelajar PB masih lagi kurang dibincangkan di kalangan penyelidik. Menurut kajian Metzger (2010) mendapati bahawa filem adalah kegemaran dan merupakan budaya kebanyakan remaja. Ia menjadikannya lebih menarik kepada pelajar yang berminat dengan Sejarah. Kajian oleh Donnelly (2014a) mendapati 83% responden bersetuju bahawa penggunaan filem dalam PdPc dapat meningkatkan empati pelajar. Ia juga mewujudkan suasana pembelajaran yang lebih segar melalui imaginasi dan imej filem tersebut. Menurut kajian Donnelly (2014b) penggunaan filem dalam PdPc Sejarah telah

menunjukkan kesan yang positif di kalangan pelajar dan mekanisme ini sangat berkesan jika digunakan di dalam kelas.

Menurut kajian Muhammad Azmi (2017) mendapati bahawa selaras dengan perkembangan teknologi penggunaan filem dalam bilik darjah merupakan salah satu alternatif untuk mewujudkan suasana Sejarah berbanding lawatan ke muzium dan juga kaedah arkeologi. Berdasarkan kajian Wagner (2018), penggunaan filem secara meluas di dalam bilik darjah bukan sahaja menyokong kandungan pembelajaran dan buku teks yang digunakan, tetapi juga menggalakkan pelajar untuk mengaplikasikan kemahiran pembelajaran yang lebih maju juga boleh dilakukan. Menurut Paxton dan Marcus (2018) dalam kajian mereka menjelaskan bahawa tidak jelas bila bermulanya penggunaan filem dalam PdPc namun ianya merupakan pedagogi yang dinamik yang mana guru cuba untuk mewujudkan suasana pembelajaran yang menggunakan media dalam PdPc mereka. Hasil dapatan kajian Samina (2018) menegaskan bahawa faedah dalam menggunakan filem untuk pembelajaran di dalam kelas *International Baccalaureate* adalah dari aspek intelek dan emosi. Beliau turut menekankan bahawa filem boleh digunakan sebagai medium untuk membina pengetahuan kolaboratif dalam kalangan pelajar.

Seterusnya Kaviza (2020) dalam kajian beliau menyatakan bahawa pembelajaran aktif dapat dilaksanakan di dalam kelas sekiranya guru membuat persediaan dari segi perancangan pembelajaran dengan baik antaranya dengan menggunakan bahan-bahan yang berkaitan dengan multimedia. Suherman, et al. (2020) membincangkan bahawa penggunaan filem dalam PdPc Sejarah di kalangan pelajar Maahad Muhammadiah telah menunjukkan respon yang positif di kalangan pelajar namun perlu ditekankan bahawa kesediaan guru amat penting khususnya dalam menyediakan kelengkapan teknikal seperti LCD, pembesar suara dan keperluan teknikal lain bagi memastikan kelancaran semasa filem itu dipertontonkan kepada para pelajar. Akhir sekali, Donnelly (2020) menambah kaedah pembelajaran menggunakan filem sudah menjadi popular di kalangan guru-guru di Australia kerana ianya berpotensi untuk memberi kesan yang positif kepada pelajar seiring dengan kemajuan teknologi. Namun, ianya berbeza dengan negara-negara yang tidak mempunyai fasiliti lengkap di dalam kelas.

Menurut Rabaah Abdullah, et al. (2021) membahaskan bahawa pelajar tertarik untuk mempelajari topik Penjajahan di Asia Tenggara pada abad ke-19 dengan menonton filem bertajuk "*The Legend of Suriyothai*" kerana pelajar berpeluang untuk berimaginasi Sejarah yang telah berlalu berbanding dengan membaca buku atau artikel ilmiah. Antara kajian yang membahaskan mengenai pembelajaran Sejarah dengan menggunakan filem adalah Nurul Hafizah Maarof, et al. (2022) penggunaan filem dalam PdPc merupakan salah satu cara untuk meningkatkan minat pelajar PB untuk mempelajari Sejarah secara santai dengan tidak dibebani dengan fakta-fakta yang perlu dihafal. Malahan, ianya juga memberi ruang kepada pelajar PB untuk meneliti ketelusan fakta-fakta yang terdapat dalam filem tersebut untuk dibincangkan bersama-sama guru di dalam kelas. Menurut Pamela, et al. (2022) dalam kajian mereka menyatakan bahawa pemahaman terdapat sesuatu Sejarah tersebut lebih mudah difahami melalui filem namun guru perlu ada bersama-sama para pelajar khususnya dalam membuat penerangan berkaitan dengan fakta-fakta yang kurang tepat dan babak-babak yang keterlaluan yang dipertontonkan dalam filem tersebut.

Kemahiran Pemikiran Sejarah (KPS)

Dalam kajian Sharifah Nor Puteh, et al. (2010) sekiranya ingin melahirkan pelajar yang mampu berfikir seperti seorang sejarawan ianya harus dimulai oleh para guru. Oleh yang demikian bagi memastikan perancangan tersebut terlaksana, para guru harus berani membuat perubahan dengan mampu untuk menguasai KPS. Rosy Talin (2015) dalam kajian beliau membahaskan guru harus menguasai KPS dan mempraktikkan amalan tersebut dalam PdPc berbanding hanya menyampaikan fakta semata-mata di dalam kelas. Sekiranya tidak, pelajar akan terus dirundung perasaan bosan dan beban dengan lambakan fakta yang perlu dihafal. Menurut kajian Rully Putri Nirmala Puji, et al. (2015) menyatakan guru harus merancang PdPc dengan penuh strategi khususnya dalam mengaplikasikan KPS di dalam kelas sesuai dengan watak-watak pelajar seperti *introvert, ekstrovert, thinking, judging* dan lain-lain. Oleh yang demikian, ianya dapat membantu pelajar dalam mengoptimumkan PdPc mereka dalam pelajaran Sejarah.

Berdasarkan hasil kajian Nurhijrah Zakaria, et al. (2018) amat penting bagi bakal guru Sejarah untuk menguasai KPS serta merancang PdPc dengan baik agar para pelajar mendapat manfaat daripadanya. Bakal guru yang tidak menguasai kemahiran tersebut akan menyebabkan pembelajaran di sekolah akan berlangsung secara konvensional iaitu hanya penghafalan fakta semata-mata. Kaviza (2019) membahaskan guru yang menggunakan KPS dalam PdPc di dalam kelas mampu untuk menarik minat pelajar untuk mempelajari serta mempunyai pencapaian yang baik dalam subjek Sejarah. Hasil dapatan kajian Mohd Mahzan Awang, et al. (2019) cara pelajar berfikir dengan KPS amat berkait rapat dengan cara mereka belajar di dalam kelas. Kelemahan yang ada pada diri pelajar boleh diatasi sekiranya guru mempelbagaikan kaedah pendekatan yang digunakan agar tiada di antara mereka yang keciciran dalam menerima serta mengamalkan kemahiran tersebut.

Menurut kajian Nurul Hafizah Maarof et al. (2021), kemahiran pemikiran Sejarah di kalangan pelajar PB masih lagi lemah khususnya mereka yang berada pada gred sederhana (C dan D) dan gred rendah (E, F, G) sungguhpun mereka mempunyai IQ yang tinggi. Oleh yang demikian guru perlu memperkasakan lagi kemahiran KPS mereka dalam memastikan pelajar PB dapat menguasai KPS dengan baik selari dengan IQ mereka. Berdasarkan kajian Kaviza (2021) pelajar akan mendapat manfaat yang optimimum di dalam kelas sekiranya guru dapat meningkatkan kemahiran mereka dan mengaplikasikan KPS tersebut di dalam PdPc mereka. Tahap kendiri pelajar juga harus diambil kira agar tiada pelajar yang rasa terpinggir dengan KPS yang dipraktikkan di dalam kelas. Asyrul, et al. (2022) membahaskan bahawa penggunaan buku teks semata-mata dalam pengajian tidak memberi makna sekiranya pelajar hanya menghafal fakta-fakta yang lepas. Proses pembinaan KPS di kalangan pelajar amat memerlukan kreativiti di kalangan tenaga pengajar antaranya dengan menerapkan elemen kognitif seperti berfikir secara kritis dan kreatif serta kemahiran menganalisa terhadap sumber-sumber Sejarah yang ada dalam mengaitkan topik-topik pengajaran yang diajar di dalam kelas. Litvin (2022) dalam kajian beliau membahaskan bahawa penggunaan filem dalam PdPc dapat membantu pelajar dalam memahami perkara yang lepas dengan menggunakan kaedah interpretasi, menganalisa sumber Sejarah, dan menilai perspektif Sejarah yang berbeza-beza. Namun cabaran buat guru juga amat mencabar khususnya dalam mengawal kandungan filem yang mempunyai unsur-unsur ganas dan seksual.

Kajian Metodologi

Kaedah penyelidikan yang digunakan sepanjang kajian ini dijalankan adalah berbentuk kuantitatif yang mana data-data yang dikumpul dianalisa dengan menggunakan perisian SPSS. Kaedah statistik deskriptif dipilih dengan mengkaji sampel yang diambil dengan mengumpul, menyusun, menganalisa dan mempersembahkan data dengan cara yang mudah untuk difahami.

Peserta Kajian

Secara ringkasnya, peserta yang dipilih dalam menjalankan kajian ini adalah secara bertujuan dengan mengumpulkan data-data daripada 78 orang peserta iaitu pelajar PB yang berumur dari 16 sehingga 17 tahun yang belajar di Kolej GENIUS@Pintar Negara, UKM.

Pengumpulan Data

Kajian soal selidik ini dijalankan dengan menggunakan kajian soal selidik tertutup yang menggunakan *skala likert* dengan 5 pilihan jawapan iaitu 1-5 (sangat setuju – sangat tidak setuju). Kajian soal selidik ini diguna pakai daripada Rully Putri Nirmala Puji & Abdul Razaq Ahmad dari artikel bertajuk Gaya Belajar dan Kemahiran Pemikiran Sejarah dalam Pembelajaran Sejarah di Peringkat Universitas. Soal selidik tersebut diubahsuai dengan mengikut kesesuaian kajian yang berkaitan dengan peningkatan KPS melalui Filem dalam kalangan pelajar PB. Soal selidik ini diberikan kepada pelajar dengan menggunakan *Google Form* melalui kumpulan *Whatsapp* kelas. Manakala markah ujian pra diambil sebelum pembelajaran sesuatu topik itu bermula manakala markah ujian pasca diambil setelah selesai dua buah filem terpilih yang berkaitan dengan topik pembelajaran tersebut dipertontonkan kepada pelajar iaitu filem Kartini: The Princess of Java bagi pelajar berumur 16 tahun yang mempelajari topik Masyarakat di Asia Tenggara manakala filem *Viceroy's House* diberikan kepada pelajar berumur 17 tahun yang mempelajari topik Dekolonisasi Kuasa Barat di India. Kedua-dua filem telah diambil daripada Netflix dan Youtube dan diberikan kepada pelajar melalui *Google Classroom*. Malahan, para pelajar juga boleh menontonnya secara terus dari *Netflix* mahupun *Youtube.*

Instrumen Kajian

Berdasarkan Nilai Cronbach's Alpha bagi kajian soal selidik tertutup yang dijalankan adalah 0.917. Oleh yang demikian, kajian soal selidik yang telah digunakan kepada para pelajar PB yang berumur 16 - 17 tahun berkenaan dengan peningkatan KPS melalui filem dalam kalangan pelajar PB ini boleh dipercayai.

Nilai *Cronbach's Alpha* > 0.7

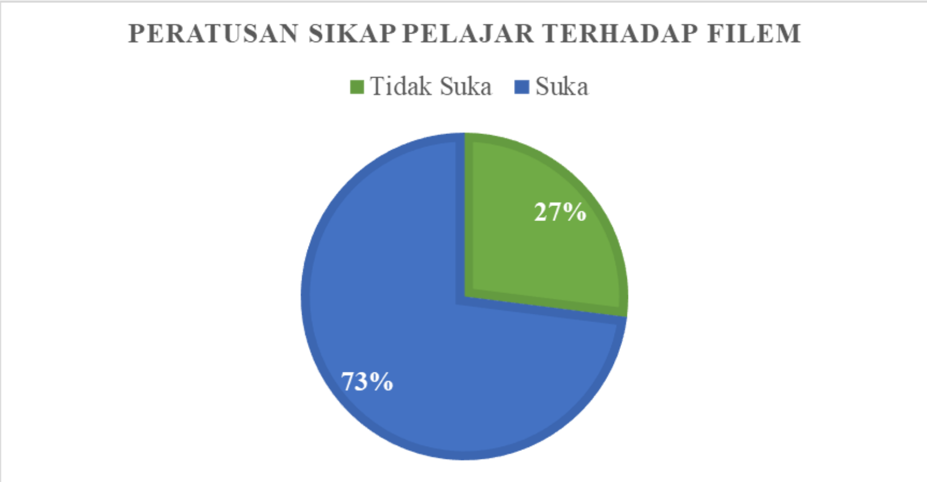
Jadual 1: Nilai *Cronbach's Alpha* bagi Kebolehpercayaan Item

Cronbach's Alpha	*N of items*
0.917	15

Penganalisaan Data

Setelah selesai soal selidik serta markah ujian pra dan ujian pasca dikumpulkan daripada para responden, perisian SPSS digunakan bagi menganalisa data-data berkaitan untuk diterjemahkan ke dalam graf dan jadual yang mudah difahami. Analisis yang dilakukan bagi kajian ini adalah analisis deskriptif. Ujian t bersandar digunakan bagi mengenal pasti perbezaan bagi markah ujian pra dan ujian pasca pelajar PB dengan melihat mean, min, sisihan piawai dan nilai signifikan, ujian Korelasi Pearson digunakan bagi menilai kekuatan hubungan bagi pekali korelasi sama ada positif atau negatif dan akhir sekali *Wilcoxon Signed Ranked Test* digunakan bagi menguji nilai ujian pra dan pasca ujian pelajar PB secara statistik.

Dapatan Kajian
1. Adakah pelajar gemar menonton filem yang berunsurkan Sejarah?



Rajah 1: Peratusan Sikap Pelajar Terhadap Filem Berunsurkan Sejarah
Berdasarkan **rajah 1** di atas, 73% atau 57 orang pelajar PB suka menonton filem yang berunsurkan Sejarah manakala 27% atau 21 orang pelajar PB tidak suka menonton filem yang berunsurkan Sejarah.

2. Adakah penggunaan filem dalam PdPc bagi subjek Sejarah dapat mempengaruhi peningkatan markah ujian pra dan pasca pelajar PB?

Jadual 2: Ujian -t bersandar bagi pencapaian markah ujian pra dan pasca

	Mean (%)	Min (%)	Max (%)	N	Sisihan Piawai
Ujian Pra	56.6%	0	100%	78	21.4%
Ujian Pasca	93.4%	33%	100%	78	14.8%

Analisa ujian t bebas digunakan untuk mengenal pasti peratusan pencapaian ujian pra dan pasca. Hasil ujian -t bersandar adalah seperti **Jadual 2** di atas. **Jadual 2** tersebut menunjukkan bahawa terdapat perbezaan yang signifikan bagi ujian pra dan ujian pasca terhadap keberkesanan filem dalam peningkatan KPS pelajar PB dengan nilai ujian pra iaitu mean = 56.6%, min = 0% dan sisihan piawai = 21.4% manakala nilai ujian pasca adalah mean = 93.4% , min = 33% dan sisihan piawai = 14.8%

Jadual 3: *Wilcoxon Signed Ranked Test*[a]

	Ujian Pasca (%) - Ujian Pra (%)
Z	-7.483^b
Asymp. Sig. (2-tailed)	0

Keputusan analisis dari **Jadual 3** menunjukkan terdapat perbezaan yang signifikan iaitu -7.483^b terhadap ujian pra dan ujian pasca yang diberikan berdasarkan filem-filem terpilih yang dipertontonkan dalam peningkatan KPS pelajar PB.

Jadual 4: Ujian Korelasi

	N	Korelasi	Sig.
Ujian Pra &Ujian Pasca	78	0.264	0.02

Analisa ujian korelasi dalam **Jadual 4** di atas menunjukkan bahawa terdapat korelasi yang positif antara ujian pra dan ujian pasca dengan nilai r = 0.264 dan sig = 0.02 ($p < 0.05$).

3. Adakah terdapat hubungan peningkatan KPS dengan pelajar PB yang mempunyai umur yang berlainan?

Jadual 5: Ujian –t bersandar bagi pencapaian markah bagi ujian pra dan pasca berdasarkan pada umur yang berlainan.

	Umur	N	Min (%)	Median (%)
Ujian Pra	16	26	28.7 %	50%
	17	52	44.9 %	68%
Ujian Pasca	16	26	22.5 %	83%
	17	52	48 %	100%

Berdasarkan **Jadual 5** di atas nilai ujian pra bagi pelajar yang berumur 16 tahun adalah min = 28.7% dan median = 50% manakala nilai ujian pasca adalah min = 22.5%. dan median = 83%. Berbeza dengan ujian pra bagi pelajar yang berumur 17 tahun iaitu min = 44.9% dan median = 68% manakala nilai ujian pasca adalah min= 48% dan median = 100%. Ini menunjukkan bahawa nilai min dan median bagi pelajar yang berumur 17 tahun menunjukkan peningkatan dari aspek KPS berbanding pelajar yang berumur 16 tahun berdasarkan filem-filem terpilih yang dipertontonkan di dalam kelas.

Perbincangan

Berdasarkan soalan kajian yang pertama; lebih dari 70% pelajar gemar menonton filem berunsurkan Sejarah. Bagi Pelajar PB, penggunaan filem membolehkan mereka melakukan analisa, interpretasi, imaginasi dan membuat rasionalisasi dalam suasana pembelajaran yang santai dan menyeronokkan serta mengoptimumkan potensi mereka untuk memahami sesuatu kandungan dalam pembelajaran dengan cepat tanpa perlu menghafal fakta semata-mata. Pelajar tertarik dengan filem yang dipertontonkan dan merasakan seolah-olah mereka sendiri berada dalam filem tersebut. (Litvin, 2022) Penggunaan filem dalam PdP juga dianggap sebagai bahan mengajar yang efektif dalam meningkatkan KPS iaitu kemahiran meneroka bukti dan membuat imaginasi kerana ia dapat memberi penjelasan kepada pelajar mengenai teori, peristiwa dan konsep Sejarah seolah-olah mereka berada dalam layar. Filem telah membantu ramai pelajar di Amerika Syarikat untuk memahami masa lalu dan ia telah digunakan oleh ramai guru dengan memerlukan sedikit panduan daripada para guru. (Metzger, 2010) Filem dianggap sebagai karya kreatif menggunakan imej, warna, muzik dan kerja kamera untuk bercerita yang mana berbeza dengan teks karya asal filem tersebut. (Domke, et al., 2018) Subjek Sejarah yang selama ini dianggap membosankan oleh para pelajar bertukar menjadi lebih menarik apabila menggunakan filem. (Arlyan Merryasni, et al., 2022) Filem boleh dijadikan sebagai bahan pengajaran alternatif yang mempunyai potensi besar untuk memotivasikan dan menarik minat pelajar untuk meneroka kandungan Sejarah. (Marcus, 2005) Kuasa dan potensi filem dalam lapangan pendidikan Sejarah tidak dinafikan sejajar dengan peningkatan mendadak dan kepelbagaian kandungan yang tersedia di papan digital seperti *YouTube, Netflix* dan *Amazon Prime*. (Peters, 2020). Kadar min bagi semua konstruk keberkesanan filem dalam PdPc subjek Sejarah adalah tinggi termasuklah konstruk kemahiran pemikiran Sejarah. (Nurul Hafizah Maaror et al., 2022) Bukan itu sahaja, pelajar dapat memahami secara kritis dan imaginatif tentang segala aspek kehidupan manusia silam sehingga hari ini dengan menonton filem. Penggunaan filem boleh membantu pelajar untuk memahami budaya Asia dengan lebih jelas dan bermakna. (Litvin, 2022) Melihat kepada keperluan ini, guru perlu memainkan peranan utama dalam membangunkan potensi intelektual pelajar dengan memfokuskan kepada kesepaduan elemen pengetahuan, kemahiran dan nilai-nilai murni yang terkandung dalam KSSM semasa melaksanakan proses pengajaran dan pembelajaran. Menurut Nurul Hafizah Maarof et al. (2022) kadar min bagi persepsi pelajar PB terhadap penggunaan filem dalam PdPc subjek Sejarah adalah tinggi bermaksud keberkesanan penggunaan filem dalam PdPc subjek Sejarah sangat membantu dalam menarik minat pelajar PB untuk mempelajari Sejarah.

Berdasarkan soalan kajian yang kedua; penggunaan filem dapat mempengaruhi peningkatan KPS pelajar berdasarkan markah ujian pra dan ujia pasca pelajar PB. Bentuk soalan yang ditanya dalam subjek Sejarah perlulah sesuai dengan umur dan kemampuan pelajar dengan bertanyakan soalan yang memerlukan kepada KPS pelajar contohnya mengapa sesuatu itu telah berlaku, bagaimana sesuatu perkara itu berlaku dan sebagainya. (Arlyan Merryasni et al., 2022) Filem Sejarah juga mampu untuk menjadikan pelajar lebih memahami bagaimana untuk menilai Sejarah dari nilai dan pengalaman orang Sejarah itu sendiri berbanding melihat masa lalu hanya melalui lensa nilai dan pengalaman hari ini. (Litvin, 2022) Pengajaran Sejarah di sekolah diharapkan dapat mengembangkan kompetensi pelajar untuk berfikir secara kronologi. Filem boleh menarik minat pelajar dalam menggunakan kemahiran berfikir aras tinggi (KBAT). (Metzger, 2010) Filem Hollywood berpotensi untuk mengembangkan pemahaman Sejarah pelajar termasuk mentafsir bukti, meningkatkan empati, meneroka perspektif Sejarah, dan menghubungkan masa lalu dengan masa kini dan kehidupan sendiri. (Marcus, 2005) Pendidikan harus membangunkan pemikiran pelajar, bukan dengan memberitahu mereka apa yang perlu difikirkan, sebaliknya dengan membantu mereka mencari makna pembelajaran yang sebenarnya. (Jordan Maria, et al., 2019) Pelajar yang melalui proses inkuiri ini di dalam kelas dapat memperkasakan KPS dan berfikir seperti ahli Sejarah apabila berinteraksi dengan kandungan Sejarah. (Callaway, 2020) Menurut Nurul Hafizah Maarof et al. (2021) KPS sangat mempengaruhi tahap pencapaian pelajar PB antaranya kemahiran interpretasi Sejarah, kemahiran rasionalisasi Sejarah, dan kemahiran imaginasi Sejarah berbanding kemahiran

identifikasi bukti Sejarah dan identifikasi kronologi Sejarah. Pelajar yang mempunyai kemahiran pemikiran Sejarah yang lebih baik adalah pelajar yang diajar oleh ahli Sejarah professional berbanding pelajar yang mempunyai latar pendidikan Sejarah di peringkat asas yang diajar oleh guru yang kurang berpengalaman dalam bidang Sejarah. (Callaway, 2020) Pengalaman mengajar yang lebih lama membuat guru lebih bersedia untuk mengaplikasikan KPS kepada para pelajar namun guru bukan bidang pengkhususan Sejarah juga mampu untuk mengaplikasikan KPS di dalam kelas kerana guru perlu sentiasa bersedia untuk mengubah cara pengajaran mengikut keperluan dan kesesuaian pelajar. (Khairunnajwa Samsudin, et al., 2017) Guru perlu teliti apabila mengajar dan melatih pelajar mengenai KPS agar kelak mereka biasa menggunakannya tanpa disuruh untuk berbuat demikian. (Callaway, 2020)
Berdasarkan soalan kajian yang ketiga; terdapat hubungan antara peningkatan KPS dengan pelajar PB yang mempunyai umur yang berlainan. Menurut Nurul Hafizah Maarof et al. (2021) umur pelajar memainkan peranan yang penting dalam menentukan kebolehan untuk mempraktikkan amalan KPS di kalangan pelajar PB bagi item kemahiran identifikasi bukti Sejarah, rasionalisasi Sejarah, dan kronologi Sejarah. KPS khususnya dalam penggunaan sumber Sejarah dikuasai oleh pelajar yang lebih berusia berbanding pelajar yang lebih muda. (Callaway, 2020) Umur pelajar yang berada di peringkat rendah atas lebih sesuai untuk diperkenalkan KPS dalam melatih mereka untuk berfikir seperti seorang Sejarawan kerana potensinya lebih besar. (Burnett & Cuevas, 2023) KPS perlu diajar dengan cara konsisten dari awal apabila pelajar itu mula mempelajari subjek Sejarah dalam memastikan KPS itu berkembang seiring dengan umur pelajar tersebut. Penguasaan KPS memerlukan masa yang lebih lama berbanding dengan penguasaan ilmu. (Said Hamid Hasan, 2010) Usaha memperkenalkan KPS ini perlu bermula dari awal tahun persekolahan ini bagi membolehkan lebih banyak lagi masa digunakan dalam menambah baik kebolehan KPS dalam pembelajaran Sejarah. (Burnett & Cuevas, 2023)

Melahirkan pelajar yang mampu berfikir seperti seorang Sejarawan memerlukan usaha dan daya kreativiti yang tinggi dalam kalangan guru Sejarah. Pendekatan PdPc haruslah menjurus kepada pedagogi yang bermakna serta berupaya mencakupi kelima-lima jenis kemahiran dalam KPS iaitu memahami kronologi, meneroka bukti, membuat interpretasi, membuat imaginasi dan membuat rasionalisasi. (Kaviza, 2021). Pelajar mempunyai masa yang panjang untuk menonton filem selepas habis waktu persekolahan yang menjadi asbab para guru boleh untuk membekalkan pelajar dengan kemahiran menganalisis, menginterpretasi dan menilai mesej yang terdapat dalam filem. (Metzger, 2010) KPS membantu pelajar menaakul secara mendalam tentang peristiwa Sejarah dalam membina naratif Sejarah penuh berbanding dengan peperiksan aneka pilihan yang hanya mendiagnos pelajar dalam memilih jawapan yang betul. (Ofianto, et al., 2022) Justeru, penggunaan filem dianggap dapat menjadi mekanisme untuk meningkatkan penguasaan KPS di samping menambah penguasaan pelajar terhadap isi pelajaran dengan lebih mendalam seterusnya dapat memenuhi matlamat dan aspirasi negara untuk melahirkan modal insan berminda kelas pertama.

Kesimpulan

Kesimpulannya, dapatan kajian ini menunjukkan bahawa penggunaan filem mampu meningkatkan KPS pada tahap yang memberangsangkan dalam kalangan pelajar PB. Pengintegrasian elemen KPS melalui pengaplikasian filem sememangnya dilihat sebagai pendekatan pembelajaran yang sangat baik untuk menerapkan kemahiran berfikir secara kreatif dan inovatif dan kaedah yang praktikal serta fleksibel bagi pembelajaran anak-anak generasi Z. Sifat dan ciri-ciri yang terdapat pada filem mampu meningkatkan kefahaman dan mengukuhkan daya ingatan pelajar terhadap sesuatu peristiwa atau fakta Sejarah kerana ia boleh ditonton berulang kali tanpa perlu merujuk kepada teks pembacaan yang panjang. Sementara itu, implikasi daripada kajian ini diharapkan dapat memberi pendedahan baharu kepada pelajar kepada pembelajaran akses kendiri dan menggalakkan guru-guru untuk mengamalkan prinsip kepelbagaian dalam PdPc bagi mewujudkan pengalaman pembelajaran yang berkesan, menarik minat pelajar serta mengembalikan motivasi mereka untuk belajar Sejarah. Jelaslah di sini bahawa PdPc berasaskan filem mampu mengasah kemahiran imaginasi dan meningkatkan nilai empati dan kesedaran bukan hanya pada kisah Sejarah, bahkan dapat memberi keseronokan dalam pembelajaran dan seterusnya meninggalkan kesan pembelajaran bermakna kepada pelajar serta matlamat kurikulum Sejarah itu sendiri.

Penghargaan

Setinggi-tinggi penghargaan diberikan kepada rakan penyelidik iaitu Nurul Suzaina Bt. Joli, Nor Syamilah Bt. Md Zin, dan Raja Muhammad Imran B. Raja Abdul serta semua responden atas kerjasama yang telah diberikan dalam menjayakan penyelidikan ini. Terima kasih diucapkan kepada Pusat GENIUS@Pintar Negara, UKM atas dana yang diberikan bagi tujuan kajian, seminar dan penerbitan yang dijalankan.

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6th Langkawi International Multidisciplinary Conference 2023 (6th LIMC 2023)
eISSN 2976-3223
9th – 10th September 2023
Bayview Hotel, Langkawi, Malaysia

ON THE DUALITY OF UNSTEADY MHD AL2O3-CU/WATER HYBRID NANOFLUID FLOW OVER A STRETCHING/SHRINKING CURVED SURFACE WITH NEWTONIAN HEATING

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Abstract: *The notable progress in contemporary engineering technology has prompted a greater emphasis on curved surfaces, due to their wide-ranging utilization in transportation, industrial domains, and electronics. However, additional research is necessary to broaden the scope of applications involving curved surfaces. This study explores the unsteady magnetohydrodynamic (MHD) Copper-Alumina/water hybrid nanofluid flow through a permeable curved stretching/shrinking surface with Newtonian heating applied. Due to the curved nature of the geometry, the present problem is modeled using curvilinear coordinates. The addition of Newtonian heating is due to its vital role in the cooling and heating process for industrial purposes. The partial differential equations (PDEs) of the fluid flow will be reduced through a similarity transformation to ordinary differential equations (ODEs). A numerical solution is obtained by resolving the equations of continuity, momentum, and energy using the bvp4c solver in MATLAB. Furthermore, a comprehensive graphical analysis is conducted to examine the impacts of various physical parameters on the velocity and temperature profiles as well as Local Nusselt number and skin friction. These include the parameters on suction, magnetic, Newtonian heating, nanoparticle volume fraction, and stretch/shrink parameters. By systematically varying these parameters, a dual solution was noticed on the graphs while observing their influence on the flow and heat transfer characteristics. The results show that the range of solutions has expanded with an increase in copper volume fraction and magnetic parameters. A shrinking sheet exhibits greater skin friction when the value of copper and magnetic parameters is increased. In the meantime, the stretching sheet portrayed an opposite trend. The local Nusselt number is enhanced with the strengthened magnetic values and Newtonian heating parameters. Besides, the presence of suction is also responsible for a noteworthy decrease in the rate of heat transfer.*

Keywords: *Curve Surface, Hybrid Nanofluid, MHD, Newtonian Heating,Stretching/Shrinking*.

Introduction

Globally, heat transfer analysis is becoming increasingly important due to the implication of the heating/cooling process in a wide range of industries and consumer products. To address the limitations of conventional working fluids, nanofluids are formulated by dispersing nano-solid particles possessing superior thermal conductivity within the fluid. This will result in enhancing the thermal conductivity of the nanofluid, as demonstrated notionally by Choi *et al*.

[1]. Subsequently, Suresh *et al*. [2] and Momin [3] have published new experimental work on increasing the thermal conductivity of the base fluid. It was discovered that dispersing two distinct categories of nanoparticles in a base fluid, which is known as a hybrid nanofluid (HN) boosts the heat capacity of the traditional fluid. The investigation on HN based on micropolar fluid theory through exponentially stretched surfaces was performed by Subhani and Nadeem [4]. Meanwhile, Elattar *et al*. [5] investigated the HN flow of slender stretching surfaces with the influence of hall current and chemical reaction. Yasir and Khan [6] conducted comparative research on the dynamic viscosity and thermal conductivity of blood-based HN. Other related studies were done by Aladdin *et al*. [7] and Yasir *et al*. [8] using carbon nanotubes and TiO_2-SiO_2 as nanoparticles, respectively. A series of literature done by [9-11] listed the most recent noteworthy articles on a HN by considering a multitude of factors and scenarios.

The study of boundary layer flow on stretching/shrinking surfaces has gained significant research interest in recent times, primarily due to its potential applications in various fields, such as manufacturing, industrial processes, and polymer technology [12]. In contrast with the findings of the stretching sheet, Bachok *et al*. [13] observed that the solutions for shrinking sheet are non-unique. To date, Zainal *et al*. [14] explore the flow of HN over a stretch/shrink surface considering Arrhenius kinetics and radiation effect. Notably, their findings revealed the existence of dual solutions. A few more research on the boundary layer flow of stretching/shrinking surface is accessible in [15-17]. The study of flat surfaces has been extensively conducted, but exposure to curved surfaces was scarce. In the modern engineering sector, the flow through curved surfaces has gained extensive attention due to its diverse applications in transportation, industry, and electronics. Sajid *et al*. [18] conducted a study that extended the previous work of Crane [19] by considering a curved stretching sheet. Afterward, Abbas *et al*. [20] expanded upon the analysis conducted by Sajid *et al*. [18] by investigating the heat transfer characteristics with the prominent of magnetic field for two distinct heating processes, namely prescribed surface temperature (PST) and prescribed heat flux (PHF). Few researchers [21-23] have addressed the fluid flow problems passing the stretching/shrinking curved surface.

The presence of conditions on the surface of a plate has a significant impact on flow behaviors in heat transfer. By imposing suitable restrictions at the boundary surface, the flow characteristics can be altered. Interesting physical challenges arise when there is a controlled transfer of heat from the boundary surface to the fluid flow field. Conventional thermal boundary requirements, such as constant temperature or constant heat flux, may not be applicable in certain cases where additional factors come into play. In such situations, the consideration of Newtonian heating conditions becomes necessary. Newtonian heating (or conjugate convective flows) refers to the scenario in which heat is transferred to the convective fluid through a bounding surface that possesses a limited heat capacity. The inclusion of Newtonian heating conditions in heat transfer analysis can be particularly relevant in high-temperature applications, such as those involving extremely high heat fluxes or intense energy generation. Merkin [24] was the pioneer in studying the Newtonian heating conditions in free convective boundary layer flow over an infinite vertical surface. Hamza *et al*. [25] proposed an analysis on the unsteady MHD free convection flow of an exothermic Arrhenius kinetic fluid with Newtonian heating. The significance of such applications has therefore caused numerous researchers [26-28] to incorporate the Newtonian heating condition into their investigations of convective heat transfer.

In all the studies cited above, it is discovered that the behaviour of unsteady boundary layer flow of a hybrid nanofluid over a curved surface has yet to be investigated. Therefore, in this study, we extend the work of Roşca and Pop [29] by choosing the hybrid nanofluids as the nanoparticles together with the effect of Newtonian heating. The outcomes of the current study on the flow behavior of hybrid nanofluid in curved surfaces are anticipated to provide valuable insights for academics, engineers, and researchers. This knowledge will enable them to better understand the characteristics of this fluid and make predictions about its properties, thereby exploring potential applications in diverse industrial and engineering processes.

Mathematical Formulation

The investigation focuses on the unsteady boundary laminar flow of an incompressible fluid over a curved surface that undergoes simultaneous stretching and shrinking, forming a coiled shape with a radius of R around the curvilinear coordinates r and s, as depicted in Figure 1(a). The larger value of R corresponds to a sheet that is slightly curvy. Meanwhile, the geometry of the stretched and shrunk surface with no stream velocity appeared as in Figures 1(b) and 1(c). Therefore, the surface was assumed to be stretched or shrunk along the direction with the velocity $u_w(s) = as$, where a is a positive constant and $v_w(t)$ is the mass flux velocity. Meanwhile t is defined as the time.

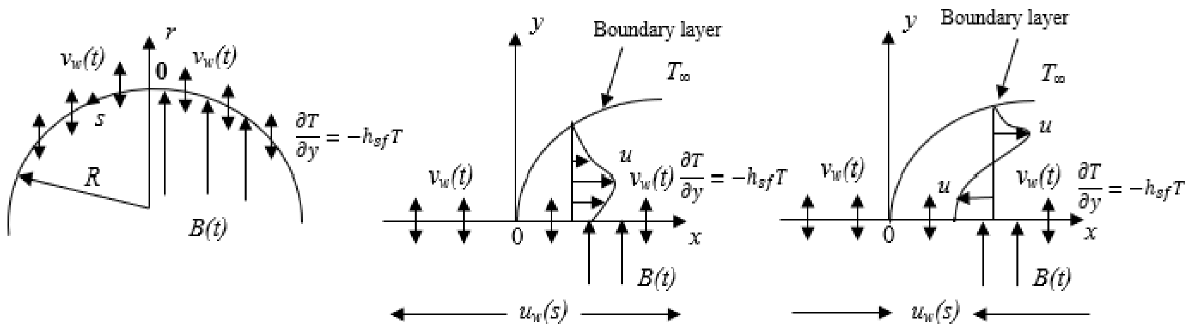


Figure 1(a): Curved sheet
Figure 1(b): Stretching sheet
Figure 1(c): Shrinking sheet

Figure 1: Schematic Diagram of The Flow for a Curved Surface

The governing equations are given as below (see Abbas *et al*. [20], Roşca and Pop [28]):

$$\frac{\partial}{\partial r}\left\{(r+R)v\right\} + R\frac{\partial u}{\partial s} = 0 \tag{1}$$

$$\frac{u^2}{r+R} = \frac{1}{\rho_{hnf}}\frac{\partial p}{\partial r} \tag{2}$$

$$\frac{\partial u}{\partial t} + v\frac{\partial T}{\partial r} + \frac{uR}{r+R}\frac{\partial u}{\partial s} + \frac{uv}{r+R} = -\frac{1}{\rho_{hnf}}\frac{R}{r+R}\frac{\partial p}{\partial s} + \frac{\mu_{hnf}}{\rho_{hnf}}\left(\frac{\partial^2 u}{\partial r^2} + \frac{1}{r+R}\frac{\partial u}{\partial r} - \frac{u}{(r+R)^2}\right) - \frac{\sigma_{hnf}}{\rho_{hnf}}B^2 u \tag{3}$$

$$\frac{\partial T}{\partial t}+v\frac{\partial T}{\partial r}+\frac{uR}{r+R}\frac{\partial T}{\partial s}=\frac{k_{hnf}}{(\rho Cp)_{hnf}}\left(\frac{1}{r+R}\frac{\partial T}{\partial r}+\frac{\partial^2 T}{\partial r^2}\right) \quad (4)$$

along with

$$\begin{aligned}&t<0: u=v=0 \text{ for any } r \text{ and } s,\\ &t\geq 0: v=v_w(t),\ u=\frac{u_w(s)}{1-\alpha t}\lambda,\ \frac{\partial T}{\partial r}=-h_{sf}T \qquad \text{at} \quad r=0\\ &\quad u\to 0, \frac{\partial u}{\partial r}\to 0, T\to T_\infty \qquad \text{as} \quad r\to\infty\end{aligned} \quad (5)$$

Here, u and v represent the velocity components aligned with r and s directions, respectively. Then, p, ρ and μ signify as pressure, density, and dynamic viscosity. The electrical conductivity is denoted by σ and R is radius. Next, λ characterize the stretching or shrinking parameter, i.e. $\lambda>0$ for the stretching surface, $\lambda<0$ for the shrinking surface, and $\lambda=0$ for the static surface. A transverse magnetic field of strength $B(t)=B_0\sqrt{1-\alpha t}$ is applied in the r direction (Naveed *et al*. [29]). Here, B_0 and α are constant where $\alpha>0$ is for accelerated sheet and $\alpha<0$ is for decelerated sheet. T is the temperature, k is thermal conductivity, C_p is heat capacitance and h_{sf} is the heat transfer coefficient. Note that the subscript of "hnf" denotes hybrid nanofluid.

Table 1 tabulates the thermophysical properties of the hybrid nanofluids from the correlation by Takabi and Salehi [30] where $\phi_{hnf}=\phi_1+\phi_2$. Hence, the subscript of '1', '2' and 'f' denote the Alumina nanoparticle, Copper nanoparticle and base fluid, respectively. Table 2 illustrates the values for the correlation of the thermophysical properties for nanoparticles and base fluid (see Oztop and Abu Nada [31] and Waini *et al*. [32]).

Table 1 Correlation on Thermophysical Properties of Hybrid Nanofluid

Properties	Hybrid Nanofluid
Dynamic Viscosity (μ)	$\frac{\mu_{hnf}}{\mu_f}=\frac{1}{(1-\phi_{hnf})^{2.5}}$
Density (ρ)	$\rho_{hnf}=(1-\phi_{hnf})\rho_f+\phi_1\rho_1+\phi_2\rho_2$
Heat Capacity (ρC_p)	$(\rho C_p)_{hnf}=(1-\phi_{hnf})(\rho C_p)_f+\phi_1(\rho C_p)_1+\phi_2(\rho C_p)_2$
Thermal Conductivity (k)	$\frac{k_{hnf}}{k_f}=\left[\frac{\left(\frac{\phi_1k_1+\phi_2k_2}{\phi_{hnf}}\right)+2k_f+2(\phi_1k_1+\phi_2k_2)-2\phi_{hnf}k_f}{\left(\frac{\phi_1k_1+\phi_2k_2}{\phi_{hnf}}\right)+2k_f-(\phi_1k_1+\phi_2k_2)+\phi_{hnf}k_f}\right]$

Electrical Conductivity (σ)	$\frac{\sigma_{hnf}}{\sigma_f}=\left[\frac{\left(\frac{\phi_1\sigma_1+\phi_2\sigma_2}{\phi_{hnf}}\right)+2\sigma_f+2(\phi_1\sigma_1+\phi_2\sigma_2)-2\phi_{hnf}\sigma_f}{\left(\frac{\phi_1\sigma_1+\phi_2\sigma_2}{\phi_{hnf}}\right)+2\sigma_f-(\phi_1\sigma_1+\phi_2\sigma_2)+\phi_{hnf}\sigma_f}\right]$

Table 2 Values of Thermophysical Properties for Nanoparticles and Base Fluid

Physical Properties	Base Fluid Water)	Copper (Cu)	Alumina (Al_2O_3)
$C_p(J/kg\ K)$	4179	385	765
$\rho(kg/m^3)$	997.1	8933	3970
$k\ (W/m\ K)$	0.613	400	40
$\sigma(S/m)$	0.05	5.96×10^7	3.69×10^7

A set of similarity variables is introduced which assures that Eq. (1) is satisfied are as below:

$$u=\frac{as}{1-\alpha t}f'(\eta),\quad v=-\frac{R}{r+R}\sqrt{\frac{a\upsilon_f}{1-\alpha t}}f(\eta),\quad \eta=\sqrt{\frac{a}{\upsilon_f(1-\alpha t)}}r,$$
$$p=\frac{\rho_f a^2 s^2}{(1-\alpha t)^2}P(\eta),\quad \theta(\eta)=\frac{T-T_\infty}{T_\infty}. \tag{6}$$

Using the Eq. (6), Eqs. (2) – (4) together with the boundary conditions (5) are transformed as below:

$$\frac{\mu_{hnf}/\mu_f}{\rho_{hnf}/\rho_f}\left(f^{iv}+\frac{2}{\eta+K}f'''-\frac{1}{(\eta+K)^2}f''+\frac{1}{(\eta+K)^3}f'\right)+\frac{K}{\eta+K}(ff'''-ff'')$$
$$+\frac{K}{(\eta+K)^2}(ff''-f'^2)-\frac{K}{(\eta+K)^3}ff'-\frac{\beta}{2}(\eta f'''+3f'')-\frac{\beta}{\eta+K}\left(f'+\frac{\eta}{2}f''\right) \tag{7}$$
$$-\frac{\sigma_{hnf}/\sigma_f}{\rho_{hnf}/\rho_f}M\left(f''+\frac{1}{\eta+K}f'\right)=0.$$

$$\frac{k_{hnf}/k_f}{(\rho Cp)_{hnf}/(\rho Cp)_f}\frac{1}{\Pr}\left(\frac{1}{\eta+K}\theta'+\theta''\right)-\frac{\eta}{2}\beta\theta'+\frac{K}{\eta+K}f\theta'=0. \tag{8}$$

along with the boundary conditions:

$$f(0)=S,\quad f'(0)=\lambda,\quad \theta'(0)=-N(\theta(\eta)+1)$$
$$f'(\eta)\to0,\quad f''(\eta)\to0,\quad \theta(\eta)\to0 \qquad \text{as} \quad \eta\to\infty \tag{9}$$

Where $N = h_{sf}\sqrt{\frac{\nu_f(1-\alpha t)}{a}}$ is the Newtonian heating parameter, $K = \sqrt{\frac{a}{\nu_f(1-\alpha t)}}R$ is the curvature, $\beta = \frac{\alpha}{a}$ is the unsteadiness parameter, $M = \frac{\sigma_f}{\rho_f}B_0^2$ is the magnetic parameter, and Pr is the Prandtl number.

The attentiveness study for this problem is skin friction C_f and Nusselt number Nu_s. Both can be represented as

$$C_f = \frac{\tau_s}{\rho_f u_w(s)^2}, \quad Nu_s = \frac{sq_s}{k_f(T_w - T_\infty)} \tag{10}$$

With τ_s is the surface shear stress and q_s is the heat flux of the wall. The expression is given as follows:

$$\tau_s = \mu_{hnf}\left(\frac{\partial u}{\partial r} - \frac{1}{r+R}u\right)_{r=0}, \quad q_s = -k_{hnf}\left(\frac{\partial T}{\partial r}\right)_{r=0}. \tag{11}$$

By using Eqs. (6) and (11), the Eq. (10) are transformed into:

$$C_{fr} = \frac{\mu_{hnf}}{\mu_f}\left(f''(0) - \frac{\lambda}{K}\right), \quad Nu_{sr} = -\frac{k_{hnf}}{k_f}\left(\frac{1}{\theta(0)} + 1\right) \tag{12}$$

where $\mathrm{Re}_s = \frac{u_w(s)s}{\nu_f}$ is the Reynolds number, $C_{fr} = C_f \mathrm{Re}_s^{\frac{1}{2}}(1-\alpha t)^{\frac{3}{2}}$ is the reduced skin friction coefficient and $Nu_{sr} = Nu_s\left(\frac{\mathrm{Re}_s}{1-\alpha t}\right)^{-\frac{1}{2}}$ is the local Nusselt number.

3. Results and Discussion

3.1 Validation of Results

The computational strategy to elucidate the boundary value problem for Eqs. (7) - (9) can be conducted by solving them numerically in MATLAB using the bvp4c package. A comparison from the prior study published by Abbas *et al.* [20] and Roşca and Pop [28] for the possible solutions to the current flow problem has been furnished in Table 3 for certain limiting cases to verify that our model and numerical computation are credible. Therefore, we are confident in presenting our results in the next section.

Table 3: Comparison Values of $f''(0)$ with $\phi_1 = \phi_2 = S = \beta = M = N = 0, \lambda = 1$ for Several Values of Curvature Parameter, *K*.

K	Abbas *et al.* [20]	Roşca and Pop [28]	Present Results
5	1.15763	1.15076	1.15763
10	1.07349	1.07172	1.07349
20	1.03561	1.03501	1.03561
30	1.02353	1.02315	1.02353
40	1.01759	1.01729	1.01759
50	1.01405	1.01380	1.01405
100	1.00704	1.00687	1.00704
200	1.00356	1.00342	1.00356
1000	1.00079	1.00068	1.00079
∞	1.00000	1.00000	1.00000

3.2 Effect of Emerging Parameters

The discussion on the results of physical interest towards the governing parameters examined for this study is elaborated in this section. The sequel to the graphical results is obtained by computing Eqs. (7) - (9) into the bvp4c, MATLAB. The emphasizing on the dual solutions can be discerned through Figures 2 – 7. Meanwhile, profiles of the hybrid nanofluid with affected limitations, including suction (S), magnetic (M), and Newtonian heating (N) parameters, were illustrated in Figures 8 - 14.

The graphical illustration for skin friction coefficient C_{fr} and local Nusselt number Nu_{sr} are presented in Figure 2 and Figure 3 for three distinct volume fractions of copper (ϕ_2) over changes of stretching/shrinking parameter λ. As we observed, two potential solutions are obtainable in this case, possibly as a result of the reversal of flow from the shrinking condition. Consequently, a critical point, λ_c for the detachment of the boundary layer appeared to be noticeable in the figures. Here, the critical point as $\phi_2 = 0$ is $\lambda_c = -0.948184$, $\phi_2 = 0.01$ is $\lambda_c = -0.988699$ and $\phi_2 = 0.02$ is $\lambda_c = -1.026986$. It can be clearly noted that the increment of the volume fraction of copper from 0.01 to 0.02 impeded the detachment of the boundary layer from occurring rapidly. Interestingly, the value of C_{fr} is affected with the elevation of ϕ_2 at the stretching region, while contradictory behavior of flow was observed at the shrinking region.

According to Figure 3, the local Nusselt number Nu_{sr} decreases with the increment of ϕ_2 from 0.01 to 0.02 for both stretching or shrinking region. It also worth noting that the value of Nu_{sr} for the first solution is greater compared to the second solution. To the author's concern, a small amount of ϕ_2 is said to be sufficient to intensify the heat transfer rate. This happen due to the systems' cooling rate with the increases in the value of copper volume fraction, ϕ_2 which has reduced the cooling capacity as the viscous fluid is transformed into the hybrid nanofluid.

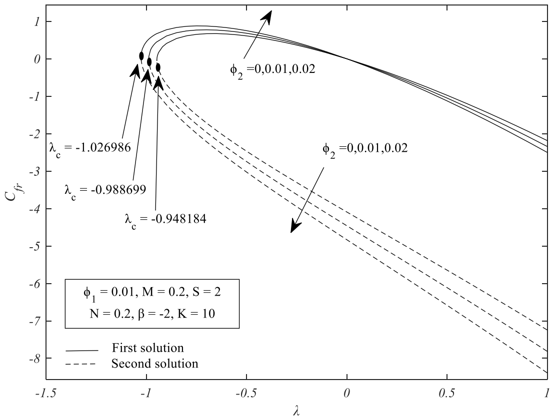


Figure 2: Skin Friction, C_{fr} Against λ for Distinct Values of Copper Volume Fraction, ϕ_2

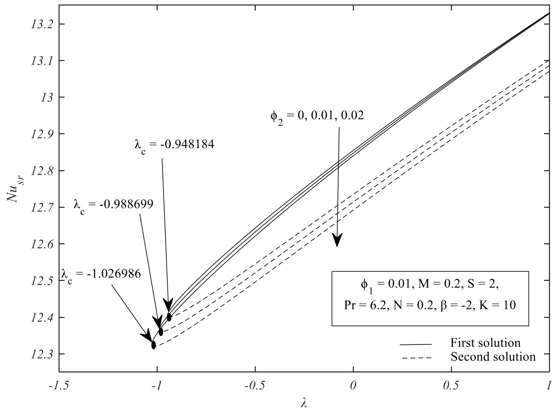
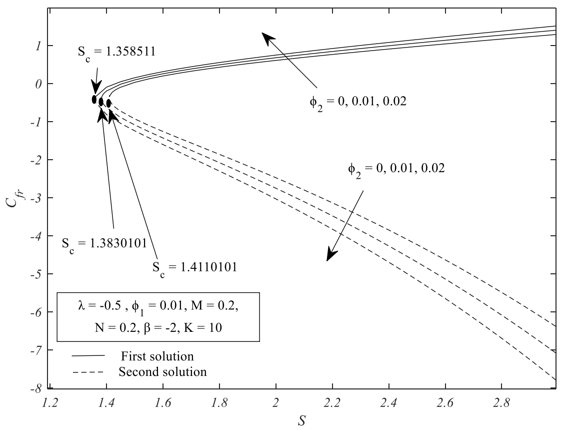


Figure 3: Local Nusselt Number, Nu_{sr} Against λ, for Distinct Values of Copper Volume Fraction, ϕ_2

Figure 4 and Figure 5 depict the sequel of the physical interest of this study towards suction S with three distinctive values of ϕ_2. In Figure 4, the slightly changes in viscosity of nanoparticles exhibits strong suction within the shrinking region and generate the emergence of the dual solution i.e.: $\phi_2 = 0\left(S_c = 1.4110101\right)$, $\phi_2 = 0.01\left(S_c = 1.3830101\right)$ and $\phi_2 = 0.02\left(S_c = 1.358511\right)$. This explains that the concentration of nanoparticles increases, causing substantial obstructions to the fluid's ability to flow freely, resulting in a higher level of suction required. However, the distribution of Nu_{sr} shows an opposed trend when ϕ_2 is added for both first and second solution regardless of the direction of the sheet. This result seems deviate with the findings from Sarkar *et al.* [33] but concurred with the findings from Khashi'ie *et al.* [34] on the role of suction with the increment of ϕ_2 in related to the heat transfer process. The addendum of ϕ_2 from 1% to 2% shorten the magnitude of S_c from 1.3830101 to 1.358511 which manifested that small concentration of ϕ_2 $\left(<1\%\right)$ is sufficient in suspending the process of boundary layer separation.



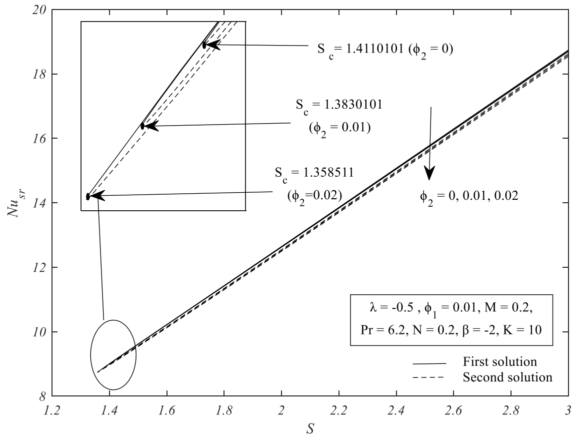


Figure 4: Skin Friction, C_{fr} Against S for Distinct Values of Copper Volume Fraction, ϕ_2

Figure 5: Local Nusselt Number, Nu_{sr} Against S, for Distinct Values of Copper Volume Fraction, ϕ_2

Meanwhile, the variation of skin friction coefficient C_{fr} and local Nusselt number Nu_{sr} against stretching/shrinking parameter λ for three distinct values of magnetic field M are deliberated in Figure 6 and Figure 7. Obviously, the strong M widen the range of the solution and also delaying the boundary layer separation process to occur in the shrinking region, ie: $M = 0\left(\lambda_c = -0.8567901\right)$, $M = 0.01\left(\lambda_c = -0.988699\right)$ and $M = 0.02\left(\lambda_c = -1.125801\right)$. Besides, both C_{fr} and Nu_{sr} increased as M is added to the flow. This means that the interaction between the magnetic field and hybrid nanofluid will trigger a resistance force which is called the Lorentz force. The presence of this force impedes the separation of the boundary layer by repelling the fluid motion. Apart from that, the constant governing parameter of S added together with the Lorentz force circulates simultaneously which activates the process of heat transfer.

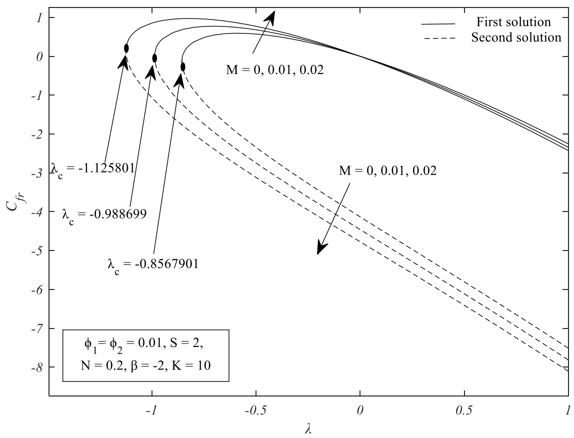


Figure 6: Skin Friction, C_{fr} Against λ for Distinct Values of Magnetic Parameter, M

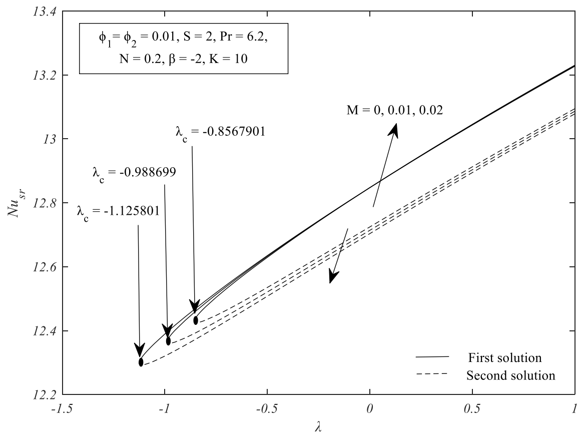


Figure 7: Local Nusselt Number, Nu_{sr} Against λ, for Distinct Values of Magnetic Parameter, M

Figures 8-11 exhibit the velocity and temperature profiles corresponding to various values of ϕ_2 for the hybrid nanofluid, as well as the suction parameter S. In certain circumstances for the velocity profile, the increasing of ϕ_2 and S resulted in an upsurge for the first solution, however, a contradicting behavior was noticed for the second solution. The selected value of $\lambda \approx 0.5$ which is close to the critical value for the justification of the resulting dual solutions obtained from the figures. On a curved surface, fluid particles experience varying flow velocities due to curvature effects. The increased shear stress near the surface due to higher viscosity may lead to a reduced momentum boundary layer thickness, particularly on the convex side of the curved surface. Simultaneously, the enhanced thermal conductivity from nanoparticles can result in a broader thermal boundary layer, particularly on the concave side of the curved surface.

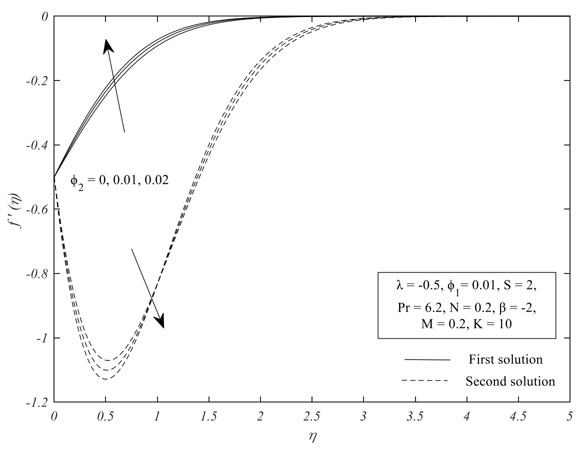


Figure 8: Velocity Profile, $f'(\eta)$ for Distinct Values Copper Volume Fraction, ϕ_2

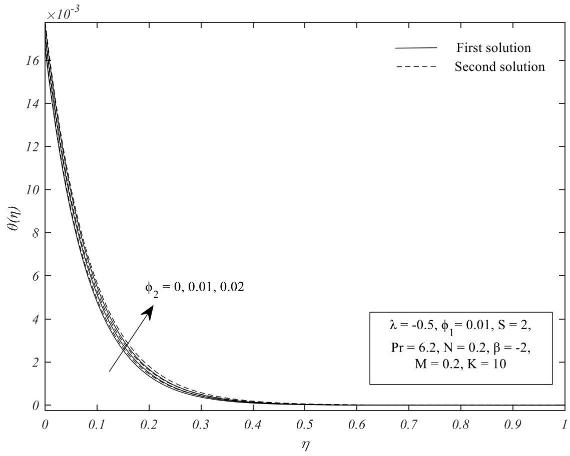


Figure 9: Temperature Profile, $\theta(\eta)$ for Distinct Values Copper Volume Fraction, ϕ_2

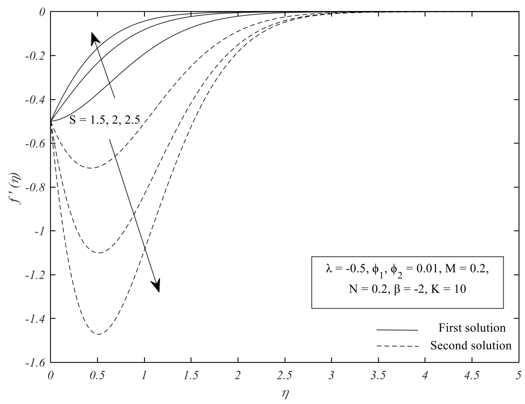


Figure 10: Velocity Profile, $f'(\eta)$ for Distinct Values of Suction, S

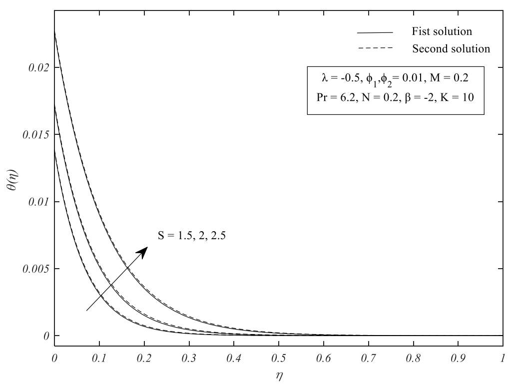


Figure 11: Temperature Profile, $\theta(\eta)$ for Distinct Values of Suction, S

Figure 12 displays the temperature profile for the effect of *N*. By observation, adding the Newtonian heating parameter increases the temperature of the fluid. This may cause a reduction in the fluids' density and amplify the surface temperature. Additionally, the fluid will have more resistance and will produce more heat. As more heat is transferred into the fluid, the temperature profile within the fluid changes. This can lead to a wider thermal boundary layer. All the figures asymptotically fulfilled the boundary condition (9).

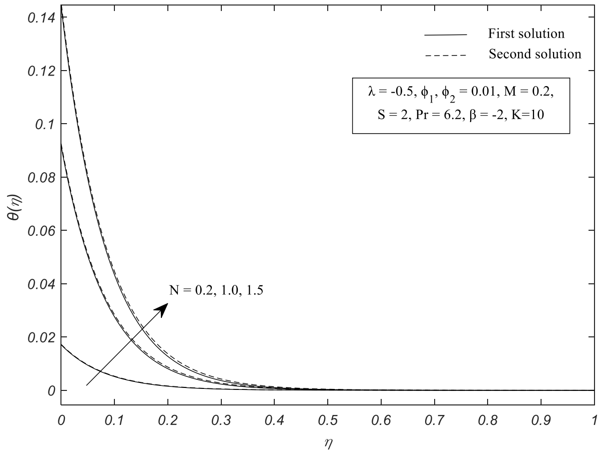


Figure 12: Temperature Profile, $\theta(\eta)$ for Different Values of Newtonian Heating Parameter, N.

Result for the Nusselt number, Nu_{sr} with three distinct values of Newtonian heating parameter N and several values of stretching/shrinking parameter λ was tabularized in Table 4. It explicates that the increasing value of λ has increase the value of the Nusselt number, Nu_{sr} for both first and second solution. It is worth mentioning that Table 4 indicates the analysis done from Figure 12.

Table 4: Result for Nusselt Number, Nu_{sr} with Three Distinct Values of The Newtonian Heating Parameter, N Through Stretching/Shrinking Parameter, λ.

N	λ	Nusselt Number, Nu_{sr}	
		First Solution	Second Solution
0.2	1	13.22888015	13.08637066
	0.5	13.04441517	12.90351932
	0	12.84752271	12.71397837
	-0.5	12.63239237	12.52104346
1.0	1	13.22888022	13.08637072
	0.5	13.04441520	12.90351939
	0	12.84752276	12.71397841
	-0.5	12.63239237	12.52104348
1.5	1	13.22888023	13.08637073
	0.5	13.04441520	12.90351940
	0	12.84752277	12.71397844
	-0.5	12.63239237	12.52104348

4. Conclusions

This innovative study presents a numerical investigation into the flow characteristics of unsteady MHD hybrid nanofluid on a curved surface that is subject to permeable stretching or shrinking, incorporating the effects of Newtonian heating. The use of magnetohydrodynamics is to examine how electrically conducting fluids behave in a magnetic field. Meanwhile, Newtonian heating is a cooling process whereby the internal resistance is significantly less than surface resistance during the heating process. For better understanding, the summarized findings are as below:

- The dual solution exists at both stretching/shrinking region.
- The utilization of hybrid nanofluid $\left(\phi_{hnf}\right)$ and M enhance the range of achievable solutions and mitigates the occurrence of boundary layer separation, thereby decelerating the process.
- The skin friction and Nusselt number exhibit a positive enhancement in magnitude with the inclusion of M .
- The Newtonian heating parameter N elevates the temperature of the hybrid nanofluid flow.

Acknowledgement

The authors appreciatively acknowledge that this research was funded by MyRA Research Grant (600-RMC 5/3/GPM (035/2022)) and School of Mathematical Sciences, College of Computing, Informatics and Mathematics, Universiti Teknologi MARA.

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AN ASSESSMENT OF GREEN ENVIRONMENTAL MANAGEMENT DIMENSIONS IN CORPORATE SOCIAL RESPONSIBILITY (CSR) PROGRAMS: A PRE-TEST STUDY AT PONTIAN DISTRICT, JOHOR STATE OF MALAYSIA

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Abstract: *Green environmental management is an important arrangement that need to be assessed precisely and accordingly in organization that can give the impact towards the quality working life of stakeholders. The study aims to identify the agreement level of the green environmental management dimensions at the Pontian District at Johor State of Malaysia. The respondents of the study was the 140 stakeholders namely as employees from municipal department in the area of Pontian District at Johor State of Malaysia. The objective of the study is to do the pre-test of the green environmental management dimensions before the questionnaires is adapted to suit the research instrument that will be used for data collection namely as survey. The pre-test is important to look over on the suitability and reliability of the research dimensions that will be used to be focused in the perspectives of Corporate Social Responsibility programs in the area of environmental management specifically. The methods of study used is quantitative methods with self-administered survey and analyse with the descriptive statistics. The findings showed that the Green Environment Efficiency dimensions overall agreement perception was 72.5 percent, the Green Environment of Waste Management overall percentage was 60.8 percent whilst the Green Quality of Life overall agreement percentage are 66.8 percent, the Green Organizational Climate Dimension overall agreement are 73.5 percentage and the Green Environment Enforcement Bodies dimension got the overall agreement of 73.3 percent. The overall percentage agreement of the green environmental dimensions showed the moderate level of agreement.*

Keywords: *Green Environment Efficiency, Green Environment of Waste Management, Green Quality of Life, Green Environment Enforcement, Green Organizational Climate.*

Introduction

Environmental Management is the process of controlling any potential negative impact on the external environment from the nature activities. It also means increasing those initiatives which may have a positive effect. Green environmental management is one of the growing developments in management to ensure of the environmental awareness, behavior and management that leads to the strategic implementation and operation of environment initiatives, planning and activities. Green environmental management dimensions selected in this pre-test study were based on the research findings and literature review in environmental management.

Literature Review
The definitions and description of each dimensions that are used in the pre-test study are as following:

Green Environment Efficiency: a green environment efficiency focuses on using resources efficiently, in a circular manner, so as to reduce waste to a bare minimum. It seeks to rebalance the consumer-driven model towards one that is more sustainable in terms of natural resource usage. Less pollution with similar or higher levels of economic production and growth, i.e. greater environmental efficiency in production processes, is a central theme in green growth.

Green Environment of Waste Management: Green waste is collected in a commercial recycling bin for organic waste, or a green bin/compost bin. The bags of green waste are then collected by a dedicated organic waste truck or a recycling/organic waste truck. Green waste, also known as "biological waste", is any organic waste that can be composted. It is most usually composed of refuse from gardens such as grass clippings or leaves, and domestic or industrial kitchen wastes.

Green Quality of Life: Quality of life is defined as a perspective of a work life style that focuses on the aspects of satisfaction, enjoyment and happiness in the workplace through what has been felt before, current and in future throughout the efforts and services they work in an organization (Indumathy & Kalamraj, 2012). Quality of life practiced by the organization effectively takes the approach that the employee is an "asset" that needs to be taken care of by providing the needs and wants of the employee in line with the level of the employee's position so that the employee can perceive the work they are doing can bring the quality of their lives. Additionally, employees can enjoy a quality of life with a healthy, happy work environment and good physical and mental health throughout their lives as long as they work in the organization (Halbesleben & Buckley, 2004). Quality of Life is a comprehensive program designated to improve worker's satisfaction, strengthen workplace learning and help workers better manage the change and transition which affects almost all workers regardless of position or status (Grant, 2008). Quality of life also means strengthening their interest and motivation to work if their work situation and environment can change their life expectancy and that work can teach and guide them in life (Pruijt, 2000).

Green Organizational Climate: involved in the establishment of a green organizational climate; this climate is defined as the employees' shared perceptions of the environmental policies and practices of the organization (Norton et al., 2012; Norton et al., 2014).

Green Environment Enforcement: The purpose of the Environmental Enforcement is to address anti-social and illegal behavior to improve the environment and minimize waste clean-up and disposal costs.

The summary of key concepts of environmental management used for this study were as follows in Table 1.

Table 1: The Summary of Key Concepts of Research Dimensions

Dimensions	Definitions	Sources
Green Environment Efficiency Dimensions	Refers to efficiency is a situation in which the distribution of environment resources in fit with society needs and requirements for environment benefits	Mitchell, B. (2002)
Green Environmental of Waste Management	The activities and actions required to manage waste from its inception to its final disposal. This includes the collection, transport, treatment and disposal of waste, together with monitoring and regulation of the waste management process.	Adam, W.M. (2009) Marans, R.W. and Lee, Y-J. (1993/10)
Green Quality of Life Dimension	Quality of work life (QWL) refers to as satisfaction of the key needs through resources, activities, and outcomes stemming from participation in the workplace	Boiral, O. and Paillé, P. (2012) Brio, J.A., Fernandez, E. and Junquera, B. (2007) Cherian, J. and Jacob, J. (2012
Green Organizational Climate Dimension	Defined as the individual employee's perception of the psychological impact of the work environment on his or her own well-being	Del Brío, J., Fernández, E. and Junquera, B. (2007) Govindarajulu, N. and Daily, B.F. (2004) Carlopio, J. (1996)
Green Environment Enforcement Bodies/Agency	Describing the network of the statutes, regulations, common and customary laws addressing the effects of human activity on the natural environment.	Tung, A., Baird, K. and Schoch, H. (2014)

Research Methodology

Research Objectives

The research objectives of this study are to identify the pre-test of the research instruments agreement percentage based on the public employees' institutions perceptions at Pontian District, Johor State, Malaysia on the aspects of green environmental management dimensions that consists of green environment efficiency, green environment of waste management, green quality of life, green organizational climate and green enforcement bodies.

Research Questions

The research questions of the study are as follows:

1. What are the perception level of agreement of employees at Pontian District, Johor State, Malaysia on green environmental efficiency dimensions?
2. What are the perception level of agreement of employees at Pontian District, Johor State, Malaysia on green environment of waste management dimensions?
3. What are the perception level of agreement of employees at Pontian District, Johor State, Malaysia on green quality of life dimensions?

4. What are the perception level of agreement of employees at Pontian District, Johor State, Malaysia on green organizational climate dimensions?
5. What are the perception level of agreement of employees at Pontian District, Johor State, Malaysia on green enforcement bodies dimensions?

The Respondents

The respondents of the study consists of 120 employees in four public institutions and municipal department at Pontian District, Johor State of Malaysia.

Research Instrument

A questionnaire is the research instrument was based on the adopted version of various researchers and was modified to meet the need and requirement of this research. The pre-test research was conducted by taking sample of 120 respondents consisting of a group of employees from various public organizations that include the municipal department at the Pontian District, Johor State of Malaysia. From the statistical analysis using SPSS Window, the acceptance index for this instrument is Alpha Cronbach as per mentioned above.

The number of statement for each instrument items of dimensions and the Alpha Cronbach value for testing of the research instrument reliability are presented Table 2.

Table 2: The Reliability of the Research Instrument

Research Dimensions	Summary Descriptor	Number of Statements	Alpha Cronbach Value
1. Green environment efficiency	Efficiency	8	0.700
2. Green environment of waste management	Waste management	8	0.800
3. Green quality of life	Quality of working life	34	0.650
4. Green Organizational Climate	Organizational climate	34	0.750
5. Green environment enforcement bodies	Enforcement	11	0.680
Total		95	

Based on the Alpha Cronbach value on testing of the research dimensions reliability showed that all research dimensions are reliable to be used as the research instrument with the Alpha Cronbach value for Green environment efficiency with eight item statements is 0.700. Green environment of waste management is 0.800, Green quality of life Alpha Cronbach Value is 0.650, Green quality of life and organizational climate with thirty four item statements as considered the highest number of item statement got the Alpha Cronbach Value 0.650 and 0.750 and the last research dimensions is Green environment enforcement bodies with Alpha Cronbach value is 0.680.

Research Findings

The presentation of the research findings will be based on the percentage of respondents' overall agreement consisting of 'Strongly Agree' and 'Agree'. The Likert Scale of the study were based on five Likert Scale with 1 – Strongly Disagree, 2 – Disagree, 3 – Moderately Agree, 4 – Agree and 5 – Strongly Agree. The findings identifying the public perception on green environmental dimensions will be based on the agreement percentage on the Likert Scale of Agree and Strongly Agree.

The research findings were presented in Table 3 showed that the majority of respondent gender are female with 52.8 percent and the education level majority are degree with 90.8 percent. The demographic profile of respondents are shown in Table 3 as follows:

Table 3: The Demographic Profile of Respondents at Pontian District, Johor State

No	Demographic Variable	Pontian District, Johor State Majority	Percentage (%)
1.	Gender	Female	52.8
2.	Citizenship	Citizen	98.0
3.	Age	21-30 years old	53.6
4.	Education Level	Degree	90.8
5.	Occupational Sector	Government	67.6
6.	Monthly household Income	RM5,001 – RM7,000	67.2

The research findings are presented based on the research question precisely and accordingly as per stated below:

Research Question 1 - Green Environment Efficiency Dimensions. What is the agreement level of public Malaysian employees at Pontian District, Johor State on green environmental efficiency practices?

Table 4: Green Environment Efficiency Dimensions

No.	Item Statements To my understanding as an employees, the impact of environmental problems and inefficiency of natural resources will……	% Agreement
1.	Be a natural waste for generation	86.7
2.	Waste water effluent	73.3
3.	Create Local & regional air pollution	80.0
4.	Increase Global pollutants e.g. greenhouse gases	80.0
5.	Increase Aesthetic effects (noise, smell, landscape)	80.0
6.	Lead to Soil contamination	80.0
7.	Lead to Risk of severe accidents	53.3
8.	Increase Use of natural resource e.g. energy, water, etc	46.6
	Overall	72.5

The research findings on Green Environment Efficiency dimensions in Table 4 indicated that most of the employees agreed on the item statements related to "Be a natural waste for generation" get the highest agreement with a 86.7 percent agreement while statement "Increase Use of natural resource e.g. energy, water, etc" get the lowest percentage with only 46.6

percent. The overall percentage agreement based on the eight item statements of Green Environment Efficiency Dimensions was 72.5 percent.

Research Question 2 - Green Environmental of Waste Management Dimension. What is the agreement level of public Malaysian employees at Pontian District, Johor State, Malaysia on green practices in waste management?

Table 5: Green Environmental of Waste Management Dimension

No.	Item Statements To my believe that the government was/will do the waste management accordingly and specifically on the following:	% Agreement
1.	Does solid waste separation from the source	80.0
2.	Uses recycled materials such as paper for work and in operations	73.3
3.	Disposes chemical wastes properly	40.0
4.	Has cooperation with recycling companies	60.0
5.	Focuses on waste reductions at all functions and operations	26.7
6.	Analyses its internal processes using the right method to minimize waste	40.0
7.	Works together with its supply chain partner to eliminate wastes	93.3
8.	Cooperates with the community in waste management	73.4
	Overall	60.8

The research findings on Green Environmental of Waste Management dimensions in Table 5 indicated that most employees agreed on the item statements related to "Works together with its supply chain partner to eliminate wastes" with a 93.3 percent agreement whilst the statement of "Focuses on waste reductions at all functions and operations" get the lowest percentage with only 26.7 percent. The overall percentage agreement based on the eight item statements of Green Environmental of Waste Management Dimensions was 60.8 percent.

Research Question 3 – Green Quality of Life Dimension. What is the agreement level of public Malaysian employees at Pontian District, Johor State, Malaysia on green quality of life?

Table 6: Green Quality of Life Dimension

No.	Item Statements To my believed that my workplace management of sustainable resources are…	% Agreement
1.	Arouse enthusiasm and build optimism on green working practices	93.3
2.	Form sound work groups towards green environmental management	93.3
3.	Provide motivation towards green environmental management	53.3
4.	Persuade employees to perform green environmental management	80.0
5.	Makes working on green tasks more pleasant for employees	73.4
6.	Treats green team members as equal	33.4
7.	Explains how green tasks should be carried out	13.4
8.	Decides what and how green management should be done	100.0
9.	Maintain definite standards of green work performance	93.4
10.	Demonstrate good communication skills in green management	93.3

11.	Demonstrate positive leadership qualities in green management)	40.0
12.	Develop practical and realistic programs in green management	60.0
13.	Analyze problems in green management and arrive at appropriate solutions	60.0
14.	Have the freedom to adapt environmental goals as needed	93.3
15.	Treat green team members as equals regardless of rank, culture, or other differences	80.0
16.	Focus both on green task and group performance	60.0
17.	Are rewarded for their achievement in green management as a team	73.3
18.	Are confident that organizations will act on their green management recommendations	46.7
19.	Communicate mostly directly and personally with each other about green management	53.3
20.	Openly share relevant information on green projects with the whole team	93.3
21.	Are happy with the usefulness of green information shared by teammates	93.3
21.	Recognize specific potentials (strengths and weaknesses) of individual team members in green management	86.6
22.	Contribute to the achievement of the team's environmental goals according to their specific potentials	66.6
23.	Discuss and further develop green management suggestions and contributions of team members	73.4
24.	Acknowledge conflict and work to resolve green management issues as a team	53.4
25.	Acknowledge the green management contributions made by others on the team	53.3
26.	Emphasis on long term development of green employee training plans	80.0
27.	Frequent evaluation of green employee training programs	80.0
28.	Adequate budget for green employee training	80.0
29.	Comprehensive green training activities for employees	100.0
30.	Extensive investment of time/ money/ other resources for green training	100.0
31.	Continuous green training activities	86.6
32.	Incentives for green employee development	80.0
33.	Offer training that provides career development opportunity	66.6
34.	Be able to develop the comprehensive environmental training policies and programs that are reliable for employees	53.3
	Overall	66.8

The research findings on Green Quality of Life dimensions in Table 6 indicated that most employees agreed on the item statements related to 'Decides what and how green management should be done", "Comprehensive green training activities for employees" and "Extensive investment of time/money/ other resources for the green training" with a 100 percent agreement while statement 'Explains how green tasks should be carried out" get the lowest percentage with only 13.4 percent. The overall percentage agreement based on the thirty four item statements of Green Quality of Life Dimensions was 66.8 percent.

Research Question 4 – Green Organizational Climate Dimension. What is the agreement level of public Malaysian employees at Pontian District, Johor State, Malaysia on green organizational climate dimensions?

Table 7: Green Organizational Climate Dimension

No.	Item Statements To my belief that the workplace that I worked for……………………..	% Agreement
1.	Will personally contribute to green management work	100.00
2.	Feel that working at green management will contribute to my success at the workplace	66.7
3.	Believe on the green-related work that I am assigned to and will make good use of my knowledge and skills	80.0
4.	Feel that convenient physical work environment enables me to do my green-related job effectively	86.7
5.	Get opportunities to grow and learn new skills in green management	80.0
6.	Am satisfied being a part of my organization that practices green environmental management	66.7
7.	Believe that I am motivated towards practicing green environmental management at work	60.0
8.	Regularly let me know what is expected of me in doing my green work effectively	93.3
9.	Provide the resources I need (equipment, materials, information, etc.) to do my green job effectively	86.7
10.	Give me the individual help and support I need to do my green job effectively	66.6
11.	Offer me opportunities to grow and learn green environmental management skills	26.6
12.	Give supportive feedback on the green job that I do	93.4
13.	Help me solve environmental problems at work	93.4
14.	Talk to the superior about something that has upset or annoyed me about green work	73.4
15.	Keep their employees informed of their latest environmental issues that affects employee interest	93.4
16.	Encourage employees to speak up and voice their opinions frankly without fear of punishment	66.6
17.	Allow employees to channel their grievance on environmental issues at the workplace	86.7
18.	Allow employees to be optimistic about the future of this organization in terms of environmental management.	80.0
19.	Make employees proud of the organization's green environmental management	40.0

20.	Encourage employees' spirit towards making the organization's green environmental management efforts a success	40.0
21.	Keep their employees informed of their latest environmental issues that affects employee interest	20.0
22.	Will personally contribute to green management work	100.00
23.	Feel that working at green management will contribute to my success at the workplace	66.7
24.	Believe on the green-related work that I am assigned to and will make good use of my knowledge and skills	80.0
25.	Feel that convenient physical work environment enables me to do my green-related job effectively	86.7
26.	Get opportunities to grow and learn new skills in green management	80.0
27.	Am satisfied being a part of my organization that practices green environmental management	66.7
28.	Believe that I am motivated towards practicing green environmental management at work	60.0
29.	Regularly let me know what is expected of me in doing my green work effectively	93.3
30.	Provide the resources I need (equipment, materials, information, etc.) to do my green job effectively	86.7
31.	Give me the individual help and support I need to do my green job effectively	66.6
32.	Offer me opportunities to grow and learn green environmental management skills	25.6
33.	Give supportive feedback on the green job that I do	93.4
34.	Help me solve environmental problems at work	93.4
	Overall	73.5

The research findings on organizational climate dimensions in Table 7 indicated that most employees agreed on the item statements related on 'Will personally contribute to green management work" get the highest agreement with a 100 percent agreement while statement 'Offer me opportunities to grow and learn green environmental management skills' get the lowest percentage with only 25.6 percent. The overall percentage agreement based on the thirty four item statements of Green organizational climate dimensions was 73.5 percent.

<u>Research Question 5 - Green Environmental Enforcement Bodies/Agencies/Public Dimension.</u>
What is the agreement level of public Malaysian employees at Pontian District, Johor State, Malaysia on green environmental enforcement bodies?

Table 8: Green Environmental Enforcement Bodies

No.	**Item Statements** **To my understanding as an employees, the following bodies/management/individual plays an important role in succeeding any initiatives and activities of government in green environment:**	**% Agreement**
1.	Public authorities	100.0
2.	Corporate headquarters	100.0

3.	Household consumers	93.3
4.	Suppliers of goods & services	80.0
5.	Investors & lenders	73.4
6.	Management employees	60.0
7.	Non-management employees	60.0
8.	Labour unions	73.3
9.	Industry & trade associations	66.7
10.	Environmental groups	53.3
11.	Community groups	46.7
	Overall	73.3

The findings in Table 8 indicated that most employees agreed on the item statements on the important role of "Public authorities" and "Corporate headquarters" get the highest agreement with a 100 percent agreement while statement "Community groups" get the lowest percentage with only 46.7 percent. The overall percentage agreement based on the eleven item statements of Green environmental enforcement dimensions was 73.3 percent.

Recommendation And Conclusions

Based on the results of the pre-test study, the recommendations related to the dimensions are suggested as follows:

Green Environment Efficiency Dimensions

As for the dimensional study on Green Environment Efficiency Dimensions showed that the overall acceptance level of the dimensions are 72.5 percent at the middle higher level. It showed that any environmental program of CSR that gives impact of society need to pay an attention on waste water affluent. Water, which is the main water consumption for the community, must be safe and bring prosperity to the community. Environmental CSR programs need to be sensitive to the trees that are planted, the land and the environment where people live. The CSR programs on environment must be focused on the improvement of energy used efficiently and it can improves indoor environmental quality, including reducing indoor pollution, improving lighting and acoustic environments that affect occupant health and productivity. Any CSR program on environment also need to reduces negative impacts on the environment throughout the life cycle of the building, including air and water pollution and waste generation that generate the peaceful life of society in the circle of the CSR environmental program and less risk of severe accidents like flash flood and any other environmental disaster.

Green Environment of Waste Management

For the findings on Green Environment of Waste Management, with the overall acceptance level is around 62 percent at moderate level, there is a need for the CSR Program to be focused on the use of use resource efficiently and educate the employees on how to use resources rightly and accordingly. The waste management must be reliable to save the environment and the society can live in peaceful and healthy environment. There is a need also the awareness of recycling initiatives for CSR programs as to educate the society of the importance of the green environment of waste management.

Green Quality of Life

For the findings of the Green Quality of Life with the overall acceptance level is around 67 percent at moderate level, it showed that the Corporate Social Responsibility Program (CSR) on green environmental management practices and activities, need to give encouragement the CSR team to make clear what is important to them and why they purse a particular route in for the beneficial of the stakeholders that related with the environmental program. The CSR team also need to have a clear and precise information to look out for problems and be open to new solutions, make dialogue and open discussion to any issues, problems and challenges on green environmental problem as to improve and to build up a kind of quality way of life

Green Organizational Climate

For the findings of the Green Organizational Climate with the overall acceptance level is around 73.5 percent at moderate level, the Corporate Social Responsibility Program (CSR) need to provide employees with skill of green management, enhance the motivation and inspiration of green work through company vision and mission, open-communication within team members and participation positively in green team decision making.

Green Environment Enforcement Bodies

For the findings of the Green Environment Enforcement Bodies, with the overall acceptance level is around 73.3 percent at moderate level, it showed that there is a need for enforcement bodies in green management to increase and strengthen enforcement on green initiatives and the appointment of people that competent in green program and initiatives.

Conclusions

Based on the research outcome, it showed that there is a challenged to deliver the CSR program on environmental that can fulfill the need and requirements of stakeholders related with the programs. So, there is a need to do the CSR program on environment based on the principles of under-standing, accepting and practicing to the aspects of environmental management in relation to the need of the society and the stakeholders. The organizations that need to do the CSR on environmental need to have a links between an organization and its environment, and some aspects of voluntary and compulsory approaches to green environmental management.

Acknowledgments

We would like to express the deepest appreciation to Tenaga Nasional Berhad (TNB) Malaysia and UNITEN Research Development Centre (URND) for funding this research under TNB Seed Fund Grant project code U-TE-RD-20-14 entitled "An Assessment of Sustainability Practices in TNB and its Impact towards TNB Social Return of Investment [SROI]' for the support and cooperation given upon completion of this research.

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6th Langkawi International Multidisciplinary Conference 2023 (6th LIMC 2023)
eISSN 2976-3223
9th – 10th September 2023
Bayview Hotel, Langkawi, Malaysia

THE COMPARISON OF PERFORMANCE OF ROOT VETIVER GRASS BETWEEN COCONUT FIBER AND EGGSHELL TOWARD SLOPE STABILIZATION

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***Abstract**: Slope stability using vegetation has emerged as a more environmentally friendly and sustainable solution for slope stabilization, replacing traditional structural engineering methods and shotcrete cover. However, despite the application of Vetiver grass, failures in the form of deformation, cracks, and slope collapse still occur. The main objectives of this study are to identify the root properties and analyze the mechanical properties of Vetiver grass with coconut fiber and eggshell fertilizers. Laboratory testing was conducted to determine the mechanical properties of Vetiver grass roots using shear box and universal testing machine. As a result, the root diameter and root length with egg shell exhibit larger values than coconut fiber for 21 days (0.40 – 1.27 cm) and 35 days (11.5 – 61.4 cm). The direct shear test results for Vetiver root with eggshell showed highest shear strength which is 43.67 kN/m2 (21 days) and 168.17 kN/m2 (35 days) compared to Vetiver root with coconut fiber which is 42.94 kN/m2 (21 days) and 61.13 kN/m2 (35 days). For tensile strength, the Vetiver root with egg shell consist higher value which is 0.066 N/mm² (group 1) and 0.068 N/mm² (group 2) compared to Vetiver root with coconut fiber which is 0.059 N/mm² (group 1) and 0.060 N/mm² (group 2). Additionally, in group 1 and 2 of 35 days, eggshell fertilizer showed higher maximum tensile strength, measuring 0.071 N/mm² and 0.094 N/mm², respectively. While, coconut fiber fertilizer 1 and 2 recorded lower tensile strengths of 0.063 N/mm² and 0.062 N/mm², respectively. The significance of this study indicates that the eggshell fertilizers have greater impact towards Vetiver root than coconut fiber fertilizers and without fertilizer.*

***Keywords:** Vetiver grass, Shear strength, Eggshell, Coconut fiber, Tensile strength.*

Introduction

The application of slope stability using vegetation has transformed into better bioengineering and sustainable solution for slope stabilization by replacing structural engineering methods and shotcrete cover. The current method of using merely engineering material or heavy structures such as wire meshes, retaining walls, concrete and fencing are more high-budget, poor environmentally friendly, less ineffective over time, unsustainable, and inadaptable with the unstable changeable slope environmentally since they are less effective, while they also require more repair and preservation [1]. The method gap could potentially be labelled by using the theory of soil bioengineering or known as a soft method to soil stabilization and slope because it is able to turn out with minimal effect on the landscape and environment [4]. Soil engineering is relate the use of vegetation which can be parts or whole plants that focuses on the low and high hazard slope for the sake of sustainability and stability [4]. According to [9], slopes with vegetation give protection against erosion and shallow sliding.

The research presents an idea about the understanding of the comparative performance of root Vetiver between coconut fiber and eggshell towards slope stabilization. Since Malaysia is known as a country which is unavoidable slope failure and inadequate research about Vetiver grass fertilizer for maintaining on the slope. The results of the research were analyzed through modeling and laboratory work. Both shear strength and tensile strength tests were carried out by using a direct shear box test and universal testing machine to analyze and compare the coconut fiber and eggshell Vetiver grass specimen.

Assessment of Vegetation and Vetiver grass
The green technique of employing plants to reduce slope instability has been used all around the world. Similarly, both aboveground and belowground attributions are commonly addressed for the two plant characteristics, namely hydrological and mechanical. Through mechanical reinforcing, anchoring, and compaction, vegetation cover improves soil shear strength by utilizing its root network. Furthermore, cover crops protect the soil surface from the effects of rainfall by reducing the erosive capacity of flowing water and restoring slope physical condition. Plant litter, on the other hand, protects the soil surface from raindrop contact and slows water transport over the soil surface. Plants also serve an important role in lowering soil moisture content through evapotranspiration, allowing the soil to absorb more water. Thus, vegetation is defined as a soft engineering structure because it maintains the soil surface from landslides through mechanical, hydrological, and hydraulic effects.

Vetiver plantation might be a promising practical choice for controlling soil erosion and its harmful impacts. Several studies have shown that Vetiver can help with soil and water conservation. According to [6], the usage of Vetiver grass strips and mulch improves soil conservation and nutrient and water absorption efficiency. Furthermore, they demonstrated that Vetiver plating on a modelled terraced slope had superior slope stability than a non-vegetated slope.

Materials and Method
The methodologies were adopted through conducting experimental studies, laboratory work, and physical modelling on the performance of Vetiver grass with different fertilizers. There are a lot of procedures required to follow systematically when executing the research before obtaining the final results. Sample preparation and physical modelling need to be done first in order to obtain the collect some samples of soil. Moreover, the research consists of 9 specimens' types of Vetiver grass, which divide into two groups of durations that are 21 days and 37 days. The sample preparation was brought into UTHM Geotechnical Engineering Laboratory Room for the purpose of setting up physical modelling and laboratory testing.

Materials
The main sample preparation are Vetiver grass, sample soil, and PVC pipe.

Physical Modelling

The plywood was cut into five small pieces to support the PVC pipe from falling down during rainy and windy days. The plywood was then assembled into a wood model, with the PVC pipe fitted into it, as shown in Figure 1. After constructing the wood model, the soil was compacted into the PVC pipe in four layers, each subjected to 28 blows totalling 11.2 kg. The last layer on the surface was mixed with fertilizers. The PVC pipe used had dimensions of 40 cm in height and 16 cm in width, as depicted in Figure 1.

Figure 1 Physical model experiment

Root Properties

The root properties of matured Vetiver specimens treated with eggshell, coconut fibre, and no fertiliser were carefully evaluated in the context of the experiment carried out with PVC pipes. The evaluation of root length, diameter, and general morphology were all included in this analysis. By using a Vernier Calliper, the root's diameter and length were precisely measured and recorded in millimetres (mm). In addition, a visual inspection was done to directly evaluate the root morphology. This technique entailed observing the physical characteristics of the root system with the unaided eye, giving an unmediated view into the structural characteristics of the roots. This thorough method enabled a thorough understanding of the effects of various therapies on the development of Vetiver root.

Mechanical Properties

The tests are essential for understanding how a material will react to external forces, including tension, compression, bending, or shearing. These tests help assess the material's behaviour under different types of loads, providing valuable information about its performance and suitability for specific applications.

Shear Box

The shear box test was performed by applied according to BS1377: Part 7: 1990 as 3 soil samples with different fertilizers were tested under varied vertical loadings of 1.75 kg, 2.5 kg, and 3.25 kg for soil with eggshell, coconut fiber, and no presence of fertilizer after visually inspected for 21 and 35 days. In order to obtain the results from direct shear test, equation of shear strength need to be apply to find out the cohesion, friction of angle and shear strength as shown in Eq.(1).

$\tau f = c + \sigma \tan \phi$

(1)

Tensile Strength

The UTHM Universal Testing Machine was used to test the tensile strength of the Vetiver grass specimens based on BS 1610. The purpose of the test was to measure the bonding strength between the root matrix system of Vetiver and soil. The individual primary roots with age 21 days and 35 days were tested for root tensile strength determination. The unit of tensile strength was measured in MPa (MN/m2).

Results and Discussion

A series of laboratory test have been conducted at the Geotechnical Engineering Laboratory Faculty of Engineering Technology, Universiti Tun Hussien Onn Malaysia. The tests were carried out on main two types of fertilizers for Vetiver grass growth, which are: eggshell and coconut fiber and both types of Vetiver grass were performed to determine the shear and tensile strength by using direct shear test and universal testing machine.

Root Properties

The root diameter has been measured by Vernier caliper and it shows the 35 days of eggshell sample 1 and 2 has the wider diameter, which are 1.27 mm and 1.22 mm according to Table 1. As for the root of length, it has been measured by steel ruler and the longest root is also from the 35 days of eggshell sample 1 and 2, which are 55.6 cm and 61.4 cm respectively. Furthermore, the root morphology of Vetiver grass are belong to root system [15], however the root morphology of 35 days can be seen more fibrous than 21 days. Moreover, the 35 days of original or no involvement of fertilizer has longer root length than 35 days of coconut fiber, however coconut fiber has wider root diameter than the original. Table 1 also presents results of vetiver roots with varying degrees of fibrousness, ranging from less fibrous to more fibrous.

Table 1: The Comparison Growth of Root Diameter, Length and Morphology

Fertilizers	Sample	Days	Root Physical Properties			
			Diameter	Length	Morphology	
Eggshell	1	21	0.55mm, 0.56mm, 0.50mm, 0.60mm, 0.66mm	12.4cm, 12.5cm, 15.6cm, 17.1cm, 18cm	Less fibrous	

6th Langkawi International Multidisciplinary Conference 2023 (6th LIMC 2023)
eISSN 2976-3223
9th – 10th September 2023
Bayview Hotel, Langkawi, Malaysia

Eggshell	2	21	0.54mm, 0.57mm, 0.65mm, 0.64mm, 0.60mm	11.5cm, 12.4cm, 12.6cm, 14.5cm, 16.7cm	Less fibrous	
Coconut fiber	1	21	0.40m, 0.42mm, 0.54mm, 0.35mm, 0.43mm	10.2cm, 11.5cm, 12.7cm, 17cm, 24.6cm	Less fibrous	
Coconut fiber	2	21	0.41mm, 0.45mm, 0.55mm, 0.36mm, 0.48mm	12.5cm, 12.6cm, 12.9cm, 13.6cm, 18.6cm	Less fibrous	
Eggshell	1	35	0.75mm, 0.92mm, 0.98mm, 1.06mm, 1.27mm	51cm, 52cm, 53.5cm, 54.7cm, 55.6cm	More fibrous	

Eggshell	2	35	0.40mm, 0.53mm, 0.71mm, 0.91mm, 1.22mm	30.4cm, 42.5cm, 50.2cm, 52.5cm, 61.4cm	More fibrous	
Coconut fiber	1	35	0.79mm, 0.88mm, 0.97mm, 1.03mm, 1.11mm	8cm, 11.1cm, 11.4cm, 12.3cm, 12.7cm	More fibrous	
Coconut fiber	2	35	0.86mm, 0.93mm, 1.08mm, 1.10mm, 1.14mm	11.3cm, 12.6cm, 13.2cm, 14.5cm, 22.5cm	More fibrous	
Original	-	35	0.38mm, 0.47mm, 0.61mm, 0.69mm, 0.95mm	15.4cm, 27.7cm, 33.5cm, 38.5cm, 41.5cm	Less fibrous	

Mechanical Properties

Root Shear Strength

The direct shear test was performed with varying loads of 1.75kg, 2.5kg, and 3.25kg. It was observed that the shear stress increased with the addition of the loading. Figure 2 illustrates that despite the absence of roots as support, the soil demonstrated high shear stress values.

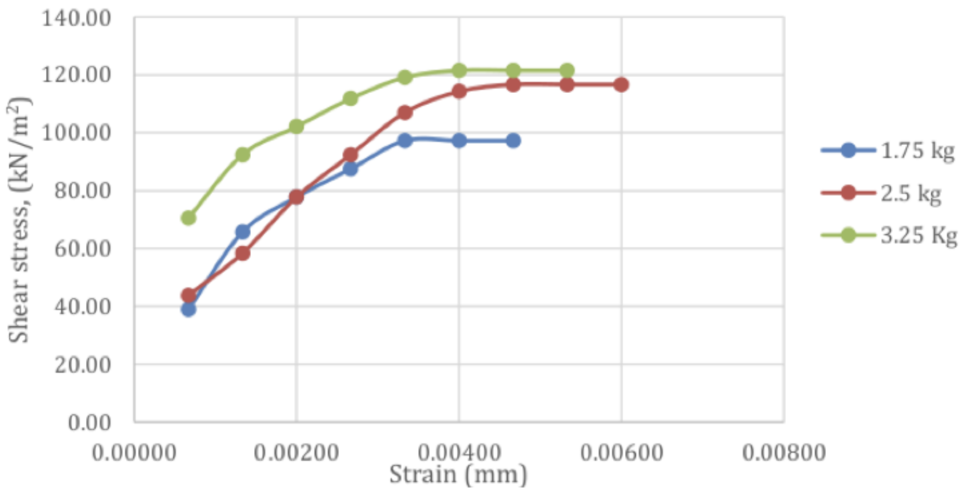

Figure 2 Shear Stress Versus Strain Graph

Result shows that the highest cohesion is the 35 days of eggshell and the lowest is the 21 days of coconut fiber according to Table 2. As for the friction angle, the lowest is the 21 days of coconut fiber with 32.37° and the highest is the 35 days of eggshell with 87.88° Thus, the 35 days of eggshell fertilizer has higher cohesion, friction angle and shear strength than coconut fiber fertilizer and original. The Figure 3 show the graph for the result in Table 2.

Table 2: Cohesion and friction angle of 21- and 35-days sample

Days and fertilizers	Cohesion, c	Friction Angle, ϕ	Shear strength, τf
21 days of Eggshell	28.36	58.02°	43.67 kN/m^2
21 days of Coconut fiber	32.37	51.23°	42.94 kN/m^2
35 days of Eggshell	65.43	87.88°	168.17 kN/m^2
35 days of Coconut fiber	47.47	57.85°	61.13 kN/m^2
35 days of Soil only	50.82	35.37°	57.13 kN/m^2

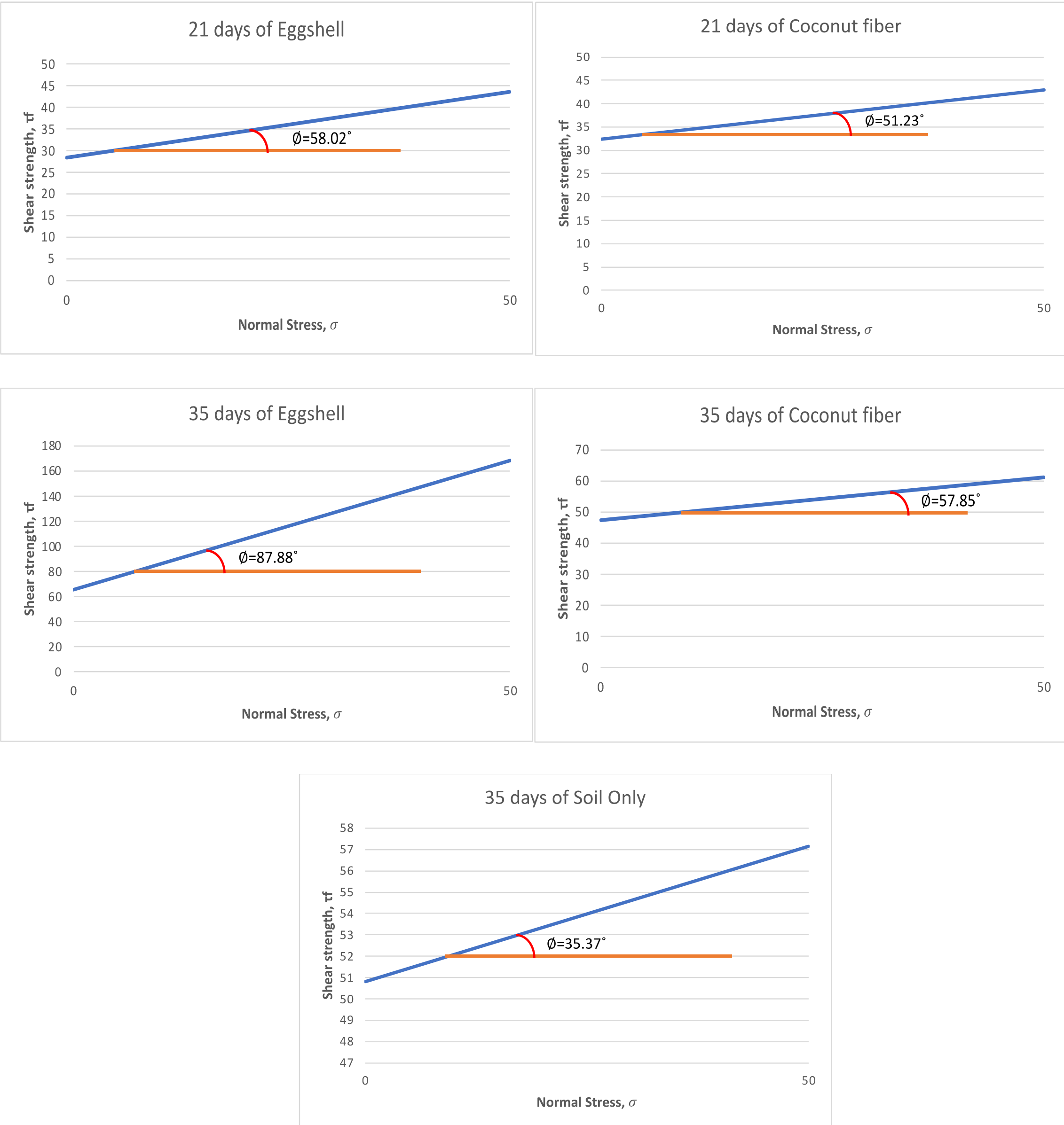

Figure 3 Direct Shear Strength Graph

Root Tensile Strength

A total of 90 samples were tested on the universal tensile machine from 21 to 35 days. Among these, 40 samples were tested at 21 days, and the remaining 50 samples were coconut fiber samples. The samples were divided into two groups for each fertilizer, except for the 35-day samples.

Root Tensile Strength of 21 Days

The 21 days consist of 40 samples, which are coconut fiber 1, coconut fiber 2, eggshell 1 and eggshell 2. In addition, all 40 samples have been concluded in as shown in Figure 4. Thus, the graph shows that the eggshell group has slightly higher tensile strength than coconut fiber. The maximum strength for 21 days has also been recorded and the highest maximum tensile strength is the eggshell group 2 of 21 days, which recorded 0.068 N/mm^2. Meanwhile, the second highest maximum tensile strength is the eggshell group 1 of 21 days, which recorded 0.066 N/mm^2. Furthermore, the lowest maximum tensile strength is the coconut fiber group 1, which recorded 0.059 N/mm^2.

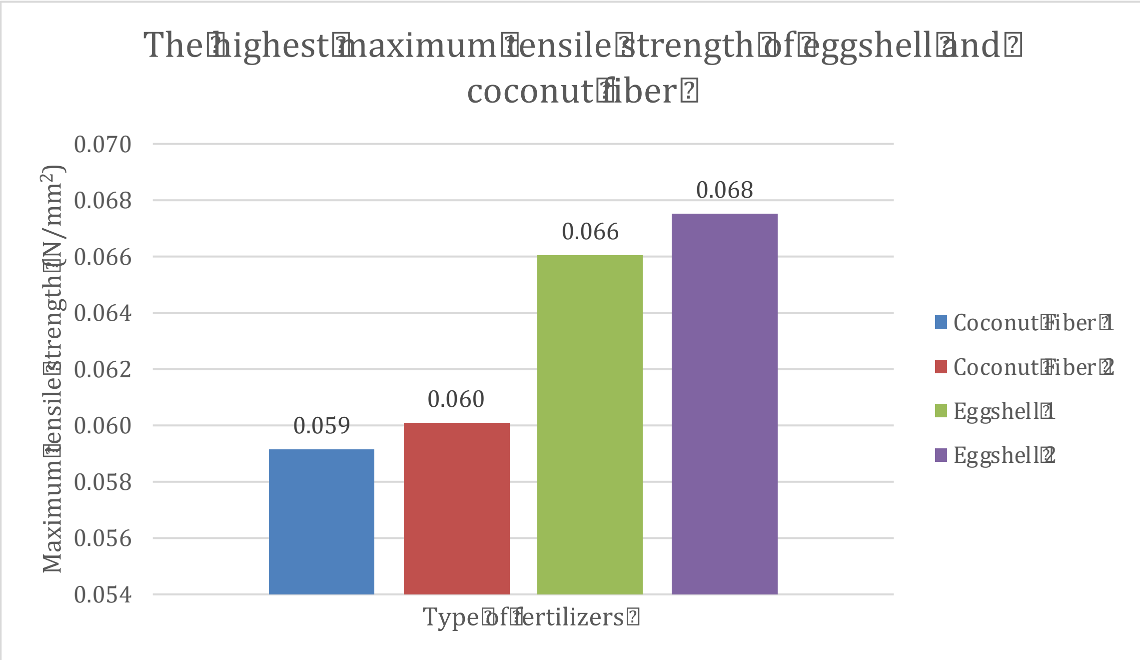

Figure 4 The column bar graph of highest maximum tensile of eggshell and coconut fiber in 21 days

Root Tensile Strength Of 35 Days

There are 50 samples total across the 35 days, including original, eggshell 1, eggshell 2, and coconut fiber 1 and 2. The graph shows that the eggshell group has shown higher tensile strength than coconut fiber especially eggshell 2. The maximum strength for 35 days has also been recorded and the highest maximum tensile strength is the eggshell group 2 of 35 days, which recorded 0.094 N/mm^2 as shown in Figure 5. Meanwhile, the second highest maximum tensile strength is the eggshell group 1 of 35 days, which recorded 0.071 N/mm^2. Furthermore, the lowest maximum tensile strength is the coconut fiber group 2, which recorded 0.062 N/mm^2. Thus, it can be concluded that eggshell from 35 days has higher tensile strength than coconut fiber and original of 35 days. Indeed, the higher tensile strength contribution of eggshell fertilizers to Vetiver grass roots compared to coconut fiber fertilizers can be attributed to their chemical composition. Eggshell fertilizers contain essential nutrients and minerals that promote root growth and strength. These nutrients enhance the structural integrity of the roots, resulting in increased tensile strength [19]. Furthermore, the richness of calcium in eggshells plays a vital role in cell wall formation and plant structure. Higher calcium levels in eggshell fertilizers positively influence root strength by enhancing the overall structural integrity of the roots.

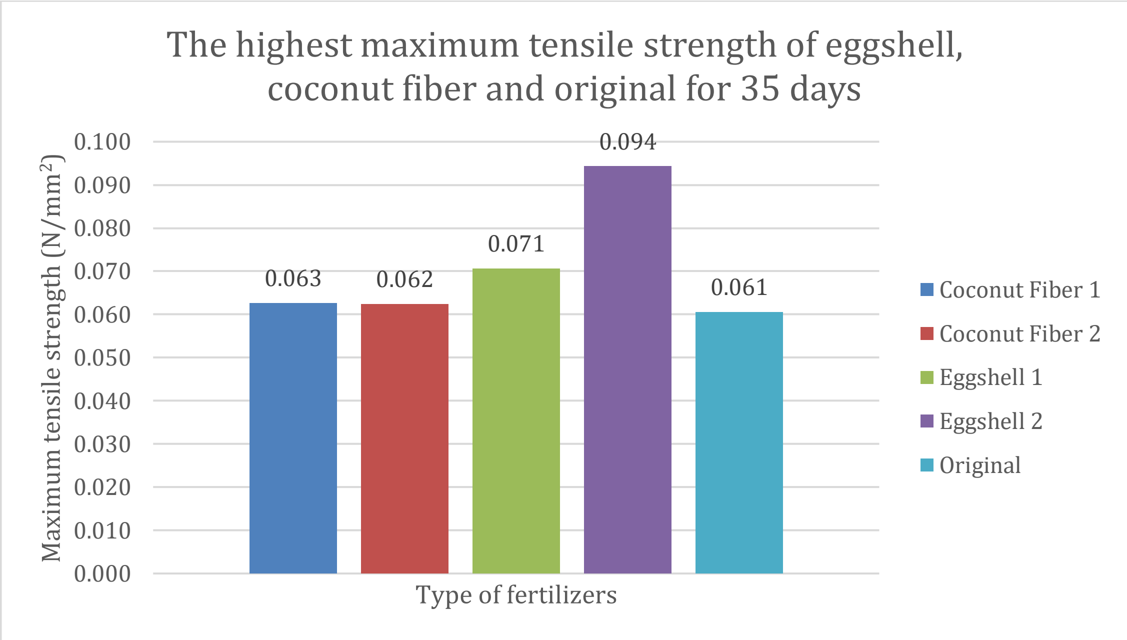

Figure 5 The Column Bar Graph of Highest Maximum Tensile of Original, Eggshell and Coconut Fiber In 35 Day

Conclusion

The eggshell fertilizers shows that it has impact the root properties than coconut fiber fertilizers and original. This is because the eggshell has contributed the most to the height of vetiver grass. Moreover, the diameter and length of root are the widest and longest than coconut fiber fertilizers. The root morphology also shows the eggshell and coconut fiber of 35 days were more fibrous than the original and 21 days of eggshell and coconut fiber samples. Thus, it shows a huge difference gap between the 21 and 35 days of progress. Despite the coconut fiber fertilizers has lesser impact on the root properties of vetiver grass, it still has wider root diameter than original. The significant contribution of eggshells to the height of Vetiver grass can be attributed to their abundant calcium content. Calcium is an essential nutrient that plays a critical role in various aspects of plant growth and development. It is vital for cell division, elongation, and the formation of cell walls. When Vetiver grass receives an ample supply of calcium from eggshell fertilizers, it promotes robust root and shoot growth, leading to an increase in plant height. The presence of sufficient calcium supports the overall health and development of the plant, facilitating its upward growth and achieving a taller stature [20].

Eggshell fertilizers is more effective on the growth of Vetiver grass height and root of diameter, length and morphology as this contribute to the shear and tensile strength. The coconut fiber only has a slightly effect on the growth of Vetiver grass height and root of diameter, length and morphology as this contribute less to the shear and tensile strength than eggshell fertilizers. Although the original sample has longer root than coconut fiber, the coconut fiber still contribute more shear and tensile strength than the original sample. Thus, it can be concluded that eggshell and coconut fiber fertilizers has higher performance of shear and tensile strength than the original sample.

Acknowledgement
This research was funded by a grant from Internal grant Tier 1 (H902). The author would also like to thank the Faculty of Civil Engineering and Built Environment, Universiti Tun Hussein Onn Malaysia for its support.

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UNDERSTANDING THE EFFECTS OF DAILY STRESS ON SINGLE ADULTS IN CHINA

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Abstract: *During the three-year duration of the COVID-19 pandemic, an increasing number of small and medium-sized enterprises (SMEs) in China have experienced decline in revenues or had to cease operations. Due to the decline in employment opportunities, individuals feel obligated to improve their level of work intensity and pace to maintain existing job opportunities. It is necessary to understand the current social context as well as the various forms and origins of stress among Chinese adults in order to alleviate their daily psychological pressure. This study is part of a larger study in developing happy toys to reduce adults' stress through passive approach. This paper presents a comprehensive literature review that delves into the social context of China, the various sources of daily stress experienced by Chinese adults, and the consequential effects of such stress on their well-being. Sources of daily stress encompass economic pressure, social isolation, traditional social and cultural pressures, work-related stress, and challenges associated with social ageing, both for men and women. However, societal recognition of the psychological pressure experienced by adults has been inadequate. The findings of this study underscore the correlation between prolonged exposure to stress and the development of various health issues, including insomnia, anxiety, depression, and a range of both physical and mental health conditions, such as compromised immune function. Following an introduction to contextual factors, this article will explore the potential correlation between happy toy and their ability to mitigate the various stressors encountered in an individual's daily life. The study aims to explore potential pairings of happy toy as a means to alleviate an individual's daily stressors. This study aims to document the various factors that contribute to the experience of daily stress among single adults in China. Additionally, it seeks to identify the underlying theoretical framework that can inform the development of happy toy specifically designed for Chinese adults with the purpose of alleviating daily stress.*

Keywords: *Chinese single adults, social background, sources of daily stress, effects of daily stress, built environment informatics*

Introduction

Due to the impact of COVID-19 and the implementation of restrictive measures over a three-year period, a large number of small and medium-sized enterprises (SMEs) are on the verge of closure. In addition, the closure of factories has led to a significant increase in the unemployment rate among adults (Li Lu et al., 2021). In recent years, the growth of China's gross domestic product (GDP) has decelerated. The current economic downturn has caused a decline in employers' revenues, forcing them to implement cost-cutting measures such as increasing employee workloads and working hours. However, adults in the workplace are subjected to increased pressure due to the increased pace and intense workload despite receiving relatively lower compensation, resulting in an increasing amount of stress. There is a growing trend among Chinese adults to work longer hours and assume greater responsibilities in order to safeguard their existing employment (Ma et al., 2021). Compared to other demographic groups, single adults in China face a greater number of stress-inducing factors, including financial burdens, social isolation, adherence to traditional social and cultural norms, and occupational demands (Wang et al., 2022). Both the physical and mental health of an individual can be negatively impacted by prolonged exposure to stress. Therefore, it is essential to understand the impact of daily stress on single adults in China. In order to promote the psychological health and social integration of this population, it is essential to gain insight into the effects of daily stress on them.

In addition, the implementation of the one-child policy has exacerbated the problem of China's ageing population. The increase in women's educational attainment has led to the emergence of a growing number of women who reject societal norms such as marriage and other traditional constraints. However, these obstacles have led to an increase in the number of Chinese adults choosing a single lifestyle and experiencing increased daily pressures. There is an urgent need for Chinese society to devote more resources to addressing the physical and mental health challenges faced by adults, with a focus on single adults (Foguet-Boreu & Ayerbe Garcia-Morzon, 2020). Insomnia, anxiety, depression, and a weakened immune system can result from prolonged exposure to chronic stress, which can have adverse effects on both physical and mental health, significantly affecting the happiness index of single adults in China and disrupting public social health and social stability (Leger & Bayon, 2010).

Therefore, this study intends to examine the stress experienced by single adults within the context of contemporary Chinese society, focusing on its effects on the physical and mental health of Chinese adults. In addition, the potential impact of daily stress on adult life satisfaction will be investigated towards developing effective stress-relieving interventions for them.

Research Methodology

The present study employs the "Systematic Literature Review Synthesis Process" as described by Ibrahim and Mustafa Kamal (2018) in Masiran et al. (2020) in order to identify relevant literature and establish a theoretical basis for the generation of research ideas. This study's typology has been recognised in the field of literature review (Rousseau, Manning, & Denyer, 2008; Yu & Watson, 2019; Templier & Paré, 2015). It involves the categorisation of research questions into three constructs: "who," "what," and "how," which define the element being influenced, the knowledge required to solve the problem, and the anticipated impact of the study (Ibrahim, 2011 & 2020).

The study commenced by defining keywords pertaining to Chinese single adults, their social background, factors contributing to their daily stress, the effects of such stress, and the field of built environment informatics. Through exhaustive searches of the Google Scholar and Scopus databases, a total of 105 articles were identified. Following a comprehensive evaluation, 46 articles were eventually selected for further examination and subjected to a comprehensive critical review. The study examined the abstracts of the selected articles, and the researchers used the Point of Departure (POD) Tree Diagram to synthesise and summarise selected articles with high potential for future utility (Ibrahim & Mustafa Kamal, 2018). Documentation of the synthesis process was conducted using the online EAGLE System.

Social Background of Daily Stress

Numerous scholarly investigations have examined the origins of stress experienced by single adults in China as well as the societal circumstances surrounding these stressors that exert an influence on them. These stressors encompass the imposition of lockdown measures during the COVID-19 pandemic, traditional educational structures,, parental or societal expectations for marriage, financial instability, unemployment, and diminished levels of social satisfaction.

Amidst the COVID-19 lockdown measures, adults across the globe encountered heightened levels of stress and anxiety. Wang and Zou (2022) emphasise the severe repercussions that the three-year COVID-19 lockdown had on the psychological well-being of Chinese adults, persisting even during the post-pandemic period. According to Wechsler et al. (2022), the absence of happiness constitutes a significant factor contributing to the experience of stress and anxiety.

In contrast to their male counterparts, female adults exhibit a higher propensity for experiencing mental health issues. In a recent study conducted by Tahara et al. (2021), it was observed that there is a positive correlation between reduced social contact and diminished psychological endurance among women, which in turn increases their vulnerability to stress and mental health disorders. According to Gui (2020), single women frequently experience pressure from their family of origin as well as societal expectations regarding marriage, education, and other traditional norms. These external factors exert a significant influence on their daily lives.

Furthermore, it is worth noting that employment and income are significant determinants that contribute to mental stress and subsequently increase the likelihood of depression among adults in China. According to Wang and Zou (2022), there is a notable emphasis on the heightened susceptibility of young individuals who are unemployed to experience elevated levels of stress and anxiety, ultimately placing them at increased vulnerability for the development of mental health disorders. In their study, Ma et al. (2021) posited that the prevalence of smoking and alcohol abuse among Chinese adults exhibited an upward trend subsequent to the COVID-19 pandemic, which can be attributed to the impact of psychological stress. Based on the study conducted by Otsuka et al. (2022), it was observed that China's one-child policy had the additional effect of augmenting the economic strain and psychological distress of contemporary Chinese adults.

According to Lu Peng et al. (2021), the closure of SMEs in China was attributed to a decrease in income and the inability to resume employment. The closure of factories resulted in a loss of employment opportunities for adults. Hua and Ma (2022) assert that unemployed adults experience heightened levels of stress, frustration, and social stigma. The combination of elevated employment pressure and limited social support has been found to be associated with diminished levels of life satisfaction. In addition, Li et al. (2021) underscored the impact of low income and life stress on the quality of sleep. Based on the findings of Grandner et al.

(2010), unemployed adults who possess a low household income, particularly those who are divorced, experience more severe symptoms of insomnia. Plus, the study revealed that single women tend to exhibit the most severe manifestations of insomnia.

Nevertheless, it is important to acknowledge that there are multiple factors that contribute to stress. Regrettably, the current level of societal awareness regarding these stressors is insufficient, and as a result, these pressures persist over extended periods of time, posing detrimental effects on the overall physical and mental well-being of adults. In essence, the primary factors contributing to the daily stress experienced by single adults in China can be attributed to the implementation of lockdown measures amidst the COVID-19 pandemic, disruptions to traditional education structures, parental or societal pressures to consider marriage, reduced economic income and unemployment rates, as well as a decline in overall social satisfaction. It is recommended that society implement rational intervention strategies for addressing this phenomenon.

Sources of Daily Stress

The physical and mental well-being of adults has been influenced by a variety of factors, including adverse childhood experiences, social income inequality, the consequences of the COVID-19 pandemic, and increased life stress. These stressors manifest in various ways, such as negative emotions, tobacco and alcohol abuse, sleeping disorders, anxiety, and depression, among others. The aforementioned issues have resulted in serious threats to the physical and mental well-being of adults in China.

The presence of adverse childhood experiences and challenging living circumstances has been found to be associated with the development of detrimental mental health problems and maladaptive social behaviours during adulthood. As revealed by Khade et al. (2018), the traditional Chinese education model frequently results in parents resorting to violent methods for the purpose of educating their children. Xu et al. (2022) discovered a positive correlation between physical abuse experienced during childhood and the likelihood of engaging in violent behaviour during adolescence. The occurrence of violence and abuse during childhood has a higher propensity to contribute to the development of mental health issues in adulthood. Likewise, Kong et al. (2021) discovered in their study that adverse childhood experiences (ACE), encompassing negative emotional encounters, can potentially lead to detrimental mental health disorders during adulthood, thereby exerting enduring effects on individuals' daily functioning in later life. Based on the findings by Chen et al. (2022), a significant proportion of Chinese adults (35%) reported having encountered at least one instance of abuse during their childhood.

Furthermore, Otsuka et al. (2022) discovered that during periods of economic downturn, there is a notable escalation in daily stress levels, leading to a higher prevalence of insomnia. This phenomenon is particularly pronounced among women who are unemployed, divorced, or single. Individuals from socioeconomically disadvantaged backgrounds exhibit a higher susceptibility to experiencing insomnia. Meanwhile, Qiu et al. (2022) observed in their study that substantial work pressure and the adverse emotional effects of working overtime are associated with sleeping disorders and job dissatisfaction among Chinese government employees. Nevertheless, Ypsilanti et al. (2018) reported that individuals suffering from insomnia exhibit a heightened susceptibility to feelings of self-loathing, anxiety, stress, depression, and other related psychological states. This vicious circle has been a persistent issue in the daily routines of adults in China for a considerable period of time. According to Ding et al. (2020), their findings indicate that the prevalence rate of Chinese adults is notably high, reaching 7.23%. This can be attributed to various factors such as increased life pressure, irregular patterns of work and rest, tobacco and alcohol consumption, sleeping disorders, and other related causes.

According to the study conducted by Duan et al. (2022), it was suggested that individuals face heightened susceptibility to infection, mortality, and psychological distress amidst the COVID-19 pandemic. In a study conducted by Ma et al. (2021), it was observed that there was a notable rise in the prevalence of smoking and alcohol consumption among Chinese adults during the COVID-19 pandemic. The confirmation of this assertion was provided through research conducted by Duan et al. (2022) and Deardorff et al. (2023) amidst the lockdown measures implemented in Wuhan city in response to the COVID-19 pandemic. Both studies observed a notable increase in sleep, weight, anxiety, and depression scores among college students, with a particular emphasis on the disproportionate impact experienced by women. Thorndike et al. (2022) observed a deterioration in mental health symptoms and a substantial rise in depression and anxiety levels among low-income adults in response to the COVID-19 pandemic and various stressors. Based on research by Zheng et al. (2020), single adults with low income and a lack of social support tend to experience elevated levels of daily psychological stress.

In addition, Wang et al. (2022) have highlighted the correlation between stress and the emergence of adverse emotional states, ultimately culminating in the development of depression. Foguet-Boreu and García-Morzon (2020) discovered a growing body of evidence supporting the notion that adults with higher levels of stress exhibit an increased susceptibility to the development of major depressive disorder (MMD) and generalised anxiety disorder (GAD) in adulthood. The main factors contributing to psychological stress encompass post-traumatic stress disorder (PTSD), anxiety, occupational demands, marital status, financial resources, and mental strain. According to Gao's (2019) survey conducted among Chinese universities, it was found that female students exhibit a higher propensity for experiencing anxiety when subjected to similar levels of pressure, stemming from concerns related to body image and physical appearance. In their study, Fan et al. (2021) identified health status, subjective well-being, life satisfaction, and marital status as significant determinants of daily stress.

In contrast to Chinese government employees, adults in other sectors exhibited higher levels of work-related stress, longer working hours, increased sleeping disorders, and a higher prevalence of anxiety symptoms. The presence of companionship and a substantial level of social support can mitigate anxiety among individuals whose work income exhibits greater volatility. Nevertheless, scant attention has been devoted by scholars and social institutions to the everyday stresses experienced by Chinese adults. The detrimental impact of negative emotions and daily stress on the physical and mental well-being of Chinese adults necessitates societal awareness and concern for this phenomenon. This study identified the primary stressors encountered by single adults in China on a daily basis encompass various aspects such as quality of life, financial income, health status, working hours, family expectations, social stigma, and child abuse.

Effects of daily stress

When an individual experiences significant levels of stress, the primary reaction often includes symptoms such as insomnia, disrupted eating patterns, and the use of substances such as alcohol or tobacco as coping mechanisms. These behaviours are not conducive to maintaining personal well-being or fostering long-term life progression. The escalation of daily stress has major consequences for individuals, communities, and public health, posing a potential threat to social stability.

The experience of chronic stress elicits emotional responses and exerts detrimental effects on individuals. According to Charles et al. (2013), minor aspects of daily life frequently serve as triggers for stress, leading to adverse emotional responses and potentially impacting the long-term mental and physical well-being of adults. Dai et al. (2020) have highlighted the association between prolonged stress and the development of chronic stress, adversity, depression, anxiety, and loneliness, among other negative outcomes. Consequently, it can be inferred that unhealthy life stress serves as the primary determinant of chronic stress. As uncovered by Liu et al. (2022), chronic stress has been identified as a potential factor contributing to various health conditions, including insomnia, bowel disease, anxiety, cardiovascular disease, mental disorders, and cancer. In the context of daily existence, emotional responses exert enduring effects on personal health.

In the context of daily stressors, individuals exhibit varying responses to stress, with notable differences observed between men and women. However, it is currently evident that these coping mechanisms are not conducive to promoting optimal physical and mental well-being. According to Chaplin et al. (2008), when faced with significant levels of stress, adult males tend to resort to alcohol consumption as a means of alleviating stress, ultimately leading to an excessive reliance on alcohol. In a study conducted by Long et al. (2021), it was observed that women exhibited a higher propensity to alleviate stress through the consumption of high-sugar beverages and desserts. Also stated by Long et al. (2021), the rapid pace of work and mounting life pressures in China have led to a dietary pattern among Chinese adults characterised by the consumption of fast food that is high in fat, salt, and carbohydrates. The prevalence of an unhealthy lifestyle among Chinese adults, exacerbated by societal pressures, is progressively posing a threat to their personal well-being.

Insomnia is currently acknowledged as a significant public health concern, as indicated by the findings of Zhao et al. (2020), who conducted a survey revealing that a substantial proportion (36.38%) of Chinese adults have experienced stress and anxiety resulting in sleep deprivation during the COVID-19 pandemic. Based on the findings of McArdle et al. (2020), sleeping disorders have been identified as potential precursors to adult sleep apnoea, obstructive sleep apnoea, and various other conditions that pose significant risks to both life and overall well-being. Some individuals even resort to drug interventions as a means of addressing stress and insomnia. Ruisoto and Contador (2019) emphasised the societal implications of stress-induced substance abuse, while Léger and Bayon (2010) underlined the severe effect of insomnia on various domains, including socio-economic factors, work productivity, public safety, public health, quality of life, and social well-being. The study conducted by Labaran et al. (2022) revealed that sleep was primarily influenced by two key factors: working beyond 41 hours per week and experiencing work-related stress. Unsurprisingly, it is worth noting that Chinese adults tend to engage in work for durations exceeding 41 hours per week. This prolonged work schedule, coupled with insufficient sleep and the presence of work-related stress, has been observed to have adverse effects on both productivity and overall happiness.

The correlation between societal stability and individuals' profound sense of happiness is inseparable; however, an excessive amount of pressure is not conducive to the enhancement of individuals' happiness. Nitschke and Bartz (2023) underscored the significance of stress-induced repercussions on individuals, positing that such effects can engender a broader prevalence of stress and negative emotions, thereby exerting an influence on social stability. Based on the findings of Jiang et al. (2021), contemporary stressors frequently stem from experiences of frustration, whereas Jackson (2014) argues that individuals who experience elevated levels of social pressure tend to exhibit lower levels of life satisfaction. The presence of an overwhelming amount of stress poses a significant risk to individuals' physical and mental well-being, as well as their overall sense of happiness. Prolonged exposure to stress has been found to have a substantial impact on the occurrence of societal unrest and instability. Therefore, the mitigation of daily stress among adults has significant ramifications for promoting social stability.

It is important to note that a significant number of scholars may not fully realise the impact of daily stress on the overall physical and mental well-being of adults, thereby contributing to the emergence of public health concerns. Stress is widely recognised as the predominant catalyst for generating negative "energy." The absence of happiness and the increased presence of negative social emotions are not conducive to the maintenance of social stability. Prolonged and persistent stress experienced on a daily basis has been associated with various adverse effects on cognitive functions, memory, moods, self-esteem, and sleep; it can also increase cancer risk as well as influence alcoholism and substance abuse.

Discussion

The primary objective of this study is to examine the impact of daily stress on single adults in China, employing a systematic literature review synthesis methodology within the context of single Chinese adults. This study revealed that various social factors contribute to the experience of daily stress among single Chinese adults, which include gender imbalance, adherence to traditional cultural norms, engaging in high-intensity overtime work, facing low income and high prices, experiencing regional development disparities, and the impact of women's higher education. The study also identified several key sources of daily stress experienced by single adults in China, including quality of life, financial income, health status, working hours, financial income, family expectations, social stigma, and childhood abuse. Moreover, this study discovered that chronic daily stress had been associated with Various adverse effects, including cognitive impairment, memory loss, negative moods, self-deprecation, insomnia, increased cancer risk, engagement in alcohol and smoking behaviors, and heightened susceptibility to depression and anxiety.This present study thus proposes the development of happy toy for adults as a means to alleviate daily stress. Figure 1 depicts a comprehensive point of departure (POD) tree diagram that elucidates the various sources of stress and the intricate processes of influence experienced by Chinese single adults. Figure 2 illustrates the conceptual framework. The creation of happy toy was motivated by the aim of alleviating the daily stress experienced by single adults in China, as shown in Figure 2.

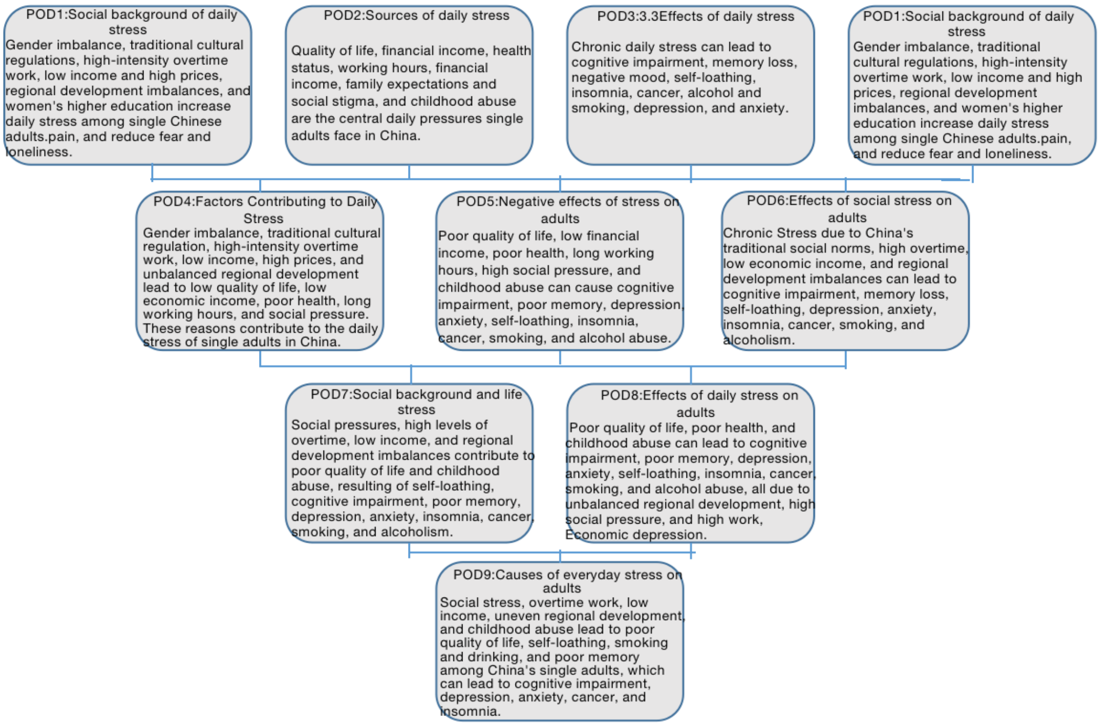

Figure 1: Point of Departure (POD) Tree Diagram for Studying on Single Chinese Adults (Adapted from Ibrahim And Mustafa Kamal, 2018)

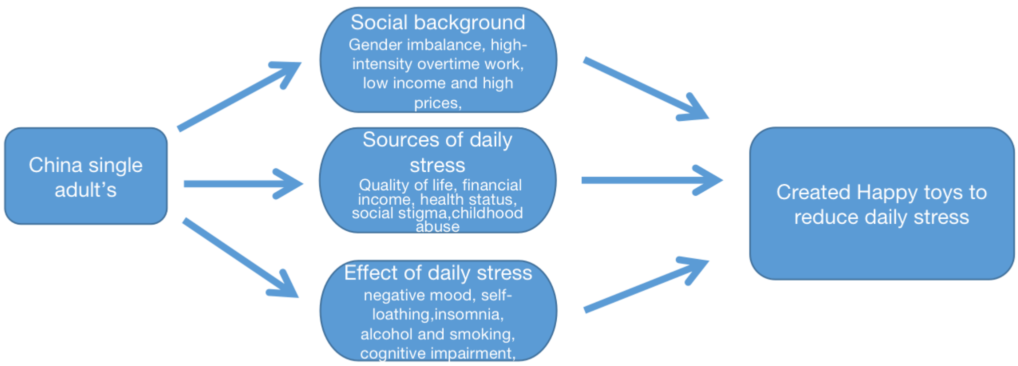

Figure 2: Proposed Conceptual Framework Based on Single Chinese Adults (Adapted from Ibrahim And Mustafa Kamal, 2018)

Conclusion

This study found a combination of factors, including social stress, excessive work hours, inadequate income, regional development disparities, and experiences of childhood abuse, contribute to a diminished quality of life, self-deprecation, engagement in smoking and alcohol consumption, as well as impaired memory among single adults in China. These factors, in turn, can potentially result in cognitive impairment, depression, anxiety, susceptibility to cancer, and sleep disorders like insomnia etc. The findings are significant as they contribute to developing happy toys for single adults in China based on the identified criteria. Future studies include matching the stress-related criteria with appropriate happy toy interventions.

Acknowledgement
This study is conducted as part of a doctoral programme (PhD) pursued by the primary author at the Faculty of Design and Architecture, University Putra Malaysia.

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6th Langkawi International Multidisciplinary Conference 2023 (6th LIMC 2023)
eISSN 2976-3223
9th – 10th September 2023
Bayview Hotel, Langkawi, Malaysia

AN ANALYSIS OF MODERN SLAVERY INDICATORS IN MALAYSIAN PUBLIC LISTED COMPANIES

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Abstract: *In an era of globalization and technological advancement, modern slavery has emerged as a pressing concern, necessitating immediate action. This form of exploitation encompasses various coercive methods, including subtle forms such as exploiting vulnerabilities and limiting victims' options. United Nations Sustainable Development Goal 8.7 urges member states to combat forced labor, modern slavery, and child labor. Countries like Australia and the United Kingdom have enacted laws to address modern slavery, emphasizing the responsibility of large organizations to confront this issue. Malaysia, a manufacturing hub, faces challenges related to modern slavery, especially among vulnerable migrant workers. Collaboration with international organizations, including the International Labor Organization, has become crucial in addressing these issues. Despite global efforts, modern slavery persists, with the number of victims increasing worldwide. This study explores the indicators of modern slavery within Malaysian Public Listed Companies (PLCs), seeking to protect human rights. It examines internal and external factors influencing the prevalence of modern slavery, highlighting the importance of corporate governance, ethical behavior, and transparency. It also discusses international regulations and initiatives aimed at eradicating modern slavery from supply chains. The findings emphasize the need for ethical alignment with business practices and ethical consumer choices. While limited Malaysian PLCs focus on modern slavery reporting, addressing this issue aligns with Sustainable Development Goals, corporate sustainability, and good governance principles. Transnational governance and industry collaboration are crucial to combat modern slavery effectively. However, this study has limitations, primarily relying on annual reports from Malaysia, Australia, and the UK. Future research should aim to enhance transparency and industry awareness, ultimately contributing to the eradication of modern slavery and the revitalization of Malaysia's economy.*

Keywords: *modern slavery, corporate governance, transparency, human rights*

Introduction

Alongside globalisation and technological advancement has been renewed attention to the phenomenon of modern slavery. A provision on modern slavery includes those prerequisites of some form of coercion, including more subtle forms such as abusing the victim's vulnerability; inability to leave the service including subtle methods such as having no viable options; and no or very little advantage for the coerced person, no or little earnings, no improvement of his situation (Jannson, 2015). United Nations Sustainable Development Goal (SDG) 8.7 (United Nations Development Programme, 2015) urged the member states to take immediate and effective measures to eradicate forced labor, end modern slavery and human trafficking, and secure the prohibition and elimination of the worst forms of child labor. National governments, such as Australia and the United Kingdom, had passed the laws to contend with modern slavery and to hold large organizations to account for the degree to which their operations are affected by the problem. Australian Securities Exchange emphasizes the responsibility of large organizations to address the risk of modern slavery. It is stipulated in the ASX's Modern Slavery Policy and Statement as a response to risk assessment (Modern Slavery Statement, 2021).

In part of that, the Government of Malaysia deposited the instrument of ratification of the Protocol of 2014 to the Forced Labour Convention 1930, to show its commitment to fight against forced labor in all its forms. Malaysia has taken various initiatives to address issues related to modern slavery, particularly concerning migrant workers due to their vulnerability and the country's high reliance on foreign workers in labor-intensive sectors and industries. In this regard, the relations between the ILO and Malaysia have undergone significant development as demonstrated by the adoption in 2019 of the Decent Work Country Programme, which outlines the cooperation between Malaysia and the ILO until 2025. Moreover, the country has strengthened its collaboration with various stakeholders, including the source countries for migrant workers by way of bilateral agreements (International Labour Organization, 2022).

Modern slavery had increased in the number of people from 3.4 to 3.5 per thousand people in the world in 2021. Asia and the Pacific is host to more than half of the global total (15.1 million), followed by Europe and Central Asia (4.1 million), Africa (3.8 million), the Americas (3.6 million), and the Arab States (0.9 million). However, this regional ranking changes considerably when modern slavery is expressed as a proportion of the population. By this measure, modern slavery is highest in the Arab States (5.3 per thousand people), followed by Europe and Central Asia (4.4 per thousand), the Americas and Asia and the Pacific (both at 3.5 per thousand), and Africa (2.9 per thousand). More than half of all modern slavery occurs in either upper-middle-income or high-income countries. When a population is taken into account, modern slavery is highest in low-income countries (6.3 per thousand people) followed by high-income countries (4.4 per thousand) (International Labour Organization, Walk Free and International Organization for Migration, 2022).

Malaysia is a manufacturing hub for everything from palm oil to iPhone components. Firms there employ migrants from countries including Bangladesh and Nepal and have faced the highest number of U.S. sanctions over forced labor allegations after China. In the last two years, U.S. Customs has excluded purchases from four Malaysian companies after finding what it called reasonable evidence of modern slavery. The Brightway raid came as the United States had barred another glove maker, Top Glove (TPGC.KL), over forced labor allegations. Top Glove said in April it had resolved the issues that led to the ban, but the sanctions remain in place and U.S. authorities seized two shipments of the company's gloves this month (Ananthalakshmi, Lee and Chu, 2021).

In 2020, the US Customs and Border Protection imposed import bans on eight of Malaysia's leading glove makers and palm oil producers for alleged labor abuses. Among the companies were Top Glove Corp Berhad, Sime Darby Plantation Berhad, Supermax Corp Berhad, and FGV Holdings Berhad. These orders were based on an allegation, as well as evidence of forced labor in the manufacturing process, which revealed acts of debt bondage, high recruitment fees, excessive overtime, retention of identification documents, and abusive working and living conditions.

Malaysia wants to take steps to improve its reputation for human trafficking and forced labor, but there are still shortcomings in the law. The work of setting up the legislative framework for eradicating modern slavery is far from finished. Thus this study aims to enhance and provide an analysis of key modern slavery indicators to the Malaysian Public Listed Companies as a first move to protect the rights of humans.

Literature Review

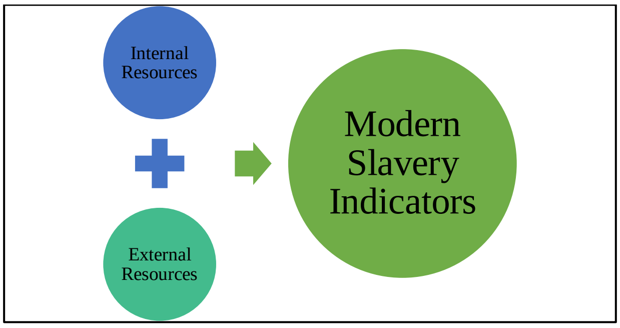
The growth of democracy and human rights protection can show great variation within and between countries, where varying degrees of state capacity and the quality of political institutions do not deliver on their promise, with pockets of dysfunctional deliberation, the persistence of informal and formal patron-client networks, and long-term impunity and lack of accountability for human rights violations (Foweraker &Treviso,2016). Le Baron and Ayers (2013) claimed that modern slavery is one of the production modes associated with capitalism and neo-liberalism favoring the interests of owners of capital over workers. Capitalist production regards the "various modalities of labor supply, exploitation, and control". Landman and Silverman (2019) argued that "popular understandings of slavery often conjure up images of African slaves brought to the Caribbean, Brazil, and the US, where such images typically include slave ships, slaves bound in chains, and slaves auctioned at the market", but that "such imagery tends to obscure current realities of slavery and relegate it as a problem of the past". Bannerjee (2020) suggested that while slavery is a crime under international law, it remains "a viable and profitable management practice for business" and that "modern slavery, far from being an aberration, is a logical outcome of the way our political economic system is organized and its historical origins in the colonial system". While slavery has been officially banned throughout the world, it still exists, but now revolves around illegal control rather than legal ownership.

Flynn and Walker (2021) suggested that the empirical work published to date on modern slavery had "yielded valuable insights into what firms claim to be doing to combat modern slavery", but that "missing from the literature, however, is the theoretical framing of the issues" and that this omission "limits our ability to understand how and why firms give effect to government and societal expectations on preventing modern slavery". Much of the abuse that occurs concerning workers happens in corporate supply chains with organizations engaging in upstream, low-value activities especially vulnerable to slavery-related practice (Crane,2013). It then follows that large companies, often located downstream, have a responsibility to work with their suppliers, and with the suppliers of their suppliers, to ensure working conditions are both legal and humane. Although some have argued this responsibility should be legalized, jurisdictional issues make the implementation of global legislation extremely difficult if not impossible. In addition, some multinational companies deal with thousands or even hundreds of thousands of independent suppliers daily, presenting practical limitations (LeBaron and Lister,2015). Thus the "question of how far corporate liability and responsibility should extend within supply chains remains contentious "and in many ways, the need to address slavery-related issues in this context remains a moral rather than a legal obligation (LeBaron,2014).

Methodology and Discussion

The indicators for modern slavery in terms of internal resources, organizations need competencies that enable them to enact institutional deflection strategies that influence and exploit environmental conditions favorable to the perpetuation of slavery and that avoid unfavorable conditions. A set of unique abilities that explain show enterprise successfully deployed slavery as a management practice despite widespread illegality and public opprobrium. That is, the presence of slavery management capabilities will mediate the effect of the competitive and institutional context on the likelihood that firms will be able to deploy slavery. Risk monitoring of modern slavery depends on the culture of the organization, such as geography, product and service, risk level employability, industry, and governance. Lynas Limited incorporated in Australia had assessed the risk of modern slavery among the employees by prioritizing local employment, directly supervising all on-site employees and contractors, and having a strict process in place to ensure that no illegal foreign workers are engaged as either employees or contractors at the site. In addition, in 2021, the company undertook modern slavery training as part of the induction program for the new employees and contractors and will become an annual training (Lynas Rare Earths Ltd, 2021). Lundan (2018) suggests that at the institutional level, ensure that employees can gather and associate, especially for those temporary work migrant workers who are vulnerable due to their employment status. In addition, promoting and monitoring fair and ethical recruitment practices through codes or regulations stipulated in the organization.

External resources by multi-stakeholder initiatives address numerous stakeholders like buyers and suppliers of the product, government, and local enforcement authorities, labor unions, and others. Its key idea is to get as many stakeholders as possible to buy into the reduction of slavery to gain legitimacy and effectiveness (Schouten and Glasbergen, 2011). Community-centered approaches aim to change the local institutional setting to immunize regions against slavery (Muthuri et al., 2012). Besides strategies for enhancing livelihood, this can for example involve education and the establishment of labour rights and civil rights groups to stimulate long-term cultural and economic changes. Companies operating in Australia, the United Kingdom, the European Union, and some states in the United States are subject to regulations that address modern slavery in supply chains. Californian law requires companies to make certain disclosures and provide consumers with information regarding their efforts to eliminate slavery and human trafficking from their supply chains so consumers can make better and more informed purchasing choices. In the UK, commercial organizations are required by law to prepare a slavery and human trafficking statement for each financial year, detailing the steps the organization has taken to prevent slavery and human trafficking in any of its supply chains or its own business. Under its Modern Slavery Act, the UK Government is empowered to confiscate assets that it views as proceeds of modern slavery/forced labor. It would be financially devastating for companies to be denied access to these large markets. Several countries require the MNCs to publicly disclose their anti-modern slavery/forced labor efforts throughout all of their supply chains. For example, Section 54 of the UK Modern Slavery Act mandates a host of disclosures and statements to be made by UK-based MNCs on their supply chains. If one fails to do so adequately, the UK Government has adopted a name-and-shame policy.



Conclusion

The organization needs to support the ethical case with the business like banning the import of goods made by the organization that practices modern slavery. At the same time, the effect of the share price can hit the performance of the companies. There are very limited Malaysian Public Listed Companies focusing on the implementation of modern slavery reporting. The target of SDG 8.7 calls for immediate and effective measures to eradicate forced labor, end modern slavery and human trafficking and secure the prohibition and elimination of the worst forms of child labor, including recruitment and use of child soldiers, and by 2025 end child labor in all its forms. The global nature of modern slavery calls for better transnational governance that elevates existing thinking from the institutional (failure) level to the level of supranational institutions. The findings of the review also have some interlinked implications for organizational society. At the corporate level, strong ethical behavior must be practiced to ensure good governance practices. It is also in line with corporate sustainability which economic aspects without social and governance are unable to sustain the organization for the long term.

This paper has several limitations that can be improved for future researchers. This study solely depends on the reviewing of annual reports in Malaysia, Australia, and London. The comparison is made as both countries highly report modern slavery in their annual report and modern slavery report. Transparency is built to ensure the confidence of investors, employees, and society. This study believed that having a voice in the industry can enlighten the issues.

Malaysia is affected a lot by the modern slavery issues arising drastically nowadays. With an analysis of the modern slavery indicators, better good governance can help Malaysia regain business from the outside and strengthen the Malaysian economy.

Acknowledgments

This research was supported by Universiti Tun Hussein Onn Malaysia (UTHM) through TIER 1 (vot Q122).

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6th Langkawi International Multidisciplinary Conference 2023 (6th LIMC 2023)
eISSN 2976-3223
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IN THE PERSPECTIVE OF CULTURAL INTEGRATION: THE DEVELOPMENT STATUS AND REASONS OF DIVERSE CULTURE IN MALAYSIA: TAKE MAHUA CULTURE AS AN EXAMPLE

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Abstract: *After the end of the Second World War, the multi-ethnic cultural policy of Western developed countries generally adopted the policy of assimilation, pluralism, and integration according to their own national conditions. Based on studying the development of multicultural integration in Western developed countries, this paper examines the current situation of multicultural development in Malaysia and explores the reasons. As one of the Southeast Asian countries, Malaysia has close exchanges with China since ancient times, and the Chinese people are an important force in the country's modernization drive. Hence, this paper using the literature research, with the Malaysian Chinese culture localization phenomenon for example, explore the performance of the multicultural fusion in Malaysia, and further explore the historical reasons for the formation of the multicultural fusion phenomenon in Malaysia. In this paper, communication of the two races from ancient to modern and from trade to immigration history is discussed.*

Keywords: *Multi-Cultural, Cultural Integration, Mahua Culture*

Introduction: This paper starts from the multicultural policy of Western developed multi-ethnic countries and discusses events after the second World War, Western developed multi-ethnic countries mainly adopted the policy of multiculturalism or cultural integration to establish a more harmonious social relation. For example, Western European countries, Canada, and other countries. From the perspective of cultural integration development of multi-ethnic countries, this paper studies the state of multicultural development in Asian countries, such as Malaysia, and further explores the motives for its formation. As a typical immigrant country in Asia located in the important road of the ancient Maritime Silk Road, Malaysia had a profound intersection with various civilizations and communicated with ancient China through the medium of trade, lived together with the immigrants from the southeast coastal areas of modern China, and had multiple cultures emerged at the historic moment. This article on the Malaysia's largest minority, which is the Chinese, as the case study for Malaysian Chinese culture development and change characteristics, analyzed the situation and reasons for the development of multiculturalism in Malaysia. Malaysian Chinese culture concluded that language expression, literature, religion, etc. With historical change, it has reflected the localization of Malaysian Chinese culture. The characteristics of Malaysian Chinese culture localization is the embodiment of the multicultural mutual integration in Malaysia. This cultural form, which not only maintains the characteristics of Chinese culture, but also reflects the local characteristics of Malay, is called Mahua culture. The existence and development of

Mahua culture shows that the integration of multicultural in Malaysia has made important achievements. This paper takes the perspective of Mahua culture, further excavation the cause of the multicultural fusion of Malaysia. This paper discusses from ancient to modern times, from the form of trade to immigration between China and Malaysia, from the source and fundamentally explore the history of Mahua culture formation, it is also one of the important reasons for the multicultural fusion of Malaysia. This paper mainly uses the literature research method to discuss the multicultural policy of Western multi-ethnic countries and the integration of multicultural development in Malaysia from the perspective of Mahua culture.

The development of multicultural in Malaysia from the perspective of cultural integration

The development and change of multicultural policies in Western developed countries

After the Second World War, multi-ethnic countries were established all over the world, and the multi-ethnic cultural policy also attracted the attention and discussion of the academic circles. Nong Yuqing (2023) conducted a study on the cultural policies of the United States, Canada, and Singapore, --typical developed immigrant countries, and believed that all countries generally choose the cultural policies of cross-use assimilation, pluralism, and integration. Among them, the United States is assimilated in the integration, Canada is the multicultural choice after the failure of assimilation, and Singapore is the cultural integration policy. No matter what kind the multi-ethnic cultural policy is, it is a choice based on its own cultural characteristics and basic national conditions. Tian Ye (2023) combed the immigration policies of developed countries in West Europe and found that since the end of the Second World War, developed countries in West Europe have generally gone through the transformation process from multiculturalism policy to cultural integration policy. After the end of World War II, multiculturalism was applied to Western European countries to protect the few immigrants. However, because Western European countries have a long history of nation state, their culture is strong. Moreover, around the twenty-first century, the refugee crisis caused a more serious multi-ethnic situation in Western Europe, and the multiculturalism policies in Western Europe led to ethnic alienation and conflict, prompting Western European countries to seek immigration policies to promote ethnic integration.

Malaysia's multicultural development from the perspective of Mahua culture

Due to historical and geographical reasons, Southeast Asian countries and there is a multicultural communication between China background. Since the 19th century, Chinese mass immigration in Malaysia, and with the founding of Malaysia, they have evolved into a member of the multi-ethnic Malaysia. Malaysia's multicultural development has received attention by scholars in many countries, especially the Chinese scholars.

For instance, Liao Guoyi & Bai Aiping (2012) made a historical exploration of the multicultural exchanges between China and ASEAN countries, pointing out that in the ancient Chinese Tang Dynasty, Guangzhou, Quanzhou, and other places were important ports of China's foreign trade; in the early Qing Dynasty, many Cantonese and Fujian people came to work in Malaysia, which is a historical trajectory from trade to immigration. The advanced civilization of ancient China also spread to Southeast Asian countries in the form of goods and tools. For example, Fang Kong Qian. "Along the coast of the Strait of Malacca, Fang Kong Qian of ancient China first became the medium of exchange recognized by merchants of all countries" (P.105). Tang Dynasty porcelain was also found in Kota Yi in Johor, Malaysia.

Among Southeast Asian countries, the Chinese population in Malaysia accounts for more than one-fifth of its national population and is the most populous minority in the said country. Therefore, this paper mainly studies the history and characteristics of the multicultural development in Malaysia from the perspective of Mahua culture.

In the fifties and sixties of the twentieth century, the thinking and practice of many Chinese sages in Singapore and Malaysia embody the values of multicultural integration, such as the Chinese industrialist Li Guangqian's thinking and practice of "multicultural coexistence." As a descendant of Chinese immigrants, Mr. Li Guangqian is deeply influenced by his multicultural values. He treated Chinese, Malays, Indians, and Arabs in the Singapore and Malaysia regions equally. The schools he funded included the Chinese schools, Indian Tamil culture schools, and Muslim schools (Hong Caizhen, 2008). Another example is the Mahua writer Lu Baiye. As a descendant of Chinese immigrants, Lu Baiye's literary works are full of cultural identity with his parents' homeland. He wrote many Chinese pioneering histories in Malaysia and praised his parents' industrious and brave spirit. At the same time, as a Malaysian citizen, Lu Baiye has also written many Malays history and culture, thinking on the multicultural of Malaya, reflecting his open, inclusive, and integrated multicultural view (Malaysian scholars Huang Weining & He Qicai, 2021).

After the eighties of the twentieth century, with the passage of time, the feelings of Malaysian Chinese for their ancestral home have become a distant imagination; Malaysia is the hometown where they live, and the national identity of Chinese in Malaysia has been very clear. However, they still have expectations for the multicultural development in Malaysia. In 1981, when the government asked all ethnic groups to review the national culture, the Chinese community drafted the "Memorandum of National Culture", which proposed that the basic characteristics of Malaysia's national culture were "diverse cultural forms, common values, and local colors" (Duan Ying, 2017, P.66).

Subsequently, the former Malaysian Prime Minister Mahathir also proposed the "new Development Policy" in 1991, emphasizing the common development of all ethnic groups in Malaysia, and he proposed the concept of "Malaysian nation" in the "2020 Great Wish" to "establish a united Malaysia with common goals" (Wu Yun, 2014, P.46).

It can be said that after years of development and evolution, Malaysia's diverse culture is constantly becoming open, inclusive, and modern, which is a new exploration and new prospect of the concept of contemporary global cultural diversity and cultural integration.

Embodiment of Malaysia's multicultural integration from the perspective of Mahua culture

In the process of multicultural integration in Malaysia, the cultural identity of Malaysian Chinese has also changed. In her article, Luo Li (2002) borrowed the British scholar Stuart Hall who is the famous expert in cultural identity to point out that "cultural identity" represents a common culture, reflecting the common historical experience and common cultural symbols, which provides us with a stable and uninterrupted meaning framework. As the Malaysian

Chinese have multiplied and lived forever in Malaysia, their feelings for Malaysia are more profound from generation to generation. They are constantly exploring the Malaysian localization of Chinese culture. In the process of integration with Malay culture, the Malaysian Chinese culture has evolved into a unique Malaysian culture, and the Malaysian Chinese have formed a new cultural identity.

Mahua culture is the product of the collision and integration of Chinese culture and Malay culture, which is reflected in the language habits of the Malaysian Chinese, Mahua literature, and Mahua religion, among others.

Localization of Malaysian Chinese language expression

There are many languages in Malaysia society, thus, the phenomenon of "language mosaic", namely, the multilingual mixing in Malaysian Chinese language expression is very common. With the intergenerational change, Malaysian Chinese language and Malay language habits are also increasing consistently, such as mixing Malay and English, as well as having their Chinese dialect the ability of degradation, that Malaysian Chinese has a language habit that reflects the characteristics of localization of Malaysia, which is the embodiment of the multicultural fusion in Malaysia (Malaysian scholars Hong Lifen, 2007).

Localization of Mahua literature

Wang Xiaofeng (2020) pointed out that after the history of Japanese invasion, British recolonization, and the founding of Malaysia, the Chinese literature in Malaysia experienced the dispute between "overseas Chinese literature" and "Mahua art" in 1948 and experienced the change from "expatriate literature" to "Mahua literature." The consciousness of seeking the "root" of Malaysian Chinese writers has also changed from the "root" consciousness of the first generation of immigrants to China to the "root" consciousness of Chinese descendants to Malaysia. Through Huang Xiaojuan's research about the changes in the creation content of Malaysian Chinese female writers, which also once again demonstrated the local development process of Chinese literature in Malaysia. The writing content of Malaysian Chinese female writers is not only gradually rooted in the social life of Malaysia, but also thinking about the fate and cultural integration of the Chinese people (Huang Xiaojuan, 2006).
It is not hard to find that as one of the important forms of Mahua culture, Mahua literature in Malaysia multicultural pattern has been realized the transformation from Chinese culture to local culture writing, which recorded the content of Malaysia local life, and the value of the content also contains the diversity and localization.

Localization of Mahua religion

When the Chinese went to sea, they hoped that the gods could bless their smooth journey and peace, and hoped to live a smooth life in the distant destination. Therefore, the phenomenon of migration and move the immortals synchronized has appeared, and the localization of the Chinese religion in the destination also gradually appeared. For example, in the Mahua religion, there is a new image of the land god: Datuk Gong. Datuk Gong is the product of the combination of Chinese culture and Malay culture and is the pioneering work of Chinese folk belief in Malaysia. First, the name "Datuk Gong" is the product of the combination of Malay and Chinese. "Datuk" is Malay and "Gong" is Chinese, both of which have respect for the holy people or natural things. Second, the statues of "Datuk Gong" are basically Malay people, but the worship ceremony follows the worship tradition of Chinese religion. The appearance of

Datuk Gong clearly reflects the Malaysian localization of Mahua religion (Wang Zhaoyuan, 2022).

Malaysia, of course, has multicultural development in many other aspects, such as the preservation of Malaysian street architectural landscape. In 2008, George Town, Penang, was selected as a World Heritage Site by UNESCO and in its core area: Bentou Gong Lane--Shi Da street area, the famous Chinese Qiu company, Xie company, ancestral hall, temples, and different ancestral Chinese hall, community headquarters, and Muslim mosque, where the street arcade stands there together, narrow alleys, courtyard and streets of the record of the history of the multicultural city. Luo Li (2002) in her article praised, “Every town in Malaysia can see the skin color and clothing of Malay, Chinese, Indians, as well as solemn Malay Mosque, Chinese temple hall, splendid Indian church with uneven row, mixed with colonial British Christian church, Dutch street; this revealed a richer Western amorous feeling” (P.20). In summary, a typical Asian immigrant country, such as Malaysia, has the multicultural development path that is not only unique according to the situation of its own country but also responds to the trend of global multicultural integration. In the process of multicultural integration of Malaysia, certain achievements have been made. It can be said that it is the openness, inclusiveness, and diversity of culture that give Malaysian cities a unique attraction. The rich and colorful multicultural resources are the valuable wealth for the cultural development of Malaysia.

The historical causes of the expression of multicultural integration in Malaysia

Through the expression of the integration of multicultural in Malaysia and the reasons for its formation, this paper still explores the reasons for the integration of multicultural in Malaysia from the perspective of Mahua culture. The reasons for the formation of multicultural integration in Malaysia are both historical and national policies and Chinese education efforts. However, this paper focuses on exploring the historical reasons, analyzing the exchange history between China and Malaysia from ancient to modern times, and from trade to immigration.

The history of exchanges between ancient China and ancient Malay countries

The "tribute trade" exchanges between ancient China and ancient Malay countries

Ancient Chinese books record the history of exchanges between ancient China and ancient Malay countries from more than 1,000 years from the China Han Dynasty (206–220BC) to the Qing Dynasty (1644–1911). Among them, some communication records from the Han Dynasty to the Sui Dynasty are listed as follows:

Table 1: Records of the part exchanges form Han Dynasty to Sui Dynasty between ancient China and ancient Malay countries.

The Chinese dynasty	Specific year	The name of ancient country	Today's address	Communicate deeds
Han Dynasty (206BC–220BC)	The 2nd century BC	Pi Zong	North Malay Peninsula	The Chinese envoys made their way to India

The Southern and Northern Dynasties (420–589 years)	442–466 years	Po Huang	Said it is in the Pahang area	Sent envoys to China seven times, and the Chinese emperor conferred their envoy the title of "General"
The Southern and Northern Dynasties (420–589 years)	515 years	Lang Ya Xiu	It is located about from Kedta to Nakhon Srithamarat, Thailand	Send the envoy Asado to visit China
The Southern and Northern Dynasties (420–589 years)	517, 522 years	Po Li	The northern part of Borneo, including Sarawak and Sabah	Send envoys to visit China
Sui Dynasty (581–618 years)	607 years	Chi Tu	It is located from Kedah to Songkhla, Pattani, Thailand, or from Kelantan to Pahang	Emperor Yang Guang sent Chang Jun and Wang Junzheng to visit the country.

Source: This table is made with reference to Zhang Yinglong's article (2005).

As shown in the table, according to Zhang Yinglong (2005), the Book of "Han Geography" records the process of Chinese emissaries traveling to India from Southern China in the 2nd century BC. The route from China to India needs to pass through Malaysia, so some scholars believe that the "Pi Zong" in this section of data is in the north of the Malay Peninsula. Emperor Yang Guang of the Sui Dynasty sent emissaries to visit: Chi Tu, the first time of Chinese envoys to Malaysia.

By the Tang Dynasty (618–907), China had a closer trade and tribute activities with neighboring countries. Many monks went to India for Buddhist scriptures, such as monk Yi Jing, who passed through Malaya to India and lived in Jie Tu (generally believed to be from Kitta to Glass City).

During the Song Dynasty (960–1279) and the Yuan Dynasty (1279–1368), the political and trade relations with Malaysia developed further, especially with the Bo Ni state located in the East Malaysia region. The "History of Song" and the "History of Yuan" also record the exchange history between the ancient China and the other ancient Malay countries shown in the table below.

Table 2: The History of Song Dynasty and Yuan Dynasty records the exchanges between the ancient China and ancient Malay countries.

Time	The name of ancient country	Today's address	Communicate deeds
In 1001,	Dan Mei Liu	It is in the northern part of the Malay Peninsula	Send envoys to visit China
In 1286,	Ding He Er	Terengganu	Send envoys to China
In 1286,	Ji Lan Yi Xun	Kelantan	Send envoys to China
In 1320,	Long Ya Men	One refers to Singapore	The Yuan Dynasty sent envoys to visit the country
In 1325,	Long Ya Men	One refers to Singapore	The country sent envoys to visit the Yuan Dynasty

Source: This table is made with reference to Zhang Yinglong's article (2005).

In short, the Maritime Silk Road, which began in the 2nd century BC, extends to the west. The Malay Peninsula, with its superior geographical location, became the meeting point of this maritime trade road. The friendly relations between China and the ancient Malay countries also developed along with the westward extension of the Maritime Silk Road, and finally reached its peak in the 15th century (the Ming Dynasty in China).

During the Ming Dynasty (1368- –1644), Zheng He led the world's largest Armada on seven voyages to the Western Seas and landed five times on Malacca.

According to ancient Chinese books, Man Ci Jia (Malacca) was originally a country of Siam (Thailand) and had to pay 40 liang of tribute to Siam every year. In 1405, Man Ci Jia sent envoys to China, and the Ming emperor "conferred" Beremy Sular as the king of Man Ci Jia, and from then on, Man Ci Jia was free of the control of Siam (Zhang Yinglong, 2005)

There are also documents says that in 1409, Zheng He was ordered to carry the imperial edict, give the king double silver seal, crown belt and robe, build a monument to seal the city, and named it "Man Ci Jia". Zheng He's navy assisted the Malays in defeating the Javanese and Siamese in their aggression and assisted in the political rule of the Man Ci Jia (Malacca) dynasty (Su Yingying, 2015).

According to Chinese historical records, the Kingdom of Man Ci Jia and Bo Ni interacted frequently with the Ming Dynasty. The Ming Dynasty sent people to escort the visiting missions form the Man Ci Jia dynasty and Bo Ni kingdom for many times, and even had Chinese envoys died in the sea on their way.

The kingdom also the great-great generations visited China in turn, the specific time is shown in the following table.

Table 3: Visit to China by three generations of Malacca dynasties.

The name of the monarch (Man Ci Jia)	Time	Communicate deeds
The founding monarch Beremy Sular	In 1411,	Led his concubines, sons, attendants, and more than 540 people to visit China
The second generation of monarch Iskandar Shaand	In 1424,	Led a delegation to visit China
Three generations of monarchs Muhammad Sha-Sultan	In 1433,	Led a delegation to visit China (Note: Muhammad Shah, namely Sri Maharaja, China translate as “Xilimahacizhe”, was the first king of Malacca dynasty to use the title of “Sultan”)

Source: This table is made by Su Yingying’s article (2015).

Malacca dynasty had friendly relations with China. Zheng He’s fleet used Malacca as an important transit station and set up a business hall in Malacca to store commodities and goods (Zhang Yinglong, 2005).

Zheng He’s activities in Malacca not only helped the dynasty expel foreign enemies, but also spread advanced production methods to Malacca, helped him cast Chinese copper coins with tin, and recommended Chinese to serve as port directors (Wang Runhua, 2021).

The Chinese were allowed to live in Malay and form settlements, such as Bukit China. The Malay monarch gave the Chinese political and the right to do business. The Chinese gradually integrated into the local society and married with the Malays, forming the “Baba Nyonya” ethnic group and the Baba Chinese culture. This should be the earliest phenomenon of Mahua culture integration (Su Yingying, 2015).

In short, according to historical records, China and the ancient Malay state have always maintained a very friendly relationship, which reached its peak in the Ming Dynasty. A large amount of data on the “tributary relationship” between ancient Malay countries and China also reflect that the important feature of the relationship between ancient China and neighboring countries was the tributary trade relationship centered on China.

Characteristics of commercial activities in ancient Malay countries

The ancient Malay countries, at the focus of the Maritime Silk Road, attached great importance to commercial activities. For example, during the Southern and Northern Dynasties in China, Don Xun (once located in the north of the Malay Peninsula) was one of the maritime trading centers on the Malay Peninsula. In the Tang Dynasty of China, the State of Luo Yue (in Johor) “gathered together for trade exchanges”, and merchant ships went to Guangzhou, China for trade activities every year. According to the “Zhu Fan Zhi” of the Song Dynasty, the king of the Bo Ni State oversaw foreign trade affairs, and people only with the king’s permission could be trade. Even if a merchant commits a capital crime, he is only punished but not killed. Wang

Dayuan, who wrote the "Island Yi Zhi Luo", also mentioned that the Bo Ni State selected a person responsible for the cashier tax, and his work makes no mistake (Zhang Yinglong, 2005). The ancient state of Malay's attention to commercial activities made the Malaysian commodities rich at that time. Commodities from abroad included rice, salt, sugar, wine, cloth, porcelain, iron bars, gold, and silver and so on (Zhang Yinglong, 2005). Ancient Malaysia produces all kinds of spices, soil, wood, sea salt and tin, etc. Even have ivory, rhino horn, etc. In the ancient Chinese records, Malacca dynasty is a pearl of Southern Sea, from Arabia, India, China, Siam, Java, and other places of merchant ships here, goods full of beautiful things. The ancient Malay country was an important business center in ancient Asia, even globally. The importance of ancient Malay countries to commercial activities is an important reason why it can accept various cultures and form the phenomenon of multicultural integration.

The multicultural characteristics of the ancient Malay countries

Ancient Malay countries accepted foreign cultures and gave the Malay culture an open and inclusive cultural tradition. For example, in terms of religion, according to ancient Chinese books, Hinduism (Brahmanism) and Buddhism were prevalent in ancient Malay countries before the Ming Dynasty, and after the Ming Dynasty, Malacca believed in Islam and there are also some other ancient countries believed in Buddhism (Zhang Yinglong, 2005).

For another example, the Chinese went south to the ancient Malay country and intermarried with the Malays to form the Baba Nyonya culture, which is a high degree integration between Chinese culture and Malay culture. Because the ancient Chinese who migrated to ancient Malay countries were mostly men, often they were married to native Malay women. "Baba Chinese" is the name of the combination of Chinese and Malays descendants, Baba refers to the male, women are called Nyonya. Baba Chinese are mainly distributed in Malacca, Penang, and Singapore. Baba Chinese culture is a new cultural phenomenon resulted by the localization of Chinese culture in Malaysia.

The cultural integration of the Chinese in Baba is as follows: Speaks Malay mixed with Southern Hokkien dialect; It combines the Malay and Chinese food and invented the dishes and cakes; The Baba Chinese women wear the Nyonya clothes; Inherit the religious culture of Chinese ancestor worship and the mixed style of Buddhism and Taoism while strictly abiding by the customs and habits of the Chinese (Wang Runhua, 2021).

Later during the British colonization of Malaya because the Baba Chinese did business with local Malays earlier, were proficient in Malay, familiar with the cultural and social situation of the Malay Peninsula and were willing to receive English education, thus, they became a trade intermediary between European businessmen and local people. Baba merchants gradually developed into wealthy local capitalists and officials of colonial government agencies. For example, Chen Zhenlu (founder of the Malaysian Chinese Party) is a typical representative of the Baba Chinese. Baba Chinese also translated the classical Chinese novels including almost all famous in China, and the Baba Chinese ballad: "Bandon" is Malay poetry that rhymes such as Chinese poetry (Wang Runhua, 2021).

Ratzel, a representative German figure of cultural communication doctrine, pointed out that cultural elements often spread with ethnic migration, and national cultural differences will be weakened or even eliminated with the communication and exchange of various ethnic groups.

The emergence of Baba Chinese culture can be seen as a model of the gradual weakening of cultural differences between the two ethnics after more than a century of communication and exchange (Su Yingying, 2015).

In short, the phenomenon of multicultural integration has appeared in ancient Malay countries, which is an important embodiment of the inclusiveness and openness of Malay culture, and also the historical basis of the phenomenon of multicultural integration in modern Malaysia. The exchanges between ancient China and ancient Malay countries were very close, which correlated to the prosperity of ancient China and the status of ancient Malay countries as a trade center in the Maritime Silk Road. The exchanges between ancient China and ancient Malay countries have always been peaceful and friendly, which is the historical basis for the formation of Mahua culture and one of the important historical backgrounds for the formation of diverse cultures in Malaysia.

However, as a great country in the Eastern civilization, China was increasingly immersed in the dream of being "the heavenly kingdom", the Western world changed quietly in the same period. In the 15th century, the initial development of Western capitalism and the demand of foreign trade promoted the great navigation of all Western countries. Finally, the Portuguese destroyed the 106-year Malacca dynasty in 1511 and occupied Malacca. Later with the Western Sea hegemony, the Dutch colonists occupied Malacca in 1641. After 1824, Britain gradually realized its colonial rule over Malacca, the Malay Peninsula, and the Northern Borneo. Throughout this period, the mode of historical communication between China and Malaysia was greatly damaged. At the same time, Malacca has also become more and more the gathering place of the worlds multicultural.

History of population migration to Malaysia from the southeast coastal areas of modern China

In the 19th century, Malaysia under British colonial rule needed many labors. The Chinese began to migrate to Malaysia on a large scale in the second half of the 19th century. According to statistics, during the 32 years from 1895 to 1927, more than 6 million Chinese people moved to the states of Malaya (Zhao Qing Research Group of Overseas Chinese Culture of Guang Government, 2015). This paper summarizes the reasons for the large-scale population migration to Malaysia in the southeast coastal areas of modern China as follows:

The people living poorly in modern China under the decline.

During the Qing Dynasty, China's population increased rapidly, and by 1833 it was about 400 million (Zhao Qing Research Group of Overseas Chinese Culture of Guang Government, 2015). The population is increasing, but the cultivated land area is insufficient, in the mountainous and hilly South China, the contradiction between man and land is very prominent. In addition to the backward production technology, low productivity, social and economic development is very slow; and most of the arable land is owned by the feudal landlords; this makes the peasants' life very difficult.

In 1840, Britain launched the "Opium War". After the defeat of the Qing government, it was forced to sign the first unequal treaty with Britain: The Treaty of Nanjing. Since then, the Qing government has signed a series of unequal treaties with Western countries. The Qing government imposed the huge war reparations on the common people through the collection of exorbitant taxes and miscellaneous taxes, which made the people's lives more difficult. And in the meantime, Guangzhou, Xiamen, and other coastal cities were opened as trade ports, the Western capitalist countries dumped goods and plundered resources to China, China's self-sufficient natural economy gradually disintegrated, during this period, Chinese society experienced violent turmoil. The Taiping Rebellion Movement in the middle and late 19th century had beginning in Southern China. In 1911, the Xin Hai Revolution overthrew the Qing Dynasty. However, in the later period of the Bei yang government, China was still divided. In the Republic of China era, the old and new warlords were still fighting and in turbulent times. Continued social unrest, coupled with the inability to control natural disasters under the political corruption, has left the fields desolate, and the people displaced and miserable. Guangdong peasant movement continues, and South China is at the forefront of the revolutionary movement in Southern China.

Modern China's immigration policy and Britain's colonial exploration of Malaysia

In 1860, China was defeated in the Second Opium War between China and Britain. The Qing government signed the Treaty of Beijing with Britain and France and other countries, which stipulated: "The Chinese are allowed to make a treaty with the British to go to the British and French territories or work in "foreign places" (Zhao Qing Research Group of Overseas Chinese Culture, 2015, P75). In the late 19th century, the Qing government set up a consul to protect the interests of overseas Chinese so that Chinese people could emigrate freely. The Bei yang government followed the policy of immigration in the late Qing Dynasty. In 1927, the Republic of China set up the Overseas Chinese Affairs Bureau to protect the political and economic rights and interests of overseas Chinese and encourage them come back to set up industries and create public welfare undertakings (Zhao Qing Research Group of Overseas Chinese Culture, 2015).

The open immigration policy of modern China was originally reflected in the unequal treaties signed with Western countries, which was completely due to the demand of labor from Britain and France in their colonies; this is like the development of Britain in Malaysia. In 1914, Britain had included the Malay Peninsula and Northern Borneo into the scope of its colonial rule. Under the British colonial rule, Malaysia became the source of raw materials, where large-scale reclamation, mining and port construction activities required a large amount of labor force. As a result, the British colonists recruited a large number of Chinese from the Southeast China to Malaysia to cultivate and mine.

Malaysia and South China have convenient water transportation; in Malaysia, abundant rainfall throughout the year, the climate conditions are very suitable for agricultural production, and there are no natural disasters, such as earthquakes and typhoons. At the same time, it is sparsely populated and rich in mineral resources. Clearly, the living environment in Malaysia is better than that in all parts of Southern China.

It was the harsh living environment and the support of government policies and the development needs of Malaysia that caused the mass migration of Malaysia from South China starting in the middle and late 19th century.

In short, the history of large-scale migration of Malaysia from South China is one of the reasons for the formation of the multicultural development pattern in Malaysia, and it is an important basis for the formation of Mahua culture.

In summary, the peaceful exchanges between ancient China and ancient Malay countries to the migration of Malaysia in modern China demonstrate that the Chinese culture is an important objective factor for the integration of Malaysian multicultural, and Mahua culture is a contemporary reflection of the integration of Chinese culture and Malay culture. Undoubtedly, the reasons for the formation of the multicultural pattern and cultural integration in Malaysia are also due to the policies of the Malaysian government of retain other ethnic languages and cultures after the founding of the state, the Chinese education's promoting, etc., which need to be further sorted out in the authors' future studies.

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LIGHT-WEIGHT FILE MANAGEMENT FOR HALAL ENTERPRISE BLOCKCHAIN - A LINKED INFRASTRUCTURE DESIGN FOR RAPID TRANSACTIONS

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Abstract. *Blockchain technology has the potential to revolutionize various industries, including the halal industry. The halal industry is a rapidly growing market, and it is projected to reach $1.9 trillion by 2024. Blockchain technology has the potential to provide a secure and transparent way to certify the transaction, ensuring that they meet the requirements of Islamic law. However, one of the main challenges in implementing blockchain technology in the halal industry is the issue of file management. The large size of the files used for certification and tracking can slow down transaction speeds and increase storage costs. This is particularly problematic for the halal industry as well as in other industries. In this paper, we discuss the current state of research on light-weight file management for halal enterprise blockchain and propose a design for a light-weight file management system for halal enterprise blockchain, which aims to provide rapid transactions in a linked infrastructure that optimizes data storage, retrieval, and management system and enables faster transaction processing.*

Keywords: *Blockchain, Light-weight File management, Halal Enterprises, Linked infrastructure.*

Introduction

Blockchain technology has the potential to revolutionize various industries [1], including the halal industry. Halal products and services have a growing global market, and the use of blockchain technology can provide a secure and transparent way to certify and track these products [2]. The halal industry is a rapidly growing market, with the global halal food and beverage market projected to reach $1.9 trillion by 2024 [3].

Blockchain technology has revolutionized the way transactions and data are recorded[4], stored, and managed. The decentralized and distributed nature of blockchain has ensured security and transparency of transactions [5]. In this context, the importance of a robust and efficient file management system for blockchain cannot be overemphasized. One of the main challenges in implementing blockchain technology in the halal industry is the issue of file management [6]. The large size of the files used, and tracking can slow down transaction speeds and increase storage costs [7]. In the context of Halal enterprise blockchain, file management plays a crucial role in ensuring the swift and secure execution of transactions [8]. A robust file management system is crucial to the success of these enterprises, as it ensures the integrity and authenticity of the transaction records [9]. However, existing file management systems for blockchain are often bulky and slow, which can hamper the performance of the blockchain network. This is especially a concern in the case of Halal enterprise blockchain, where rapid transactions are of utmost importance. Furthermore, current file management systems are often vulnerable to security breaches, which can compromise the confidentiality and integrity of the transactions. In this research paper, we propose a linked infrastructure design for a light-weight file management system for Halal enterprise blockchain. Our design aims to address the limitations of current file management systems by providing a fast and secure solution for the rapid execution of transactions. We believe that our proposed solution can significantly improve the performance of Halal enterprise blockchain and contribute to the wider adoption of blockchain technology in the Halal enterprise sector.

Literature Review

The importance of file management systems for blockchain technology has been widely discussed in the literature. A file management system is responsible for storing, organizing, and retrieving data within a blockchain network. In the context of Halal enterprise blockchain, it is crucial to have a secure and efficient file management system that can handle the large volume of transactions while ensuring the integrity and authenticity of the transaction records. Several studies have addressed the limitations of existing file management systems for blockchain. For example, in [10], the authors have discussed the slow performance of current file management systems and the need for a more efficient solution. They have proposed a new file management system that utilizes a decentralized and distributed architecture to improve the speed and security of transactions.

In [11], the authors have focused on the security aspect of file management systems for blockchain. They have proposed a novel file management system that utilizes advanced encryption and authentication techniques to secure the transaction records. The proposed system is designed to prevent unauthorized access and tampering of data, ensuring the confidentiality and integrity of the transactions. Another important aspect of file management systems for Halal enterprise blockchain is the compliance with Shariah law. In [12], the authors have discussed the principles of Shariah law and their implications for the design of file management systems. They have proposed a new file management system that is based on the principles of Shariah law, ensuring that the transactions are in compliance with the Islamic laws.

In [7], the authors have proposed a file management system for blockchain that utilizes a hierarchical structure for organizing the data. The proposed system is designed to handle the large volume of transactions and provide fast access to the data. The system is also scalable, allowing for the easy expansion of the blockchain network as the number of transactions increases. Another related work is presented in[13], where the authors have focused on the use of smart contracts in the file management system. The proposed system utilizes smart contracts to automate the execution of transactions and ensure the integrity and authenticity of the transaction records. The authors have also discussed the security aspects of the system and proposed measures to prevent unauthorized access and tampering of data. In [14], the authors have proposed a new file management system that utilizes blockchain and cloud storage technology. The proposed system is designed to provide a fast and secure solution for the storage and retrieval of data within the blockchain network. The authors have also discussed the scalability and reliability aspects of the system, making it suitable for large-scale deployments.

In conclusion, the literature review highlights the importance of a robust and efficient file management system for Halal enterprise blockchain. The existing file management systems are slow and vulnerable to security breaches, making it crucial to develop a new solution that addresses these limitations. Our proposed linked infrastructure design for a light-weight file management system aims to provide a fast and secure solution for the rapid execution of transactions in Halal enterprise blockchain.

Lightweight File Management Systems for Blockchain

There are several lightweight file management systems for blockchain technology that have been proposed in the literature. In this section, we will discuss seven of the most prominent and widely used systems.

IPFS (InterPlanetary File System): IPFS[15] [16] is a decentralized file storage system that uses a distributed hash table to store and access data. IPFS offers fast and efficient data retrieval, reducing the latency and cost of transactions. It also supports file versioning and data deduplication, which can further reduce the amount of data stored on the blockchain.

Filecoin: Filecoin [17] [18] [16]is a decentralized storage network that allows users to rent out unused disk space. It uses a consensus mechanism to ensure the security and reliability of the stored data. Filecoin also supports data deduplication, which helps to reduce the size of the data stored on the blockchain.

Sia: Sia [19-21]is a decentralized cloud storage platform that uses a proof-of-work consensus mechanism to secure the stored data. It is designed to offer fast, secure, and cost-effective data storage and retrieval. Sia supports data deduplication, encryption, and versioning, which helps to reduce the amount of data stored on the blockchain and to ensure the privacy and security of the stored data.

Fluree: Fluree [22] [23] is a blockchain-based database management system that uses a directed acyclic graph data structure to store and access data. It is designed to be fast, secure, and scalable, offering efficient data storage and retrieval. Fluree supports data deduplication and encryption, which helps to reduce the size of the data stored on the blockchain and to ensure the privacy and security of the stored data.

Benefits of Light-Weight File Management Systems

The use of light-weight file management systems in blockchain technology offers several benefits. Firstly, these systems can reduce the size of the data stored on the blockchain, making it easier to process and manage. This in turn leads to faster transaction speeds and lower computational costs. Secondly, these systems support data deduplication and encryption, which helps to ensure the privacy and security of the stored data. Thirdly, they support file versioning, which allows users to track the changes made to a file over time. This is particularly useful in the Halal enterprise blockchain where the authenticity and integrity of products and services are critical.

Limitations of Light-Weight File Management Systems

Despite the benefits of light-weight file management systems, there are also some limitations that need to be considered. Firstly, these systems can be vulnerable to attacks such as denial-of-service (DoS) attacks, which can result in the loss or corruption of data. Secondly, they may not be suitable for large-scale applications that require high data storage capacity and scalability. Finally, the decentralization of these systems can also lead to challenges in terms of governance and coordination.

Table 3. Illustrating A Comparison of Light-Weight File Management Systems in Blockchain

System	Transactions per second (TPS)	Encryption	File Versioning	Scalability	Security
IPFS (InterPlanetary File System)	Hight	Yes	Yes	Limited	Good
Filecoin	Medium	Yes	Yes	Moderate	Good
Sia:	Low	Yes	Yes	Moderate	Good
Fluree:	Hight	No	Yes	High	Fair

Table 1 highlight the comparison on the key features of light-weight file management systems in blockchain and provides a general understanding of their capabilities. Further details are given bellow.

Transactions per second (TPS): The TPS rate is an important factor in determining the performance of a file management system. IPFS and Fluree have a high TPS rate, while Filecoin and Sia have a low and medium TPS rate. The TPS rate is important because it determines the number of transactions that can be processed in a given time frame, which can impact the overall efficiency of the system.

Data Deduplication: Data deduplication is an important feature that helps to reduce the storage requirement of the system by eliminating duplicate data. All systems except for System 6 and System 7 support data deduplication.

Encryption: Encryption is an important security feature that helps to protect the privacy and confidentiality of the stored data. System 1, System 2, and System 3 support encryption, while System 4, System 5, System 6, and System 7 have limited or no encryption capabilities.

File Versioning: File versioning allows users to track changes made to a file over time. System 1, System 2, and System 3 support file versioning, while System 4 has limited support and System 5, System 6, and System 7 do not support file versioning.

Scalability: Scalability refers to the ability of the system to handle an increasing volume of data and transactions over time. System 3, System 5, and System 7 have a high degree of scalability, while System 1, System 2, System 4, and System 6 have limited scalability.

Security: Security is an important factor in the implementation of any file management system. The security of a system is determined by a combination of its encryption capabilities, data deduplication, and file versioning. Based on these features, System 1, System 2, and System 6 have a good level of security, while System 3, System 4, System 5, and System 7 have a fair level of security.

In conclusion, each light-weight file management system in blockchain has its own strengths and weaknesses based on the features discussed. The specific requirements of the Halal enterprise blockchain will determine the best system to use, as each system will have different trade-offs in terms of performance, security, scalability, and other features. It's important to carefully consider the requirements of the enterprise blockchain and thoroughly evaluate the different file management systems to determine the best solution.

A new Linked Infrastructure Design for Rapid Transactions.

In this section, we propose a new linked infrastructure design for rapid transactions in the halal enterprise blockchain. However, several solutions have been proposed. These solutions include using off-chain storage solutions, such as cloud storage, and using distributed file systems, such as IPFS and Filecoin. However, these solutions may not provide sufficient security and transparency for the halal industry. Therefore, a linked infrastructure design has been proposed as a potential solution for efficient and cost-effective file management in the halal industry. The design utilizes a combination of blockchain technology and a distributed file system to provide a secure and transparent way to store and transfer large files. The linking mechanism in the design ensures that the files are securely linked to the corresponding transactions on the blockchain.

The proposed design consists of a linked infrastructure that integrates multiple light-weight file management systems to provide a comprehensive solution for data storage and retrieval in the halal enterprise blockchain as shown in figure 1. The linked infrastructure consists of three main components: a data storage layer, a transaction layer, and a consensus layer.
The data storage layer is responsible for storing and retrieving data in the blockchain. It uses a combination of light-weight file management systems to ensure data security, efficiency, and scalability. The data storage layer is designed to be highly modular and flexible, allowing organizations to easily add or remove file management systems as needed to meet their changing needs.

The transaction layer is responsible for processing transactions in the blockchain. It uses a combination of algorithms and protocols to ensure rapid and efficient processing of transactions. The transaction layer is designed to be scalable and flexible, allowing organizations to easily adapt to changing transaction volumes and processing requirements.

The consensus layer is responsible for ensuring the consistency and integrity of the blockchain. It uses a consensus algorithm such as Proof of Stake or Proof of Work to reach consensus among nodes in the network. The consensus layer is designed to be secure and efficient, ensuring that the blockchain is protected against malicious attacks and that transactions are processed quickly and efficiently.

The linked infrastructure design for rapid transactions provides several benefits for organizations that implement it in their halal enterprise blockchain. Firstly, it provides a comprehensive solution for data storage and retrieval that is efficient, secure, and scalable. Secondly, it is highly modular and flexible, allowing organizations to easily add or remove file management systems as needed. Thirdly, it provides a scalable and efficient transaction layer that can process transactions rapidly and efficiently. Fourthly, it provides a secure and efficient consensus layer that ensures the consistency and integrity of the blockchain.

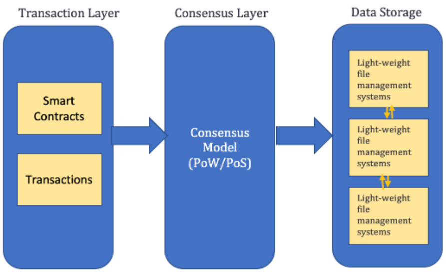

Fig. 43. Figure Illustrates the Linked Infrastructure Design.

Preliminary Simulation
In this section, we will discuss the preliminary results of the linked infrastructure design for rapid transactions in the halal enterprise blockchain. The initial results are based on a initial simulation of the proposed design and will only focus on key performance metrics such as transaction processing time, data storage capacity, and security.

The initial simulation was performed using a test network consisting of 10 soft nodes, with 2 organization and 5 node representing a different organization in the halal enterprise blockchain. The simulation was run for 24 hours and tested various scenarios, such as high transaction volumes, network congestion.

The results of the simulation showed that the linked infrastructure design for rapid transactions was able to process transactions rapidly and efficiently, with an average transaction processing time of less than 2 seconds. This is a significant improvement over current light-weight file management systems, which can take several minutes or even hours to process transactions.

In terms of security, the linked infrastructure design showed excellent resilience against malicious attacks. The design's combination of multiple light-weight file management systems and a secure consensus layer provided a high level of protection against attacks such as hacking, malware, and data theft. The design was also able to detect and respond to network congestion and other performance issues quickly, ensuring that the blockchain remained operational and secure at all times.

Conclusion:
To conclude, Blockchain technology has the ability to completely transform a variety of businesses, including the halal industry. The halal sector is quickly expanding, with an estimated value of $1.9 trillion by 2024. The large size of the files, which can slow down transaction rates and raise storage costs, is one of the key problems in using blockchain technology. This is especially problematic in the halal business and other industries. The linked infrastructure design for rapid transactions in the halal enterprise blockchain provides a comprehensive and cost-effective solution for organizations looking to implement a halal enterprise blockchain. The design combines multiple light-weight file management systems and a secure consensus layer to provide rapid transaction processing, large data storage capacity, and high levels of security. The simulation results demonstrated that the linked infrastructure architecture could handle transactions quickly and effectively, with an average transaction processing time of less than two seconds.

Acknowledgment
This research work is a part of an ongoing research project jointly funded and facilitated by the Universiti Teknologi PETRONAS, Malaysia, University of Southeastern Philippines, Philippines, Department of Science and Technology, Philippines, and MS3 Agri-ventures Corporation, Philippines (Grant Number: 015ME0-307).

Authors also acknowledge support, guidance, and advise of Prof. Dr. Mohd Shahir Liew and Assoc. Prof. Dr. Mohd Fadzil Hassan in the completion of this work.

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ENERGY MEASUREMENT AND POTENTIAL ENERGY CONSERVATION MEASURES IN FIVE HEALTHCARE BUILDINGS IN MALAYSIA

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Abstract: *Carbon emissions and energy consumption are rising across the board in the global economy, which is causing concern throughout the world. One of the most energy-intensive constructions in the world is the healthcare institution. As a result, energy-saving plans must be developed that analyse building energy performance and implement energy-saving methods. A full energy audit is the most typical method for boosting building energy efficiency. The current approach for analysing all types of building energy performance is the BEI. The operating hours of a healthcare facility are longer than those of a commercial building. The issue emerges when there is no clear criterion for establishing whether or not a healthcare facility is energy efficient, and the present norm may misread healthcare energy consumption. The optimal BEI, according to MS1525:2019, is less than 135 kWh/m^2/year. To determine the actual onsite energy use at the healthcare building, a full energy audit is performed. Five places are selected based on the sort of healthcare services offered. According to the on-site complete energy evaluation, cooling equipment consumes the most energy. The study's findings may be divided into two categories: HBEI from DEA results and HBEI derived directly from power bills for the years 2018 and 2019. In terms of HBEI, there is a contrast between utilising DEA data and using utility bills directly. Nonetheless, a comparison of HBEI of hospital facilities with existing Malaysian requirements reveals a significant discrepancy. Based on the audit and analysis results, several savings opportunities may be presented.*

Keywords: *Building, Healthcare,Energy,BEI.*

Introduction

Energy is essential for economic growth and can be divided into renewable and non-renewable sources. The trend of world energy consumption indicates that 73% is from non-renewable energy (Ahmad & Zhang, 2020). In Malaysia, almost 80% of electricity is generated by natural gas and coal (Chong, Ni, Ma, Liu, & Li, 2015), which cannot be replenished. The depletion of non-renewable energy sources quite worrying the world to sustain the energy demand. The increasing number of buildings in Malaysia will have an excessive impact on national development and demand high energy to supply. The International Energy Outlook report shows that global energy demand will keep increasing by 56% between 2010 and 2040 (US Energy Information Administration, 2019). Malaysia has committed to reducing its greenhouse gas emission intensity by 45% by 2030 and has launched a National Energy Efficiency Action Plan (NEEAP) (Suruhanjaya Tenaga, 2020). Healthcare buildings are known as complex and high-energy-demand buildings due to their long operation hours and need a lot of energy for lighting and air conditioning systems, medical and office equipment, and other devices (Khalid, Zaki, Rijal, & Yakub, 2019). A benchmark to measure energy efficiency is Building Energy Intensity (BEI) which is a measurement of the total annual energy used in a building in kilowatts hours divided by factors such as gross floor area (Moghimi, Mat, Lim, & et al, 2011). According to MS1525:2019, the optimum BEI standard is 135 kWh/m2/year which is implemented in all types of buildings. Because Malaysia has several types of healthcare facilities, such as major hospitals and district hospitals, utilizing a current BEI will result in an inaccurate assessment of energy performance (Zuharah, Wai, Ab Muis, & et al, 2021). The healthcare building has long operation hours than a commercial building. It is quite challenging for the healthcare building to achieve BEI standard according to MS1525:2019 standard. The problem arises when the current standard might misinterpreted the energy usage in healthcare building. The objective of this research project is to enhance the facility's energy efficiency, suggest cost savings, and establish a new standard for measuring the building's energy performance. The following are the objectives for this research, identify the building characteristic and energy consumption to operate a healthcare building, propose a potential Energy Conservation Measure (ECM) and analyse the economic benefits of the potential of ECM and identify Healthcare Building Energy Index (HBEI) to measure energy usage for the healthcare building.

A healthcare building is designed to operate for long working hours and has unique and intensive energy use requirements (Mathur, Seth, Padmanaban, & Walia, 2009). It is important to identify and evaluate the energy consumption of a healthcare building to enhance energy effectiveness. The electricity consumption usually depends upon the scope and complexity of equipment and services provided in the healthcare building (Singer, Mathew, Greenberg, & et al, 2009). These conditions have affected the demand for electrical energy. Energy issues are less to be prioritized by Malaysians nowadays due to a lack of awareness. This research project will act as an educational platform for raising awareness of the necessity of energy-saving measures in the community. It is substantial to raise their awareness regarding the consequences of extensive electricity usage to nature. Hence it is crucial to identify and evaluate the energy consumption of a healthcare building. The significance of this research in enhancing energy effectiveness of healthcare buildings. Furthermore, developers and design teams such as architects or consultants involved in creating energy-efficient building design projects and preventing mistakes from occurring in future development by using any useful information provided in this research study on current building performance are encouraged to participate. Finally, this research project will act as an educational platform for raising awareness of the necessity of energy-saving measures in the community. Malaysia, being a developing country and a member of the ASEAN, is exploring inexhaustible and repeatable alternative energy sources such as biomass, solar, micro-hydro and wind. Malaysia is also physically located in a tropical and humid environment, making it simple to utilize a variety of renewable energy sources. Malaysia's government has created a renewable energy programme to encourage enterprises and people to employ renewable energy systems in electricity applications.

Energy Act and Policy

Energy Commissioning plays an important role in energy management. Energy Commissioning has the authority to regulate and enforce energy supply operations and legislation in Malaysia under the Energy Commission Act 2001. One of the functions and powers of the Energy Commissioning is providing advice to the Minister on all matters concerning the national policy objectives for energy supply activities. It also put energy supply rules into effect and enforcing them. Energy Commissioning also can control all aspects of the electricity supply sector and to safeguard everyone from the dangers of electricity generation, production, transmission, distribution, supply, and consumption as set out in the energy supply legislation. Malaysian Standard 1525 or known as MS1525 is a Malaysia energy-efficient building design standard, focusing on air conditioning, lighting, electrical power, architectural and passive design, and control management. The main goal for MS1525 is to encourage the design, construction and maintenance of new and existing buildings in ways that minimize energy consumption while preserving originality in design, building function and occupant comfort and productivity. It also deal effectively with economic issues. In addition, establish criteria and minimum energy efficiency requirements for new construction and retrofitting existing structures, as well as means for evaluating conformity with these criteria and minimum standards. Similarly, ISO 50001 International Energy Management Standard (EnMS) was released in June 2011 to enable companies to improve their energy performance through a systematic strategy. Furthermore, National Energy Efficiency Action Plan (NEEAP) 2016-2025 aims to reduce Malaysia's power usage by 8% by 2025. It is primarily targeted at industrial and commercial customers, who account for the majority of the country's electrical energy demand. As a result, Ministry of Energy, Science, Technology, Environment, and Climate Change (MESTECC) established the national BEI initiative for government buildings in 2018 to encourage building owners to optimize energy consumption. The ratio between yearly building energy consumption and the net floor area of the building is used to calculate a bench marking tool that evaluates a building's energy performance based on energy consumed per square meter per year. BEI theory states that any building with a good energy performance will receive more stars. In additional to, Energy Management Gold Standard (EMGS) is a certification system based on energy management excellence offered by the (AEMAS). It offers businesses a Sustainable Energy Management System (SEMS) that not only achieves but also maintains and improves cost reductions. Companies will also receive extensive training for their energy managers to achieve their company's Energy Efficiency goals. Moreover, Green Building Index (GBI) is one the initiative which is a green grading system created in 2009 by the Malaysian Institute of Architects and the Association of Consulting Engineers Malaysia to raise awareness about green buildings and establish sustainability and BEI criteria. A building has to fulfil a certain set of key criteria to be recognized as a green building under the green rating system.

General Operation of Healthcare Building in Malaysia

Healthcare building especially hospitals are highly energy-intensive structures, with their own set of design standards, equipment, occupancy rates, and operation schedules. According to American Society of Heating, Refrigerating and Air Conditioning Engineer (ASHRAE) the average hospital uses 2.5 times more energy than a commercial building. Despite the increase in energy demand, awareness of energy-efficient opportunities and approaches is still low (Quek, 2009). Malaysia's healthcare system is made up of universal services supported by taxes and managed by the government, as well as a burgeoning private sector. There are five categories of healthcare buildings in Malaysia: general hospital, district hospitals, teaching hospitals, clinics or medical centre, laboratories (Ministry of Health, 2016). The most well-known form of hospital is the general hospital, which is designed to treat a wide range of diseases and injuries and usually includes an emergency room. A district hospital is smaller than a general hospital and only accepts patients from the same district or community. Teaching hospitals are hospitals that relate to universities for medical research and the training of medical professionals. Clinics are medical institutions that are smaller than a hospital and are operated by a government body for health care or a private partnership of physicians. Healthcare buildings come in a variety of shapes and sizes, and it is important to research each one's unique characteristics to compare electrical energy. The purpose of selecting these five healthcare buildings is that they share certain similarities owing to the fact that they are all government healthcare building and receive government funding. However, it has different variables that cause the energy evaluation to deviate. The various variables such as net floor space, operating hours, and the equipment used in each facility. Besides that, each building represents the category of healthcare building as discussed earlier.

Research Methodology and Result

The data collected during this study was divided into two phases which is the first phase by gathering all the general information. The general information about each healthcare building will be collected using the desktop audit method and meeting with the building owner. During this stage, the selection of healthcare buildings is decided. The healthcare building will be labeled as A, B, C, D, and E. The second phase gathering information about equipment. The information about equipment will be gathered during detailed energy audit on site. Additionally, the number of electrical appliances in each healthcare building should be noted in more detail as they have different types and energy power. Each healthcare building represents the category of healthcare building and features equipment similar to those seen in healthcare. The government manages the public hospital and provides financing, and all of the buildings adhere to the same environmental sustainability strategy. During data collection, four aspects are considered: identification, location, building user trends, and building characteristics. Real energy cost is obtained from the electrical provider's bill. The location refers to a specific place or area on the planet's surface. It may be described using absolute location, which plots the building's longitude and latitude using a Cartesian coordinate grid. The relevance of knowing the location of a structure is to be able to predict the weather in the area. The weather in all case study locations is normally hot, oppressive and rainy. The average temperature is around 26^{o}Celsius – 35^{o}Celsius. The operating hours of each department in the healthcare building are referred to as the user trend. Throughout the year, the healthcare building is recognized for operating at overlong hours. However, certain departments keep regular working hours.

Conducting an onsite audit is the most effective approach to learn about each piece of equipment. There are three types of data collection methods; walk through assessment, Energy survey and analysis and Detailed Energy Audit (Gasiorowski-Denis & Lazarte, 2011). Significant energy user or known as SEU can help the owner building tackle the sector that use a lot of energy. The SEU that has largest percentage must be focused and come up with the solution to reduce the energy usage. The typical hospital architecture comprises of huge structures, which need careful temperature management on the inside and external cooling and heating. For example a standby electric generator is also required by the hospital to provide a constant supply of electricity during emergencies and vital procedures. Estimation of electric energy consumption is calculated based on the number equipment that existed in each building, the operation hour with their power rate. The significant energy user which is lighting and air conditioning systems consume the bulk of energy in a building. On the contrary, the other equipment least using energy. The other equipment is usually related to the work nature of the building .The air conditioning system accounts for 75% of energy costs, while lighting and other basic equipment account for 18% (Noranai & Kammalluden, 2012).

Table 1: General Information Regarding Healthcare Building

Location	Johor	Putrajaya	Selangor	Johor	Kuala Lumpur
Year of Operation	21 Years	23 Years	32 Years	9 Years	31 Years
Type of Healthcare Building	University Health Clinic	General Hospital	District Hospital	State Mental Hospital	National Laboratory
Operation Hour	8.30 am to 7.30 pm (Office working days)	8 am to 5 pm, 24 hours, 7 days/week.	8 am to 5 pm 24 hours, 7 days/week.	8 am to 5 pm for 24 hours, 7 days/week.	8.30 am to 7.30 pm (Office working days)
Net Floor Area	2,739 m^2	40,575 m^2	16,167 m^2	102,310 m^2	49,225 m^2
Number of Staff	49	2,800	1,375	897	700
Electrical Tariff	C1	C1	B	C1	C1
Cooling Equipment	ACSU	Chiller, AHU, ACSU, ACPU	Chiller, AHU, ACSU, ACPU, FCU	ACSU, AHU, ACPU	Chiller, AHU, FCU
Lighting Equipment	Fluorescent	Fluorescent, LED, Metal Halide, CFL	Fluorescent, LED, Metal Halide, CFL	Fluorescent, LED, Metal Halide, CFL, PLC	Fluorescent, LED, HPSV, CFL
Other Equipment	Office & Biomedical	Office & Biomedical	Office & Biomedical	Office, Biomedical & Laboratory	Office & Biomedical
Lift	Not Available	1	5	1	Not Available

Table 2: Significant Energy User

Location	Johor	Putrajaya	Selangor	Johor	Kuala Lumpur
Cooling Equipment	65%	73%	87%	45%	77%
Lighting Equipment	19%	6%	7%	40%	3%
Other Equipment	16%	21%	6%	15%	20%

The main energy consumer in each building is cooling equipment, which accounts for the biggest percentage of energy demand. Because the temperature and humidity in the healthcare building must be maintained, the cooling system must perform ideally to meet demand. Because it is the greatest user of energy, the cooling system must be priority in order to decrease energy consumption. Aside from that, cooling equipment is frequently obsolete and inefficient in terms of energy use. Older technology needs a lot more energy to run when compared to modern technology. Second, other equipment ranks second in terms of energy use. Biomedical equipment, office equipment, a lift, and other items make up the rest of the equipment. The only approach to decrease energy usage for other equipment is to ensure that it is turned off when not in use. The user's or worker's energy awareness is critical. Finally, the lighting system in a healthcare facility consumes the least amount of energy. The majority of healthcare facility owners have already switched from non-energy-saving to energy-saving lamps. LEDs are the most energy-efficient form of bulb now in use in most buildings. The low cost and ease of acquisition have sparked a shift to this kind. The lamps don't use any more energy, but they still need to be managed to avoid any energy waste (Amlus, Ibrahim, Abdullah, & et al, 2018).

Development on Healthcare Building Energy Index

BEI is used as a benchmark to measure energy efficiency in all type building in the industrial and commercial sectors, but there is no unique instrument or method for determining the efficiency of energy use in healthcare facilities. Nevertheless, Healthcare Building Energy Index (HBEI) is a ratio of a healthcare facility's total annual energy usage to its net floor area. Total energy consumption is measured in kWh per year and is defined as the total amount of electricity or equivalent utilized by the building. Net floor area is divided into three types: gross floor area, net floor area and air conditioned area. Healthcare buildings must meet specific standards that set them apart from other structures or building. The exclusive factor that healthcare building have is the healthcare building is recognized for being a building that runs nonstop all year. Normally, during peak seasons, such as during the holiday season, the number of patients admitted will increase. Secondly, the equipment used in healthcare building especially biomedical equipment for laboratory usage, such as X-ray machines, MRI machines, ultrasound machines, and pathology machines consumes a lot of energy. Lastly, the typical hospital architecture comprises of huge structures, which need careful temperature management on the inside. Internally, the inhabitants and running equipment create a significant quantity of heat. Depending on the external weather conditions, effective cooling and heating. The ventilation technology, in combination with the hospital's well-insulated. Walls will help to decrease the hospital's susceptibility to the weather. A standby electric generator is also required by the hospital to provide a constant supply of electricity during emergencies and vital procedures.

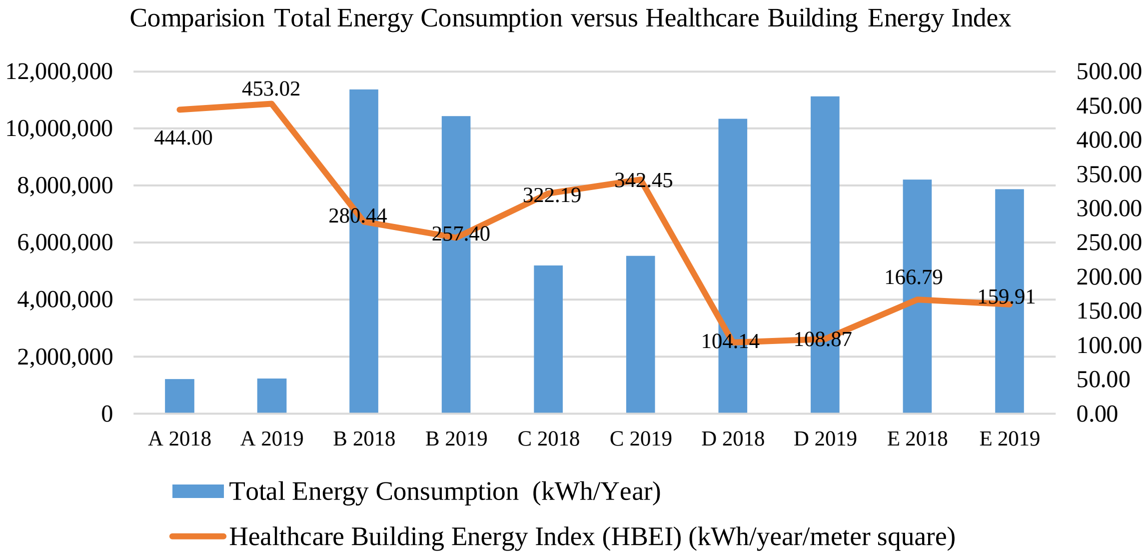

Figure 44: Comparison Total Energy Consumption Versus Healthcare Building Energy Index

HBEI from DEA results and HBEI obtained directly from electric bills for the years 2018 and 2019. In terms of HBEI, there is a distinction between utilizing DEA results and directly using utility bills. Building A has the greatest HBEI among the other buildings, although having the lowest NFA of roughly 2,739.79 m^2. When utilizing data from an energy bill, the HBEI for building A is roughly 400 kWh/m^2/year. Building A has the lowest energy usage when compared to other healthcare buildings, yet the key factor determining the HBEI is the size of the facility or for this research refer to net floor area of the premise. Furthermore, the use of ineffective equipment and instruments has a significant impact on the energy consumption at the building. While utilizing DEA data, the HBEI is just 119.98 kWh/m^2/year. The distinction is because the utility cost for Building A includes all departments, not only the university health clinic. The HBEI using utility bills for building B is roughly 300 kWh/m^2/year, whereas the HBEI using DEA data is 270 kWh/m^2/year. The HBEI for building C in both conditions is roughly 200 kWh/m^2/year. The HBEI from electricity bills and DEA data for building D is essentially identical, with a range of 100 kWh/m^2/year. Last but not least, there is a disparity in HBEI between the DEA and the electricity bill for Building E. The DEA HBEI is 98.01 kWh/m^2/year, but the HBEI from utility bill is roughly 100 kWh/m^2/year.

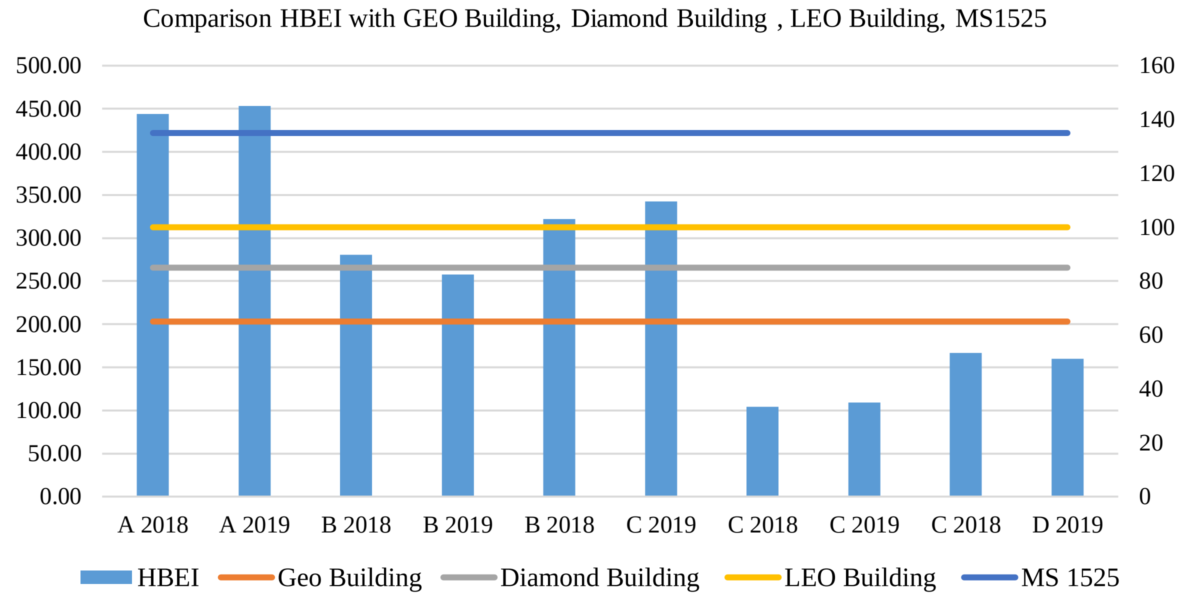

Figure 45: Comparison HBEI With Current Standard

There are a few buildings in Malaysia that may be used as examples of energy efficiency, such as the Green Energy Office (GEO) building which has a BEI of 65 kWh/m^2/year. Furthermore, the diamond building refers to the Energy Commissioning Building in Putrajaya. The BEI for diamond construction is 85 kWh/m^2/year. In addition to Low Energy Office or LEO buildings, the suggested BEI must be less than 100 kWh/m^2/year. Finally, MS1525 is the most commonly used reference standard in terms of BEI. The ideal BEI, according to MS1525, is 135 kWh/m^2/year. Figure 2 depicts a significant disparity between HBEI of healthcare buildings and present Malaysian norms. The use of commercial buildings, which are regular office buildings that function 10 hours per day, is common to all standards, whereas healthcare buildings operate with high energy and a lengthy operating period. This makes it unfair for healthcare facilities to compete with regular structures, thus they must have their own standard.

Potential Energy Conservation Measure

Potential Energy Conservation Measure (ECM) is the identification of possible energy saving strategies is based on the evaluation of site survey data and the analysis of monitoring data. Measurement and Verification plan is essential for appropriate savings calculation and verification. All data needed for appropriate savings determination will be accessible when the energy savings programme is implemented, within an acceptable budget, thanks to advanced preparation. Each of proposed ECMs will be analyse in term of economic analysis. The advantages of ECMs must be assessed in terms of energy and non-energy savings, as well as Carbon Dioxide reduction. The building owners will spend about 30% of their budget on energy, the economic impact study is one of the most critical concerns (Nam, Kim, Kim, & et al, 2016).

Conclusion

In a nutshell, for virtually all case studies, the cooling system is the largest energy consumer. The cooling system is critical for healthcare to maintain the necessary conditions and to function all day. Other systems are the second-largest energy consumer. Office equipment, pantry equipment, biomedical equipment, and other systems are examples of other systems. Last but not least, the lighting system consumes the least amount of energy because it is generally turned off when not in use. It will assist in lowering energy use. During 2018, building B had the greatest energy consumption compared to all four other healthcare buildings, while building A had the lowest energy consumption of all five healthcare buildings. Meanwhile for year 2019, the highest energy consumption recorded in building C while building A had the lowest energy consumption of all five building for this research. Malaysia's government has aggressively promoted energy saving principles and established a benchmarking tool that tracks a building's energy usage. In order to earn a high star rating, the building owner must continue to evaluate the facility's energy performance and take the lead in installing energy saving measures. For this research HBEI is develop as benchmarking tool to measure the energy consumption that specifically for healthcare sector only. Based on the research, building A has the highest HBEI value for both year 2018 and 2019. Meanwhile, for the same period, building D show the good value in term of HBEI. After implement energy conservation measure, each building have a chance to reduce energy consumption.

Acknowledgement

The author acknowledges the funding of this research by the Ministry of Higher Education Malaysia (MOHE) through the Fundamental Research Grant Scheme (FRGS/1/2018/TK07/UTHM/02/6) and research grant No. K091, Centre for Energy & Industrial Environment Studies (CEIES), Faculty of Mechanical & Manufacturing Engineering (FKMP), and Universiti Tun Hussein Onn Malaysia (UTHM).

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6th Langkawi International Multidisciplinary Conference 2023 (6th LIMC 2023)
eISSN 2976-3223
9th – 10th September 2023
Bayview Hotel, Langkawi, Malaysia

DIRECT AND INDIRECT INFLUENCE OF TRUST AND COMMITMENT ON LOYALTY AMONG STUDENTS OF ONLINE DISTANCE LEARNING HIGHER EDUCATION INSTITUTIONS: THE ROLE OF STUDENT DELIGHT AS A MEDIATOR

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Abstract: *This study consolidates trust, commitment, student delight and student loyalty to examine the influence of student delight as a mediator in the relationship between trust and commitment and student loyalty among online distance learning students of higher institutions in Malaysia. For research hypotheses testing, an online survey involving Malaysian students from different online distance learning institutions was administered, yielding 241 clean data that was used for data analysis. In this study, the structural equation model method (SEM) was used for data analysis. The model was developed based on conceptual development and then analysed using the Partial Least Square (PLS) technique using the data from the online questionnaire survey. The results show that trust and commitment have a positive and significant direct relationship with student loyalty. Student delight was a significant mediator in the relationship between trust and commitment and loyalty among Malaysian students in ODL higher institutions. This study has shown that student delight plays an important role in student loyalty in online distance learning environment. This study has made a significant contribution to online distance learning higher education institutions, lecturers and students by exploring the importance of trust and commitment among online students.*

Keywords: *commitment; trust, students' loyalty; students' delight; online distance learning.*

Introduction

In today's globalised world, higher educational institutions (HEI) are generally recognised as business organisations. The higher education system has to be seen as a service industry and universities as the service providers. Therefore, universities should focus on the needs and wants of all stakeholders, particularly the students as their external stakeholders. Student loyalty is among the upmost important factors that contributes to the sustainability of the university. The students' need has becoming very sophisticated and demanding. The students expect not only good quality education but also satisfaction coming from the facilities, infrastructure etc. Therefore, it is crucial to understand their desire and needs as well as their inner reasons to maintain the good relationship. Once the relationship is bonded between the students and university, the likely of students dropping out of the system will be reduced and eventually will create strong commitment from students. In fact, they will show their delight only when they are satisfied and happy with the trust and commitment in the education provided to them. The student delight will create engagement and loyalty that allow sales promotion, improvement of product quality, rise in customer satisfaction, cost and risk minimisation and competitive advantage enhancement (Kahn, 2014; Zepke & Leach, 2010). The success of the education sector lies not only in providing quality teaching, learning and research that are the assets of universities but also to utilise them to meet the student delight. Moreover, among the strategic goals to remain sustainable is to be able to attract and retain student loyalty through the efficient practices and engagements. Therefore, the aim of this study is to evaluate the relationship among trust, and commitment towards student delight, eventually maintaining the student loyalty among Malaysian online distance learning (ODL) higher education institutions.

Literature Review

Anderson (1994) mentioned that the student's loyalty comes from the students' encounters and impression of the services by the HEIs. The services include those from the academic staff, study content and acquired skills that will be evaluated, eventually influenced loyalty of the students. On another note, a study by Helgesen & Nesset (2021) also supported that the student loyalty is also influenced by their perceptions towards the university itself. Consequently, it is a must for universities to value their good relationship with students to improve the student loyalty. In contrast, a study by Milliken (2007) mentioned that the student-client's decreasing loyalty towards education is proving to decrease the chances for many universities to survive. This problem has been given more consideration since globalisation and the constant struggle between all HEIs. Behr (2020) also clearly described how the epidemic of dropping out from tertiary education has becoming a concern involving the national education system, the university as well as the students themselves. Apart from that, concerns such as criminal behavior, financial distress and other personal problems are also considered rising issues amongst universities. Therefore, there was a need for the HEIs to retain the student loyalty and satisfy their delight in order to remain sustainable amongst universities.

As proposed by Ghosh, Whipple, & Bryan (2001) trust is 'the degree to which a student is willing to rely on the institute to take appropriate steps that benefit him and help him achieve his learning and career objectives. In fact, trust is seen as a critical factor to success for HEIs in extremely competitive environment (Yousaf, Mishra, & Bashir, 2020). In the education studies, trust has been conceptualised as a unidimensional construct indicating students' belief about brand attributes and is explored as a process for evaluating students' expectations about the reliability of a brand that fulfilling its promises (Chaudhuri & Holbrook, 2001). Trust and commitment from the student-university relationship will create sufficient value (Moreira and Silva, 2015) that will sustain competitiveness. In fact, the students' trust of the HEIs' commitment to serve them best education will continue to use and recommend the brand to others later (Lim, Jee, & De Run, 2020).

Morgan and Hunt (1994) define commitment as one party's perception that the relationship with another is critical, resulting in all effort are needed to maintain it. In developing commitment, the ODL higher education institutions should have the ability to deliver high-quality performance as promised and the students show the appreciation of those. This effort will indirectly create positive perceptions towards the service as well as generate customer satisfaction (Bunce, Baird, & Jones, 2017). Commitment to overall quality of service by the

ODL higher education institutions is considered essential to solve students' problems, ensure the similar commitment of students towards the HEI and create long-term relationships (Li & Miniard, 2006). In fact, this commitment represents a strong relational bond that encourages the students to continue her relationship (Ali et al., 2016). If there is a positive trust from the students together with the commitment from the HEI, then both will receive sufficient value from this relationship (Moreira and Silva, 2015).

The following hypotheses presented in this study were formulated based on the development outlined above:

H1: There is a relationship between commitment (COMM) and delight (DEL) among online distance learning higher education institution students.

H2: There is a relationship between trust (TRU) and delight (DEL) among online distance learning higher education institution students.

H3: There is a relationship between commitment (COMM) and loyalty (LOY) among online distance learning higher education institution students.

H4: There is a relationship between trust (TRU) and loyalty (LOY) among online distance learning higher education institution students.

H5: There is a relationship between delight (DEL) and loyalty (LOY) among online distance learning higher education institution students.

H6: There is a mediating effect of delight (DEL) on the relationship between commitment (COMM) and loyalty (LOY) among online distance learning higher education institution students.

H7: There is a mediating effect of delight (DEL) on the relationship between trust (TRU) and loyalty (LOY) among online distance learning higher education institution students.

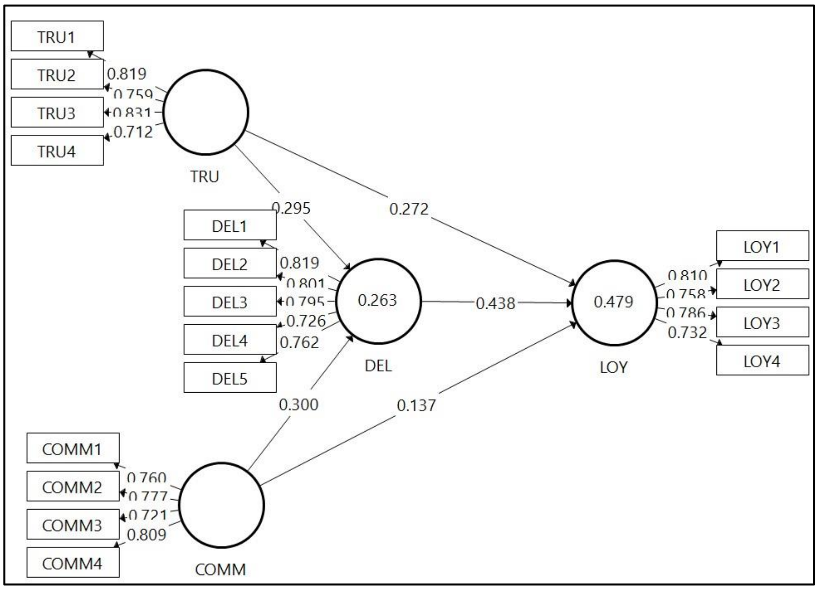

Figure 1: Research Model

Note: TRU=Trust COMM=Commitment DEL=Delight LOY=Loyalty

Research Methodology

Methodology

This study focused on online distance learning higher education institutions students who were selected as survey respondents. Primary data were collected using survey equipment and the survey questionnaires used in the study were carefully designed based on previous studies to ensure reliability and validity. A non-probabilistic snowball sampling technique was employed and participants received a survey questionnaire by email. This study included 17 observational variables, including exogenous and endogenous measures. Endogenous variables included constructs of four-item trust (Zeithaml et al., 1996) and four-item commitment (Kwan & Ng, 1999). The mediating variable was 5-item delight (Yang & Lee, 2016) and the dependent variable was 4-item loyalty (Agrawal et al., 2009). Participants rated each item on a 5-point Likert scale, ranging from "strongly disagree" to "strongly agree." Of the 315 questionnaires distributed, 241 were collected, corresponding to a response rate of 76.5%. After reviewing the data and removing outliers, 227 questionnaires were left for analysis. Smartpls4 software utilizing Structural Equation Modeling (SEM) techniques was used for data analysis and hypothesis testing. This selection was made due to the software's evaluation capabilities and suitability for multivariate data analysis. In addition, the method of model measurements and structural model validation followed the method reported by Ringle et al. (2022), With Smartpls4, researchers can now perform comprehensive multivariate data analysis and effectively test proposed hypotheses. Software capabilities allow exhaustive evaluation of measurement and structural models for research purposes.

Data Analysis

Respondents' Profiles

In this study, females made up 55.9% of the sample and males made up 44.1%. By age group, those under the age of 30 accounted for 38.8%, the most. The 31-40, 41-50, and 51-60 age groups accounted for 42.3%, 15.4%, and 3.5% of the sample, respectively. In terms of year of study, the majority of respondents were evenly distributed in her first four years, with the most in her second year (22.9%), followed closely by her third year (22.5%). A small percentage of respondents are five years old (9.3%) or older (6.6%). In terms of study level, the majority of respondents have a bachelor's degree (64.8%), followed by graduates (22.9%) and master's degrees (10.1%). Only a small percentage of respondents (2.2%) have a Ph.D. Finally, when it comes to employment, the public sector is the most popular with 49.8% of respondents, followed by the private sector (37.9%), the unemployed (9.7%) and the self-employed (2, 6%).

Common Method Bias

One of the main challenges faced in management research is the presence of common method bias, which occurs when the variation in a study is mistakenly attributed to the nature of the data, when in fact it is influenced by the measurement method used. In order to address this issue, the researchers in this study chose to utilize Harman's one-factor test method to assess the measurement points. The findings of the test revealed that only 41.2% of the variability could be attributed to the main factor, indicating that there was no significant presence of general method bias in this particular study. This outcome aligns with the suggestion put forth by Podsakoff & Organ (1986) that if the primary components account for less than 50% of the variance, bias is not a major concern. By employing this method, the researchers were able to enhance the reliability and validity of their findings by minimizing the potential impact of common method bias on their results.

Outer Model Assessment

In order to establish the credibility and accuracy of construct measurements in this study, the PLS-SEM algorithm was utilized. In accordance with the guidance provided by Hair, Hult, Ringle, and Sarstedt (2017), two fundamental aspects were evaluated: the reliability and validity of the external goodness model. The findings presented in Table 1 revealed that all constructs achieved an AVE range of 0.589 to 0.611, surpassing the minimum threshold of 0.5 and confirming the presence of convergence validity. Additionally, Table 1 also demonstrated that the composite reliability of all constructs ranged from 0.851 to 0.887. The Cronbach's alpha values as suggested by Hair et al. (2017) ranged from 0.767 to 0.840. Discriminant validity was established by analyzing the cross-loads of the measures, revealing that all items had greater loads than their respective cross-loads (Table 2). To further confirm the presence of discriminant validity, the heterotrait-monotrait (HTMT) ratio was further evaluated, which confirmed that they were all below the threshold of 0.9 (Table 3). The HTMT technique is a recommended criterion for examining discriminant validity in Variance-Based Structural Equation Modeling (VB-SEM) (Henseler, Ringle & Sarstedt, 2015). As a result, this study effectively verified the reliability and efficacy of all potential components suggested by Hair, Hult, Ringle, and Sarstedt (2014).

Table 1: Construct Reliability &Validity

	CA	CR	AVE
COMM	0.767 (0.710, 0.812)	0.851 (0.820, 0.977)	0.589 (0.533, 0.641)
DEL	0.840 (0.796, 0.876)	0.887 (0.859, 0.910)	0.610 (0.551, 0.668)
LOY	0.775 (0.715, 0.820)	0.855 (0.822, 0.881)	0.596 (0.537, 0.648)
TRU	0.787 (0.728, 0.831)	0.862 (0.828, 0.888)	0.611 (0.547, 0.664)

Note: CA=Cronbach Alpha CR=Composite Reliability AVE=Average Square Root

Table 2: Cross Loadings

	COMM	DEL	LOY	TRU
COMM1	**0.760**	0.338	0.305	0.251
COMM2	**0.777**	0.269	0.361	0.279
COMM3	**0.721**	0.378	0.386	0.571
COMM4	**0.809**	0.359	0.359	0.348
DEL1	0.424	**0.819**	0.535	0.423
DEL2	0.375	**0.801**	0.463	0.347
DEL3	0.314	**0.795**	0.423	0.285
DEL4	0.273	**0.726**	0.483	0.290
DEL5	0.325	**0.762**	0.499	0.352
LOY1	0.408	0.562	**0.810**	0.506
LOY2	0.392	0.378	**0.758**	0.375
LOY3	0.327	0.469	**0.786**	0.389
LOY4	0.296	0.478	**0.732**	0.347
TRU1	0.387	0.318	0.390	**0.819**
TRU2	0.381	0.340	0.364	**0.759**
TRU3	0.373	0.316	0.371	**0.831**
TRU4	0.366	0.381	0.500	**0.712**

Table 3: Hetrotrait-Monotrait (HTMT) Ratio

	COMM	DEL	LOY
DEL	0.540 (0.380, 0.680)		
LOY	0.593 (0.450, 0.732)	0.752 (0.637, 0.853)	
TRU	0.603 (0.489, 0.709)	0.527 (0.391. 0.646)	0.655 (0.519, 0.771)

Result

Structural Model

Hair et al. (2017) conducted an evaluation of the structural model by assessing both the pathway coefficient (β) and the coefficient of determination (R2). To verify the significance level of the path coefficients, this study employed the PLS method and utilized 5000 subsamples. The results, including path coefficients (beta), t-statistics, p-values, and the outcomes of hypothesis tests for confidence intervals, are presented in Table 4.

For hypothesis 1, the statistical analysis result showed that the relationship between commitment (COMM) and delight (DEL) is strongly supported, with a significant beta coefficient of 0.300 ($p < 0.001$). The high t-statistic of 3.938 further confirms the strength and statistical significance of this relationship. For hypothesis 2, the statistical analysis result showed that the relationship between trust (TRU) and delight (DEL) also receives strong support, with a significant beta coefficient of 0.295 ($p < 0.001$). The t-statistic of 4.481 indicates a high level of statistical significance, highlighting the importance of trust in influencing delight outcomes. For hypothesis 3, the statistical analysis result showed that the relationship between commitment (COMM) and loyalty (LOY) shows marginal significance, with a beta coefficient of 0.137 ($p = 0.047$). Although the t-statistic of 1.987 is relatively lower than the previous hypotheses, it still indicates a discernible relationship between commitment and loyalty. For hypothesis 4, the statistical analysis result showed that the relationship between trust (TRU) and loyalty (LOY) receives strong support, with a significant beta coefficient of 0.272 ($p < 0.001$). The high t-statistic of 4.653 further underscores the importance of trust in fostering customer loyalty. For hypothesis 5, the statistical analysis result showed that the relationship between delight (DEL) and loyalty (LOY) is strongly supported, with a significant beta coefficient of 0.438 ($p < 0.001$). The high t-statistic of 7.048 emphasizes the crucial role of delight in influencing customer loyalty. For hypothesis 6, the statistical analysis result showed that delight (DEL) mediated the relationship between commitment (COMM) and loyalty (LOY) demonstrating a significant beta coefficient of 0.131 ($p = 0.002$). The t-statistic of 3.154 indicates that the mediating effect of delight on the relationship between commitment and loyalty is statistically significant. For hypothesis 7, the statistical analysis result showed that delight (DEL) mediated the relationship between trust (TRU) and loyalty (LOY) which is strongly supported, with a significant beta coefficient of 0.129 ($p < 0.001$). The t-statistic of 3.844 confirms the statistical significance of this mediating relationship. The study's analysis yielded significant findings that provided strong support for the majority of the hypotheses, confirming the relationships between the variables under investigation.

A summary of the hypothesis testing outcomes is presented in Table 4, which includes the effect size, a measure of the magnitude of an effect independent of the sample size. In this study, Cohen's criteria (1992) were employed to assess the effect sizes, categorizing them as small (0.020 to 0.150), medium (0.150 to 0.350), or large (0.350 or greater). The observed effect sizes in this study ranged from small (0.025) to large (0.272). Table 5 presents the values of the intrinsic value inflation factor (VIF), all of which were below the less strict threshold of 5. The highest VIF value observed was 1.429. This level of collinearity ensures that meaningful comparisons of sizes and interpretation of coefficients can be made in the structural model. The results of the analysis revealed a significant amount of variance explained by the endogenous construct, with an R^2 value of 0.479, as shown in Figure 1.

In terms of the mediator, the model accounted for approximately 26.3% of the variance in the structure, as indicated by an R^2 value of 0.263. To assess the model's ability to make inferences and provide management suggestions, an out-of-sample predictive analysis was conducted using the PLSpredict method, as described by Shmueli et al. (2016, 2019). The predictions made by PLS-SEM outperformed the standard naive mean predictions, as indicated by Q^2 predictions higher than 0 in Table 6. Furthermore, the root mean square error (RMSE) values of the PLS-SEM predictions were lower than those of the linear model (LM) prediction benchmark in all nine instances, demonstrating the predictive power of the proposed model (Table 6). According to Ringle and Sarstedt (2016) as well as Hair et al. (2018), Importance

Performance Analysis (IPMA) was recommended for evaluating the significance and effectiveness of latent variables in explaining acceptance.

Table 4: Hypotheses Testing Results & f^2

Hypotheses	Beta	T Statistics	P Values	f^2	2.50%	97.50%	Decision
COMM -> DEL	0.300	3.938	0.000	0.093	0.142	0.437	*Supported*
TRU -> DEL	0.295	4.481	0.000	0.090	0.156	0.415	*Supported*
COMM -> LOY	0.137	1.987	0.047	0.025	0.004	0.276	*Supported*
TRU -> LOY	0.272	4.653	0.000	0.099	0.156	0.379	*Supported*
DEL -> LOY	0.438	7.048	0.000	0.272	0.312	0.557	*Supported*
COMM -> DEL -> LOY	0.131	3.154	0.002		0.059	0.218	*Supported*
TRU -> DEL -> LOY	0.129	3.844	0.000		0.068	0.201	*Supported*

Table 5: Collinearity Statistics (VIF Inner Value)

	DEL	LOY
COMM	1.308	1.429
DEL		1.356
TRU	1.308	1.426

Table 6: PLS predicts

	PLS RMSE	LM RMSE	PLS-LM	Q^2_predict
DEL1	0.6	0.604	-0.004	0.221
DEL2	0.621	0.632	-0.011	0.161
DEL3	0.693	0.701	-0.008	0.1
DEL4	0.725	0.746	-0.021	0.089
DEL5	0.611	0.628	-0.017	0.139
LOY1	0.612	0.619	-0.007	0.269
LOY2	0.614	0.623	-0.009	0.181
LOY3	0.659	0.667	-0.008	0.161
LOY4	0.72	0.734	-0.014	0.126

Table 7: Importance-Performance Map Analysis (IPMA)

	LOY	Perf
COMM	0.268	62.635
DEL	0.438	61.943
TRU	0.401	64.362

Discussion

The results of this analysis can be found in Table 7. In terms of their overall impact, delight exhibited the strongest influence on loyalty (0.438), followed by trust (0.401), and commitment (0.268). These values indicate the relative importance of each latent variable within the recruitment context. In terms of performance scores, trust achieved the highest score (64.362), while delight had the lowest score (61.943) on a scale ranging from 0 to 100. This indicates that delight performed well in terms of total effects but had the lowest level of performance.

Despite delight being the most crucial factor for loyalty, it exhibited the lowest performance level. Based on these findings, it is recommended that top management in ODL higher education institutions prioritise and emphasize activities aimed at enhancing student delight. By focusing on improving students' delight, overall performance can be enhanced.

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INTEGRATED REPORTING QUALITY AND FIRM VALUE: EVIDENCE IN ASIA

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Abstract: *This study aims to examine the voluntary nature of Integrated Reporting Quality in most countries and its impact on firm performance. The research focuses on companies that have adopted the "Integrated Reporting" title, with data obtained from the International Integrated Reporting Council website for the period 2020-2022, that includes a total of 16 companies. The data analysis technique employed is content analysis, ensuring that the components and sub-components align with the integrated reporting framework established by the IIRC. The research data is processed using regression analysis. The findings indicate that Integrated Reporting Quality has a significant influence on company performance. Integrated reporting offers a comprehensive overview of company activities and can assist in expanding the investor base, consequently leading to reduced capital costs.*

Keywords: *Integrated Reporting Quality, Firm Value, International Integrated Reporting Council.*

Introduction

Integrated Reporting, a reporting framework developed by the International Integrated Reporting Council (IIRC), encompasses a comprehensive approach to address the informational requirements of report users, encompassing both financial and non-financial data. Integrated reporting, commonly known as sustainable disclosure, is a recent advancement within developing economies. In certain instances, it is more commonly referred to as triple bottom line (TBL) reporting (Mbat et al., 2013).

The predominant issues included the solicitation of highly sensitive information, challenges encountered in data provision due to technical limitations, and the substantial resource demands involved. There have been raised concerns, specifically regarding the complete implementation of the Integrated Reporting (IR) structure and the calibre of integrated reports. The attention of both practitioners (Ernst & Young, 2014; KPMG, 2012; PricewaterhouseCoopers, 2014) and (Eccles and Serafeim, 2015).has lately turned from the type and quantity of information contained in integrated reports to the focus on their quality.

According to Barth et al. (2017), there is a presence of information asymmetry between managers, who possess more comprehensive knowledge about the organisation, and external parties such as investors, who have a disadvantage due to limited or absent access to relevant information. In the present scenario, the inclusion of pertinent and reliable information within the integrated report offers a means by which individuals responsible for governance can mitigate information asymmetry. This practise may inadvertently result in decreased expenses associated with direct oversight for stakeholders (Eccles and Serafeim, 2015).

The primary findings suggest that the examined integrated reports exhibit a low level of quality. Firms often conform to the Investor Relations (IR) framework; yet, they tend to provide very little disclosure regarding crucial elements such as capital, the business model, strategic priorities, and the process of value development. Each section of the integrated report undergoes a restricted amount of scrutiny. The prioritisation of form over content is observed in the field of International Relations.

De Villiers et al. (2017), Velte & Stawinoga (2017), and Vitolla et al. (2019) conducted several literature reviews on IR, but studies still lack a systematic understanding of governance, reporting, and performance as key determinants and their effects on firm value from research methodology IR can help financial markets and other stakeholders positively evaluate a company.

It is evident from prior study that the two most crucial proxies in IR research are IR adoption and IR quality. Although it is debatable whether certain governance, performance, and reporting-related factors can support management's decision to implement IR or whether IR adoption will increase firm value, IR quality is more useful as a primary proxy because IR adoption is largely voluntary throughout the world.

The remainder of the study is organised as follows: the next section provides a review of the relevant literature, a conceptual framework, and the study's hypothesis. The chosen approach is then used. The study's results are presented in the result part, and the study's conclusions and practical consequences are discussed in the conclusion section.

Literature Review

Integrated Reporting Quality

A reporting method called integrated reporting can satisfy all of the information needs of report users, including both financial and non-financial information. By demonstrating how organisations engage with the social, environmental, and investor variables that can affect the production of company value, IR can influence how companies add and convey company value in the short and long terms. By demonstrating how organisations engage with social, environmental, and investor conditions that can affect the production of company value, IR can influence how companies add and communicate company value in the short and long term when describing company accountability to users (Velte, 2022).

The IR framework aims to shed light on the fundamental ideas of the six capitals such as financial, manufacturing, intellectual, human, social and relational, and natural capital as well as how organisations interact with the outside world and capital to generate value over the short, medium, and long term. As a result, this money is now a component of the organization's business plan. Additionally, this guide offers seven guiding principles to assist in the creation of integrated reports. These are strategic focus and future orientation, information connectivity, stakeholder responsiveness, materiality and conciseness, reliability and completeness, consistency and comparability, and reliability and completeness.

In a conceptual sense, Integrated Reporting Quality (IRQ) pertains to the extent to which an Integrated Report (IR) adheres to the stipulations outlined in the applicable framework. Hence, it can be inferred that a significant degree of adherence corresponds to IR of superior quality, while a minimal degree of adherence corresponds to IR of inferior quality (Barth et al., 2016). According to Baboukardos and Rimmel (2016), the significance of the IR structure is deemed unimportant, with the focus instead placed on the substance and quality of the information being presented. Materiality and conciseness are two key guiding concepts that shape the content, presentation, and overall process of an integrated report. The concept of materiality holds significant significance in the process of deciding the content to be incorporated into the integrated report, hence ensuring the report's brevity and succinctness.

International Relations (IR) is required to provide disclosure of information that significantly impacts the operational outcomes of the organization. The capacity to generate value over different time horizons, as mentioned in the source (IIRC, 2013 p.18). The idea of conciseness posits that integrated reports should include enough contextual information to comprehend an organization's strategy, governance, performance, and prospects, while avoiding the inclusion of extraneous or less pertinent details. Furthermore, it is imperative for organizations to strive for a harmonious equilibrium in the field of IR, taking into account not just conciseness but also other fundamental characteristics such as completeness and comparability. It is necessary for information retrieval to comprehensively address all relevant topics, including both good and negative aspects, in a fair and unbiased manner, while ensuring the absence of significant inaccuracies (IIRC, 2013).

Integrated Reporting Quality and Firm Value

The practice of organizational reporting often involves the categorization of reports into two main types: financial reports and non-financial reports. According to Eccles and Krsuz (2014), financial reporting primarily emphasizes the concerns of shareholders and the attainment of financial objectives. Presently, pertinent information refers to the comprehensive depiction of an organization that establishes a connection between its strategic endeavors and operational activities, hence generating value for the corporation (Bernardi & Stark, 2018). Integrated reporting is a concept that stems from the notion that a business process encompasses the utilization of diverse resources inside an organization (Tirado et al., 2019). The composition of integrated reports in firms continues to exhibit variation, as evidenced by the findings of Pistoni et al. (2018).

Recognizing the importance of disclosing financial and non-financial information to capital providers, the provision of both types of information in a consolidated report has the potential to generate a positive impact on value (Van der Meijden, 2016). The efficient market hypothesis (EMH) posits that markets operate in a rational manner, with stock prices accurately reflecting all relevant information (van der Meijden, 2016; Orlitzky, 2013). Consequently, the provision of comprehensive and high-quality integrated reports plays a crucial role in facilitating the efficient functioning of capital markets. According to agency theory, firms characterized by a bigger agency problem are more likely to disclose a larger amount of information as a result of a heightened issue of information asymmetry (Frias-Aceituno et al., 2014).

The field of investor relations (IR) has been linked to the allocation of more resources within a corporation. It is commonly claimed that there exists a positive relationship between financial performance and IR strategy, as evidenced by studies conducted by Girella et al. (2019) and Vitolla et al. (2020). Top-level executives are likely to exhibit greater motivation in improving their investor relations (IR) endeavors when they attain specific performance metrics that enable them to showcase the effectiveness of their business model and their individual contributions to their stakeholders. Previous studies have employed a range of diverse financial performance indicators. Financial performance measures encompass both accounting-based metrics, such as Return on Assets (ROA), and market-based indicators, such as Tobin's Q.

Implementing this approach would enhance the caliber of their integrated reports, so bolstering the reliability of the information provided to investors, ultimately leading to economic benefits. Consequently, through the voluntary dissemination of more comprehensive integrated reports, management may seek to exert influence on the valuation of their companies' shares, potentially leading to a favorable perception among investors regarding the value of those shares, thereby stimulating investor demand. The voluntary disclosure of supplementary information in higher-quality integrated reports is anticipated to mitigate information asymmetry among stakeholders, with a particular focus on investors. This is projected to lead to enhanced company value, as reflected in upward share price valuations (Zhou et al., 2017).

H : integrated reporting quality is associated with firm value

Research Method

The methodology employed for data analysis through content analysis aims to verify the inclusion of components and sub-components inside the integrated reporting scoreboard, as well as assess the qualities of quality. The utilization of a matrix is employed by the researcher to categorize the various elements based on the integrated reporting components, namely background, reassurance, and dependability (Hammond and Miles, 2004).

Table 1: The Relation Between the Areas and Variables of The Integrated Reporting Scoreboard and The Attributes Of Quality Assessment

Areas of the Integrated Reporting Scoreboard	Variables of the Integrated Reporting Scoreboard	Attributes of quality assessment
Background	1. motivations underlying the choice of adopting IR 2. objectives pursued by the IR 3. beneficiaries of the document 4. manager in charge of IR process 5. CEO's commitment 6. title of the report 7. consistency of IR with generally applied disclosure standards	1. Adoption of reporting guidelines and standards 2. Clear statement of vision from the CEO
Assurance and reliability	1. internal audit 2. third-party verification 3. acknowledgements and awards for IR	3. Third party verification 4. Achievement of awards/ accolades

Content	1. organizational overview & external environment 2. business model 3. risks & opportunities 4. strategy & resource allocation 5. governance 6. performance 7. outlook 8. basis of presentation 9. capitals 10. value creation process	5. Quantitative disclosure 6. Establishment of, and reporting against (appropriate) targets 7. 'Warts and all' reporting 8. Ability to accurately assess performance from disclosure 9. Good coverage of significant issues 10. Reporting of normalized data
Form	1. readability and clarity 2. conciseness 3. accessibility	11. Wide access of the document

Each item is coded using a six-point scale from 0-5, namely:

a. point 5: if IR information is disclosed in quantitative/monetary form with narrative;
b. point 4: if IR information is disclosed in quantitative/monetary form only, without narration;
c. point 3: if IR information is disclosed in narrative form
d. point 2: if IR information is disclosed and discussed with limited references, or only briefly presented when discussing other information;
e. point 1: if the company states that the disclosure of IR items is immaterial;
f. point 0: if IR information is not disclosed.

The formulation in determining the index for each aspect in assessing IR disclosure is:

$$\text{IR Index} = \frac{\text{Disclosed items}}{\text{Total items}}$$

A greater IR score signifies an elevated standard of IR disclosure, since it signifies a heightened adherence to the International Integrated Reporting Framework (IIRF). The assessment of quality cannot be exclusively based on quantity, as a greater amount of material revealed does not necessarily indicate higher quality. This is due to the fact that conciseness is considered one of the fundamental principles of Information Retrieval (IR).

The measuring of company performance can be conducted through the utilization of market-based firm performance measurement techniques, such as Tobin's Q. Tobin's Q is calculated by dividing the sum of the market value of equity and the book value of total liabilities by the total assets. To conduct an empirical investigation utilizing regression analysis. In line with the stated research objective, this study focuses on the voluntary disclosure of Integrated Reporting (IR) by public companies that are listed in the Integrated Reporting Examples Database found on the International Integrated Reporting Council (IIRC) website. The specific reports examined in this study include those titled "Integrated Reporting," "Annual Integrated Reporting," "Integrated Annual Reporting," and "Annual Report." The purpose of this action is to ensure consistency in the chosen unit of analysis. Certain corporations continue to utilize the traditional practice of employing an annual report title, despite the fact that the contents of said report consist of integrated reports pertaining to a total of 16 companies in the Asian region.

Analysis and Result

The findings of the disclosure study pertaining to the quality of Integrated Reporting, namely in the areas of background and assurance & dependability, indicate that the largest proportion of disclosure is observed in relation to internal audit information, with a rate of 98%. The disclosure pertaining to the company's background represents the most comprehensive disclosure concerning the framework and standards employed by the organization. This indicates that the company's internal control and disclosure practices are founded upon relevant standards. The disclosure pertaining to the title of Integrated Reporting indicates a very low proportion of 50%, as several firms do not explicitly utilize the term "Integrated Reporting" in their annual reports. However, it is important to note that these companies' disclosures align with the principles and guidelines outlined in the Integrated Reporting framework established by the International Integrated Reporting Council (IIRC).

The disclosure rates for internal audit and external audit information are 98% and 88% respectively. In contrast, the disclosure rate for information pertaining to awards and acknowledgements is the lowest at 38%. In general, the category of awards/acknowledgments information exhibits the lowest percentage in the measurement of integrated reporting disclosure.

Table 2: Quality Integrated Reporting

	NO	%	YES	%	Total	%
Background						
Reasons	19	40%	29	60%	48	100%
Goals	11	23%	37	77%	48	100%
Recipients	10	21%	38	79%	48	100%
Responsible	7	15%	41	85%	48	100%
Commitment	8	17%	40	83%	48	100%
IR in Title	24	50%	24	50%	48	100%
Framework Standards	5	10%	43	90%	48	100%
Assurance & Reliability						
Internal audit	1	2%	47	98%	48	100%
External audit	6	13%	42	88%	48	100%
Awards/Acknowledgements	30	63%	18	38%	48	100%

Table 2 presents the mean value of the Integrated Reporting variable as 0.6625, whereas Tobin's Q is reported as 1.0169. The standard deviation value for the Integrated Reporting variable is 0.12875, while the Tobin's Q value is 0.40594. This observation indicates that the standard deviation is lower than the mean, suggesting that the data falls within the optimal range.

Table 2 : Descriptive Statistics

Statistics

		IR	TBQ
N	Valid	48	48
	Missing	0	0
Mean		,6625	1,0169
Median		,6700	1,0000
Std. Deviation		,12875	,40594

Based on the findings presented in Table 3, it can be inferred that there exists a statistically significant relationship between Integrated Reporting and Tobins'Q. This inference is supported by the significance value of 0.019, which is lower than the predetermined alpha level of 0.05. The F table value for this test is 4.047. The test results presented in the table indicate a F count value of 5.884, indicating that the calculated F value is more than the critical F value.

Table 3: Significance test

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,878	1	,878	5,884	,019[b]
	Residual	6,867	46	,149		
	Total	7,745	47			

a. Dependent Variable: Tobins'Q

b. Predictors: (Constant), IR

Based on the findings presented in Table 4, the calculated t-value of 5.826 exceeds the critical t-value of 1.67. This implies that there exists a partial impact on the quality of integrated reporting on Tobin's Q. Additionally, it is corroborated by a significance value that is less than the predetermined alpha level of 0.05.

Table 4 : Uji t

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	1,720	,295		5,826	,000
	IR	-1,062	,438	-,337	-2,426	,019

a. Dependent Variable: Tobins'Q

The impact of integrated reporting on corporate performance is evident through its correlation with market performance. This suggests that investors tend to invest in stocks of companies they are familiar with, as the acquisition and analysis of information about a firm often incurs substantial costs. Hence, the adoption of integrated reporting, which offers a comprehensive overview of a company's activities, has the potential to facilitate the expansion of a company's investor pool, consequently leading to reduced capital expenses. Barth et al. (2017) posit that integrated reporting (IR) can serve as a valuable instrument in mitigating parameter uncertainty and estimation risk. The authors argue that IR aims to give financial capital providers with a concise understanding of a company's value creation process across time by presenting a comprehensive overview. The interdependence among the six capitals upon which the company is dependent.

The inclusion of information in integrated reporting serves to enhance the ability of capital providers to make informed and efficient decisions regarding capital allocation. Consequently, it is anticipated that capital providers will express a favorable evaluation of organizations that express a desire to implement comprehensive and reliable integrated reporting practices. This aligns with the principles of voluntary disclosure theory, which posits that enhanced integrated reporting, stemming from the voluntary provision of supplementary information, can mitigate information asymmetry among stakeholders, particularly investors. Consequently, this can lead to an augmented corporate valuation and an increase in stock price valuation.

The implementation of integrated reporting instruments is crucial in the regulatory framework. In this context, it is imperative for the government to mandate adherence to prescribed standards of disclosure quality. Enhancing the quality of information disclosed via integrated reporting holds significant importance, as the dependability of a company's reporting framework hinges solely upon it. This is crucial in ensuring the trust and confidence of investors who have contributed capital to the organization, as they require comprehensive disclosure to make informed decisions.

Conclusion

The findings of the study indicate that there is a significant relationship between the quality of Integrated Reporting and the value of a corporation. Integrated reporting offers a comprehensive overview of a company's activities, so facilitating the expansion of its investor base and subsequently leading to reduced capital expenses. The inclusion of information in integrated reporting serves to enhance the ability of capital providers to make informed and efficient decisions regarding capital allocation. Consequently, it is anticipated that capital providers will express a favorable evaluation of organizations seeking to implement robust and comprehensive integrated reporting practices.

The International Integrated Reporting Council (IIRC) has recognized the difficulties in effectively implementing the Integrated Reporting (IR) framework, as demonstrated by the organization's documentation of input received from institutional investors and corporations. One of the main obstacles encountered by firms pertains to the proficient dissemination of their corporate strategy and the attributes of their value generating process. The International Integrated Reporting Council (IIRC) has recognized this barrier as being of considerable importance, and our research findings are consistent with this assessment.

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6th Langkawi International Multidisciplinary Conference 2023 (6th LIMC 2023)
eISSN 2976-3223
9th – 10th September 2023
Bayview Hotel, Langkawi, Malaysia

THE EFFECT OF ENVIRONMENTAL MANAGEMENT ACCOUNTING ON COMPANY CORPORATE SUSTAINABILITY

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Abstract: *This study aims to examine the effect of Environmental Management Accounting on corporate sustainability. The sample in this study was taken using a purposive sampling technique. The research sample is a company registered on the IDX for the 2018-2021 period. Out of a total of 740 existing companies, only 16 companies met the criteria, so the number of samples in this study were 16 companies observed in four observation years, namely 2018 - 2021. All of these companies were INCO, PTBA, BUMI, ANTM, ITMG, TINS, PTRO, ANJT, JPFA, AALI, PGAS, JSMR, ABMM, WIK, INTP and ASII. The research data were obtained from the company's financial statements and analyzed using panel regression analysis techniques. The results of this study indicate that Environmental Management Accounting has a positive effect on corporate sustainability, both on environmental and social aspects. companies that have low Environmental Management Accounting.*

Keywords: *Environmental Management Accounting, Eco-efficiency, sustainability.*

Introduction

Environmental management issues continue to be a concern for various parties. Scientists are anxiously observing weather patterns in the Arctic. Temperatures in the Arctic region reached 38 degrees Celsius and became the all-time highest temperature in the history of temperatures in the Arctic region. The World Meteorological Organization (WMO) has verified this and warned about changes in the earth's climate (Kompas.com, 2021). The impact of these high temperatures causes permafrost that is permanently frozen underground to begin to melt, carbon dioxide and methane that were previously locked underground to be released into the air. If left unchecked, humans and nature will be hit by catastrophic-scale warming characterized by increasingly severe droughts, rising sea levels, and the extinction of large numbers of species.

One of the environmental damages is caused by the existence of industrialization. The tendency is that companies pay less attention to environmental issues. Companies pay more attention to making the maximum profit without paying attention to the waste left over from production. Therefore, the industry is required to improve its production system by not abandoning the three main pillars of sustainable development, namely economic profit, ecological balance and business responsibility to the social environment (Tu & Huang, 2015).

Therefore, a management accounting system is needed that can consider environmental issues and costs involved in environmental management. One of the management accounting information systems that can be used is Environmental Management Accounting (EMA). Limited information about the environment that is not available in management accounting will influence management decisions. For example, the unavailability of environmental impact information resulting from an entity's activities will result in decisions that will later have a negative impact on the company's image and sustainability. Thus, the implementation of EMA makes companies gain competitive advantage and increase corporate value (corporate social responsibility value) (Tanc &; Gokoglan, 2015).

Lisi (2015) shows that there is a positive influence between environmental costs and improved environmental performance. Latan, et.al (2018) shows that companies with excellent environmental performance tend to disclose information that is robust, verifiable, and difficult to replicate. In addition to positive research, there are also some contradictory studies. Qiu, et.al (2016) and Nazari, et.al (2017) show that there is a negative or insignificant influence between the disclosure of environmental information on environmental performance.

Various studies on environmental management accounting have actually been carried out. Several studies have been conducted in several countries, such as in Malaysia (Fuzi, et al, 2016), Iraq (Chicha, Mohammed, & Alabdullah, 2021), and Germany (Buritt, et al, 2019). On the other hand, research in Indonesia has also been carried out (Agustia, 2020). However, research on environmental management accounting with eco-efficiency as an indicator and its impact on environmental performance has not been widely conducted, especially in manufacturing sector companies. This kind of research needs to be done because it can provide information about how environmental management accounting is applied to manufacturing companies in Indonesia and influence the sustainability of the company. In addition, the findings obtained can be the basis for development research and can also be used by companies as a basis for implementing environmental management accounting.

Literature Review

Environmental Management Accounting

Environmental Management Accounting (EMA) as part of environmental accounting, has been claimed as a useful tool to overcome the limitations of conventional management accounting to better understand and measure environmental problems in the decision-making process (Burritt et al., 2002). EMAs have been specifically introduced to help companies manage natural resources, energy, and pollution (Burritt et al., 2019). EMA is an important management tool to be adopted by businesses in responding to environmental challenges (Doorasamy &; Garbharran, 2015) which is used in improving the company's financial and environmental performance to achieve sustainability.

EMA is categorized into two main elements, namely physical terms and monetary terms (UNDSD, 2013; Burritt et al., 2002). In the category of physical information that is the focus is not only monetary data but also non-monetary data, so as to properly assess costs. Non-monoter data in question such as working hours and material usage. Burritt, et al (2002) give examples such as the number of kilograms of materials used in serving customers, and the energy used in one unit of goods produced. In the category of monetary information related to environmental aspects of company activities expressed in money, for example the cost of paying fines for violating environmental rules and the monetary value of environmental assets owned by the company.

Fuzi, et al (2016) reviewed the relationship between EMA and environmental achievement in the manufacturing industry. EMA consists of environmental costs, environmental safety, continuous improvement, management commitment. The Structural Equation Modeling (SEM) approach was used to review the relationship between EMA and environmental achievement, it was found that EMA practice has a positive relationship with environmental achievement. This finding also shows environmental achievement includes materials, energy, and natural resources.

To measure the extent to which EMA affects corporate sustainability, this study uses ecoefficiency indicators (World Business Council for Sustainable Development, 2015). It is one of the concepts used by an entity to declare itself as an environmentally friendly entity. Indicators in eco-efficiency are economic and environmental achievements. It is mathematically described as follows:

$$eco-efficiency = \frac{product\ or\ service\ value}{environmental\ influence}$$

In this study, the value of a product or service is measured by net sales. As for environmental influence, it is measured by total energy consumption. Energy data comes from the company's sustainability reporting.

Corporate Sustainability

Sustainability theory was first proposed by Meadows, et al (1972) who explained that community efforts to prioritize social responses to environmental and economic problems. This social response is expected to meet the needs of the present and future generations (WCED, 1987). The concept of sustainability is currently growing and being applied in the context of corporate sustainability (Pemer, et al, 2020). It was further explained that Corporate sustainability as a business and investment strategy can improve business practices by balancing the needs of present and future stakeholders (Artiach, et al (2010); Pemer et al. (2020). This concept emphasizes the interests of stakeholders by balancing the economic, social, and environmental dimensions of company performance.

Corporate Sustainability is usually measured through the Triple Bottom Line (TBL), this concept was developed by Elkington & Rowlands (1999). There are three dimensions of TBL, namely economic, social, and environmental. Pemer et al. (2020) stated that companies can move towards sustainability development by integrating TBL in management strategies. Markley and Davis (2007); Pemer, et al (2020) prove that TBL-focused organizations can increase a company's competitive advantage.

This research uses content analysis to measure the sustainability of the company. Content analysis brings a new perspective. Researchers better understand problem phenomena or inform practical actions. The number of disclosures is measured by page count, word count, and sentence count (Aras, Tezcan, Kutlu Furtuna, &; Hacioglu Kazak, 2017). Using sentences as a coding medium is much more reliable than other units of analysis because it cannot improve reliably when words are used (Ahmad, 2018). Content analysis with a scoring or weighting approach in assessing environmental and social achievements is carried out and reported by the object of research. Each implementation and reporting of activities by the object of study will be given a value of "1" and "0". Otherwise, it will be disclosed. After weighing the values on all items, these values are accumulated to produce the total value of the entity. Then an index is obtained with the following calculation:

$$CSDI = \frac{Total\ corporate\ sustainability\ disclosed}{Sustainability\ disclosure\ items}$$

Methods

Descriptive analysis provides an overview of the value of research variables through the minimum, maximum, mean and standard deviation values. The results of the analysis in table 1 show that the Environmental Management Accounting (EMA) of sample companies during the period 2019 – 2021 has a minimum value of 47355.7 and a maximum of 3,260,000,000 with an average of 114000000 and a standard deviation of 479000000. Furthermore, the Corporate sustainability data is the average data efficiency environment and social efficiency have a minimum value of 4% and a maximum of 92.5% with an average of 37.93% and a standard deviation of 20.74%

Table 1: Descriptive Statistics

Variable	N	Mean	SD	Min	Max
Efficiency Environment	64	38.22%	24.12%	6.00%	96.00%
Efficiency Social	64	37.64%	20.38%	4.00%	89.00%
Corporate Sustainability	64	37.93%	20.74%	6.50%	92.50%
EMA	64	114000000.0	479000000.0	47355.7	3260000000.0

Source: Data Analysis (STATA, 2023)

The influence of Environmental Management Accounting (EMA) on corporate sustainability in this study was analyzed using the panel regression analysis technique. The initial stage of the panel regression analysis is the selection of the panel regression model, based on the results of the Chow test, Hausman test and Lagrange Multiplier test in Table 2, the Random Effect model is selected to be the best regression model. However, because the results of the heteroscedasticity test indicated that there was heteroscedasticity in the panel regression model, the random effect model was estimated using the GLS technique.

Table 2. Panel Regression Result

	Model 1	Model 2	Model 3
Chow Test	0.615*** -9.2800	0.495*** -11.1100	0.570*** -10.0200
Hausman Test	-0.0821 (-1.38)	-0.0770* (-2.06)	-0.170** (-3.22)
LM Test	64	64	64
Spesification	Heteroskedastic No Autocolrelation	Heteroskedastic No Autocolrelation	Heteroskedastic No Autocolrelation

Source: Data Analysis (STATA, 2023)

The results of the regression analysis in table 3 show that in both model 1, model 2 and model 3, EMA has a positive and significant effect on the company's corporate sustainability, the results of the analysis show that both on environmental and social aspects, high Environmental Management Accounting can support company sustainability in the future, companies with Environmental Management Accounting tend to have better corporate sustainability than companies with low Environmental Management Accounting. The relationship between EMA and corporate sustainability can be described in one regression equation, namely:

$Y = -0{,}0821 + 0{,}615\,X$ ....overall model

$Y_{env} = -0{,}070 + 0{,}495\,X$ ....environment model

$Y_{soc} = -0{,}170 + 0{,}570\,X$ ....social model

X = EMA

Y = corporate sustainability; Y_{env} = environment efficiency; Y_{soc} = Social efficiency

Research on the effect of Environmental Management Accounting on corporate sustainability has been carried out several times by previous researchers, but in a different measurement concept of Environmental Management Accounting. The results of research (Pratiwi et al., 2020) conducted on mining, agriculture, construction and construction materials, energy, textile and apparel companies in Indonesia in 2014-2018 show that there is a positive effect of EMA on corporate sustainability. The results of another study conducted by (Runlei et al., 2020a) also show results that a high EMA will support the company's sustainability in the future and will have a very good impact on company performance. (Yang et al., 2020) in his research also suggests that in an uncertain financial situation, the company's high EMA from time to time will maintain the company's sustainability in the future. (Abdelhalim et al., 2023) in his research also shows the results that one of the company's corporate sustainability is determined by the company's EMA value, in this era of digitalization, digital environmental management is also needed to strengthen the relationship between EMA and corporate sustainability. The results of the study (Runlei et al., 2020b) also show results that there is a positive contribution of EMA to corporate sustainability. (Solovida & Latan, 2021) in this study also highlights the positive impact of EMA on corporate sustainability. Other research results that are also supported by the results of this study are research (Burritt & Christ, 2016; ENDIANA et al., 2020; Gunarathne & Lee, 2021; Hutchings & Deegan, 2022; Johnstone, 2020; Köseoglu et al., 2021; Lee , 2011; Nzama et al., 2022; Qian et al., 2018; Scarpellini et al., 2020; Schaltegger et al., 2017; Schaltegger & Csutora, 2012; Schaltegger & Wagner, 2006; UYAR, 2020; Wicaksono & Tarisa , 2022).

Table 3. Panel Regression Analysis Results

	Model 1	**Model 2**	**Model 3**
EMA	0.615*** -9.2800	0.495*** -11.1100	0.570*** -10.0200
Constant	-0.0821 (-1.38)	-0.0770* (-2.06)	-0.170** (-3.22)
Observations	64	64	64

Source: Data Analysis (STATA, 2023)

Conclusion

The results of this study indicate that Environmental Management Accounting has a positive effect on corporate sustainability, both on environmental and social aspects, high Environmental Management Accounting can support company sustainability in the future, companies with Environmental Management Accounting tend to have better corporate sustainability than companies that have low Environmental Management Accounting.

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IMPLEMENTATION OF VAT RATES ACCORDING TO LAW NO. 7 OF 2021 AND ITS IMPACT ON MSME TAXPAYERS

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Abstract: *Value Added Tax (VAT) is a tax that is collected and imposed on the delivery of Taxable Goods and Taxable Services. As of April 1, 2022, the government has officially increased the VAT rate from 10% to 11%, which is a mandate from Law No. 7 of 2021 concerning Harmonization of Tax Regulations. This study aims to discuss the implementation of changes to the 11% VAT rate which is considered to increase selling prices and decrease people's purchasing power after Law No. 7 of 2021 was enacted, as well as find out the obstacles encountered in the implementation that occurred. The method used in this research is descriptive quantitative method with data collection techniques, namely: questionnaires, interviews, observation, and documentation.*
The results of the study show that the increase in the VAT rate at 11% causes the selling price to increase. However, when viewed from the selling price as the basis for imposing tax, there are taxpayers who still determine the same price. People's purchasing power decreased slightly due to the increase in the price of their daily needs. The increase in economic prices was caused by an increase in the 11% VAT rate, forcing them to spend a lot more for their needs. Many Micro, Small, and Medium Enterprises (MSMEs) still experience obstacles related to the 11% VAT increase which is feared will make the economy more difficult. To overcome the decline in consumer purchasing power by continuing to provide the same price as before and only VAT has increased for a while.

Keywords: *VAT, MSMEs, purchasing power, selling price*

Introduction

Taxes are the largest source of revenue for the Indonesian government. Taxes are mandatory contributions to the state owed by individuals or entities that are coercive based on the law, by not getting compensation directly and used for the needs of the state for the greatest prosperity of the people. (Law No. 28 of 2007). The responsibility for the obligation to pay taxes, as a reflection of the obligations in the field of taxation lies with the community members themselves to fulfill these obligations. This is in accordance with the self-assessment system adopted in the Indonesian Tax System. Tax payment is a manifestation of state obligations and the participation of taxpayers to directly and jointly carry out tax obligations for state financing and national development. In accordance with the philosophy of the tax law, paying taxes is not only an obligation, but is the right of every citizen to participate in the form of participation in state financing and national development.

There are several types of taxes collected by the central government, including Income Tax, Value Added Tax (VAT), Land and Building Tax, and Stamp Duty. VAT is a tax imposed on Taxable Goods and/or Taxable Services. Taxable Goods subject to VAT are tangible goods, personal goods and real estate or intangible goods. Taxable Person for VAT Purposes are entrepreneurs who submit Taxable Goods and/or deliver Taxable Services which are subject to tax based on the 1984 VAT Law and its amendments. Taxable Person for VAT Purposes who make deliveries which are tax objects in accordance with the VAT Law are required to report their business to be confirmed as Taxable Person for VAT Purposes, except for small entrepreneurs whose limits are set by the Minister of Finance, as part of a series of tax reforms.

The Law on the Harmonization of Tax Regulations is one of the joint efforts of the Indonesian nation to realize the ideals of an advanced Indonesia. This tax reform is in line with the country's efforts to accelerate economic recovery and support long-term national development. The provisions in the Law on Harmonization of Tax Regulations regulate the expansion of the VAT basis by reducing institutions and companies that do not have VAT. VAT-free facilities are provided for basic needs, health services, educational services, social services and various other types of services that are actually needed by the community.

The government sets a single tax rate for VAT, agreed to increase the VAT rate from 10% (Law No. 42 of 2009) gradually to 11% starting April 1, 2022 and to 12% no later than January 1, 2025. This policy takes into account the situation in the world social business. Haven't fully recovered from the impact of the COVID-19 pandemic. The House of Representatives of the Republic of Indonesia passed the Law on the Harmonization of Tax Regulations, aimed at reviving the country's economy from the impact of COVID-19 by increasing state revenue from the tax sector (Cheisviyanny, Charoline. 2020). In general, the Law on the Harmonization of Tax Regulations amended and added several tax regulations, which are an integral part of the series of tax reforms that have been implemented to date, both in administrative reform and policy reform (Ragilia, 2022).

With the change in VAT rates, it also has an impact on Micro, Small, and Medium Enterprises (MSMEs) taxpayers in the city of Bandung. The development of the city of Bandung is quite rapid, because it is located close to the national capital. Various businesses are growing, the number of MSMEs in Bandung is also increasing. The level of understanding of Taxable Entrepreneurs in carrying out their tax obligations is still low (Genia, 2019). The Minister of Finance, Sri Mulyani, said there were at least 3 (three) sectors that would start to revive around October 2020, namely the tourism, trade and manufacturing sectors (Djumena, 2020).

This study aims to discuss the implementation of changes to VAT rates which are considered to increase selling prices and decrease people's purchasing power after Law No. 7 of 2021 was enacted, as well as find out the obstacles encountered in the implementation that occurred.

Literature Review

Tax

Taxes according to Law Number 16 of 2009 concerning the Fourth Amendment to Law Number 6 of 1983 concerning General Provisions and Tax Procedures Article 1(1) stipulates that taxes that must be paid to the State by individuals or legal entities: declared as contributions. Forced and used for the benefit of the state for the greatest prosperity of the people without receiving direct compensation according to law.

In carrying out tax obligations, it cannot be separated from a regulation or regulation. Basically, tax laws and regulations are expected to provide legal certainty, accommodate the dynamics of developing economic activities, increase taxpayer compliance, strengthen the tax base, and increase tax revenues and also ultimately increase state revenues. Tax reform will create changes in the field of taxation. Tax reform can be in the form of changing the method of tax collection by improving tax administration, increasing the tax base, improving tax regulations, and others.

Since October 29, 2021, President Jokowi together with the House of Representatives have ratified Law no. 7 of 2021 or better known as the Law on the Harmonization of Tax Regulations as a legal product that aims to increase sustainable economic growth and support the acceleration of economic recovery, create a more equitable tax system, and increase voluntary taxpayer compliance. The Law on Harmonization of Tax Regulations, was issued with the aim of implementing administrative reforms, consolidative tax policies, and expanding databases as well as increasing voluntary taxpayer compliance. Subroto (2020, 265) says that Indonesia's tax administration practices are dominated by a very strong target regime. This target regime has become the organizational culture of the Directorate General of Taxes, to be precise, shared values.

His is in accordance with what was conveyed by Bawono Kristiaji, a DDTC partner, that post-covid-19 tax policies in various countries are more related to the VAT sector, for example in the form of increasing rates, expanding the base, and improving the tax system (Setiawan, 2020).

In general, in the Law on the Harmonization of Tax Regulations, there are several rules that have been changed or added, such as changes to the Law on General Provisions and Tax Procedures, the Law on Value Added Tax, the Law on Income Tax, changes in excise tax rules, additions to programs voluntary disclosure of taxpayers, as well as adding carbon tax provisions.

Value Added Tax (VAT)

VAT is a tax imposed on: Delivery of Taxable Goods within the Customs Area by entrepreneurs, Delivery of Taxable Services within the Customs Area by entrepreneurs, Import of Taxable Goods, Utilization of Intangible Taxable Goods from outside the Customs Area within the Area Customs, Utilization of Taxable Services from outside the Customs Area within the Customs Area, Export of Intangible Taxable Goods to Taxable Entrepreneurs, Export of Tangible Taxable Goods to Taxable Entrepreneurs, Export of Taxable Services to Taxable Entrepreneurs.

VAT rates have been changed after the passage of the Law on the Harmonization of Tax Regulations. The existing VAT law stipulates that the VAT rate is 10%. This rate is valid until March 2022. Starting April 1, 2022, a new VAT rate of 11% will apply under the Tax Regulations Harmonization Act. Then, the VAT rate will increase again to 12% until January 1, 2025. The Law on Harmonization of Tax Regulations also provides room for the imposition of special VAT rates on certain types of goods or services and certain business fields. Although it does not explain the sectors that apply standard or final VAT. This special rate uses a final tariff clause on sales regulated by the Minister of Finance.

In accordance with Article 4 paragraph 1 of the VAT Law Delivery of Taxable Goods in the customs area is carried out by entrepreneurs, Delivery of Taxable Services in the Customs Area carried out by Entrepreneurs, Import of Taxable Goods, Use of intangible Taxable Goods outside the customs area within the customs area, Type of Taxable Entrepreneur Exports Taxable Goods, Use of Taxable Services outside the customs area within the customs area, Export of intangible Taxable Goods from a Taxable Entrepreneur, Export of Taxable Services by a Taxable Entrepreneur.

Goods are not subject to VAT

Types of goods that are not subject to VAT are goods included in categories of goods such as: Goods resulting from mining or drilling results taken directly from the source, Basic necessities needed by the community, food and drinks served in hotels, restaurants, stalls and the like, including food and drinks, even if not consumed on the spot, including food and drinks provided by catering companies or restaurants, gold bars, money and securities.

VAT object exceptions and VAT facilities

The Law on the Harmonization of Tax Regulations provides for VAT object exemptions and VAT facilities as follows: Basic goods, social services, educational services, health services, and several other types of services.

MSMEs

According to Law No. 20 of 2008 concerning Micro, Small and Medium Enterprises, as amended in Law no. 11 of 2020 concerning Job Creation, Article 1 paragraph (3), Micro, Small and Medium Enterprises, hereinafter abbreviated as MSMEs, are micro, small and medium enterprises as referred to in the Law concerning Micro, Small and Medium Enterprises.

Purchasing power

According to Supawi Pawengan (2016: 25) interpreting purchasing power is the ability of the community as consumers to buy the goods or services needed. The purchasing power of the people is marked by increasing or decreasing, where purchasing power increases if it is higher than the previous period, while purchasing power decreases which is indicated by the higher purchasing power of the people than in the previous period.

Factors that affect people's purchasing power include (Supawi, 2016: 26)
Income Level. Income is a remuneration from someone for the energy or thoughts that have been donated, usually in the form of wages or salaries. The higher a person's income, the higher his purchasing power and the more diverse needs that must be met, and vice versa.
Level of education. The higher a person's education, the higher the needs he wants to fulfill. For example, a graduate needs a computer more than someone who graduated from elementary school.

Requirement Level. Everyone's needs are different. Someone who lives in a city has higher purchasing power than those who live in a village.

Community Habits. In this modern era, consumerism tends to emerge in society. The application of an economic lifestyle, namely by buying goods and services that are really needed, has indirectly increased the welfare of life.

Price of goods. If the price of goods increases, the purchasing power of consumers tends to decrease, while if the price of goods and services decreases, the purchasing power of consumers will increase. This is in accordance with the law of demand.

Mode. Goods that have just become fashionable in society will usually sell well in the market so that consumption increases. Thus the mode can affect consumption.

Methods

This research is a quantitative descriptive research, namely research that collects data in the form of words, pictures, and not numbers, Moleong (1988: 2), the author tries to find out the symptoms that occur in the research object that takes place at a certain time and then describe these events with data obtained from observations and research in the field.
The data needed in this study is primary data, which is obtained directly from respondents in the field, namely taxpayers, especially taxable entrepreneurs. The survey method is a way of collecting data in which researchers or data collectors ask questions to respondents both orally and in writing (Sanusi, 2014). Questionnaire is a data collection technique that is carried out by giving a set of questions or written questions to respondents to answer (Sugiyono, 2014). Data Collection Techniques through Questionnaires, Interviews, Observations, Documentation, Data Analysis (Data Reduction, Data Classification, Data Interpretation), as well as Conclusion and Verification.

Research Result

This research is one year after the implementation of the increase in VAT rates in Indonesia began. The government has officially imposed VAT rates from 10% to 11% since April 1, 2022. This new rate policy is regulated in Article 7 of Law no. 7 of 2021 concerning Harmonization of Tax Regulations. The imposition of VAT of 11% is one of the government's policies to increase the performance of tax revenues. By encouraging growth in tax revenues, the government hopes to improve the state budget deficit to 3% in 2023. VAT is a government levy on all buying and selling transactions of goods or services carried out by individual taxpayers or entities that have become taxable entrepreneurs.

This research was conducted on taxpayers in the category of Medium, Small and Micro Enterprises (MSMEs), with a sample of 50 MSMEs in the city of Bandung with various business activities. The questionnaire was structured in a similar way to the results of previous research in the city of Surabaya (Larasati & Wibowo, 2022), covering selling price increases, consumer buying power decisions, and strategies implemented by MSME taxpayers.

Based on the research results, it was found that:
MSMEs who are respondents are already taxpayers, but not all of them are registered as Taxable Entrepreneurs so that some can collect VAT, some do not have the obligation to collect VAT, but these MSMEs make purchases of goods subject to VAT.

Increase in selling price

Based on the results of the questionnaire (88%) stated that an increase in VAT rates could increase the selling price of goods sold by MSME taxpayers, because as a result of the increase in VAT, production costs, especially home industries, where one of the components is raw materials, also increased. This affects the determination of the selling price of the product.

The increase in VAT of 11% of the selling price causes the selling price to increase even though it is only 1%. Some taxpayers increase the selling price, although the increase is not too big. There are also taxpayers who still provide the selling price as the same basis for imposition of tax before the VAT increase, so only the VAT increases.

Consumer purchasing power decisions
80% of MSME respondents stated that from a financial point of view, in general, consumers have been able to keep up with the increase in selling prices caused by this policy of increasing VAT rates. But there are also their consumers who prefer to reduce their purchases than usual.

Strategy
With the increase in the VAT rate, 72% of MSME taxpayers will look for cheap supplier prices, as well as consumers who are looking for the best price due to the increase in VAT. This is done so that the cost of goods sold is not too significant in the increase in VAT rates. 86% stated that overcoming the decline in consumer purchasing power by continuing to provide the same price as before and only the VAT increased for a while.

Constraints on MSMEs.
MSMEs stated that the 11% increase in VAT meant that the amount of money they prepared on a daily basis was greater than before the VAT rate increase. Consideration is needed in buying an item at this time especially for daily necessities. They are of the opinion that there are still many shortcomings that are felt from this 11% VAT rate increase, but MSMEs will still comply with the applicable regulations. On the other hand, this deficiency has a direct impact on people's daily needs. MSMEs also added that the advantage regarding the 11% VAT increase would have a good impact on the State.

Conclusion
From the results of research that has been carried out using the questionnaire method and interviews with taxpayers, in this case MSMEs in Bandung, which are affected by the 11% VAT increase in Law Number 7 of 2021 concerning Harmonization of Tax Regulations, it is concluded that the increase in the VAT rate at 11% causes the selling price to become go on. However, if you look at the selling price as the basis for tax imposition, there are taxpayers who still determine the same price. From interviews with several people it was concluded that people's purchasing power decreased slightly due to the increase in the price of their daily necessities. The increase in economic prices was caused by an increase in the 11% VAT rate, forcing them to spend a lot more for their needs. Many MSMEs still experience obstacles related to the 11% VAT increase which is feared will make the economy more difficult. In general, MSME taxpayers continue to comply with this regulation that has been in effect since April 1, 2022. To overcome the decline in consumer purchasing power by continuing to provide the same price as before and only VAT increased for a while.

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www.pajak.go.id

6th Langkawi International Multidisciplinary Conference 2023 (6th LIMC 2023)
eISSN 2976-3223
9th – 10th September 2023
Bayview Hotel, Langkawi, Malaysia

DETERMINANTS OF PROFITABILITY OF INSURANCE COMPANIES IN INDONESIA (CASE STUDY ON AN INSURANCE COMPANY LISTED ON THE INDONESIAN STOCK EXCHANGE)

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Abstract: *Insurance as one of the Non-Bank Financial Industries (IKNB) plays an important role in the economy and must perform well and be healthy. Profitability is one of the most important things to assess the performance of an insurance company. This study aims to determine the determinants of the profitability of insurance listed on the Indonesia Stock Exchange. This research uses multiple linear regression method. The dependent variable is Return On Assets (ROA) and the independent variable is Liquidity, Leverage, Claim Expenses, Premium Income and Company Size. The conclusion is that partially premium income has a significant effect on profitability and simultaneously liquidity, leverage, claims expense, premium income and company size have an effect on insurance company profitability*

Keywords: *Return on Asset, Liquidity, Leverage. Claim Expenses, Premium Income, Company Size.*

Introduction

Financial institutions are institutions that produce financial products and services. Financial institutions are one of the sectors that contribute to economic growth in Indonesia. To achieve Indonesia's economic growth target, the financial services sector is one of the important sectors and is needed to finance investment and development needs. Based on data from the OJK, the assets of the financial services sector in Indonesia reach Rp. 29,000 trillion in the June 2022 period, consisting of a capital market contribution of 54%, banking 36% and 10% from the Non-Bank Financial Industry (IKNB), one of which is insurance. based on data from OJK, the development of insurance in Indonesia in 2022, namely, the accumulation of premium income from the insurance sector from January 2022 to October 2022 reached Rp. 255.20 trillion, or grew by 1.81% compared to the same period in the previous year. However, the accumulation of life insurance premiums decreased by 5.76% compared to the previous period.

The number of insurance companies in Indonesia in 2017 was 152 companies and in 2022 it decreased to 149 companies, while for insurance supporting companies in 2017 there were 239 in 2022 to 223. The level of solvency or Risk Based Capital (RBC) of the insurance industry has also decreased, based on OJK data, at the end of 2019, insurance RBC was at 789.37% then in 2020 it became 528.59%, in 2021 it was 539.75% and experienced a decline again as of August 2020 to 485.56%. Based on OJK regulation No. 71/POJK.05/2016 concerning the Financial Soundness of Insurance and Reinsurance Companies, stipulates a minimum solvency level based on Risk Based Capital (RBC) of at least 120%. The greater the RBC, the higher the strength of insurance capital to meet long-term obligations. The phenomenon that occurs in the insurance industry in Indonesia is the RBC which continues to decline. This is evidenced by the presence of several insurance companies that were sanctioned by the OJK, including Kresna Life Insurance in August 2020 which was subject to sanctions from the OJK in the form of Restrictions on Business Activities (PKU) for failing to pay for their insurance products and the revocation of the Wana Artha Life Insurance license on December 5 2022 by the OJK for not being able to meet the RBC requirements. With the decline in the RBC of the insurance company, this indicates a decrease in the ability of the insurance company's capital to cover all losses that may be experienced by the insurance company and another phenomenon is based on OJK insurance statistics data that the insurance industry's total premium is only 9%, while bank lending is 12.88%, which is wrong. One of the causes is the low literacy and public trust in the insurance industry, so Insurance companies must maintain their soundness, especially profitability in order to increase public confidence in the industry and Insurance products.

Banking, insurance and finance companies have the same role, namely offering financial services, insurance offers services in the form of guarantees to customers against the risk of uncertainty, with increasingly intense competition between financial institutions, encouraging insurance companies to have good financial conditions, one of which is the profitability ratio. Based on the financial statements of 8 (eight) insurance companies listed on the Indonesia Stock Exchange, the Return On Assets (ROA) of insurance companies is between 2-9%. Apart from Return On Assets, the data also shows that the movements of the insurance company's premium growth ratio and Risk Based Capital for the 2019-2021 period have decreased.

Based on the results of research conducted at insurance companies in several countries, there are several differences in research results, including research on insurance companies in Palestine conducted by Abdeljawad et al (2020), namely that there is a significant effect of the premium growth ratio on return on assets. According to Malik (2011), who examined 34 insurance companies in Pakistan, stated that company capital and size had a significant effect on profitability, while Aemiro (2013) stated that for insurance companies in Ethiopia, that size, leverage and assets had a significant effect on profitability, while Pervan (2012)) concluded based on the results of his research for insurance companies in Bosnia and Herzegovina that company age, market share and performance have a significant positive effect on profitability and claim ratio has a significant negative effect. Alamjali (2012) concluded based on the results of his research that liquidity and size had a significant positive effect on profitability in insurance companies in Amman while for Romania based on research results from Bartica (2014) that the determinants of financial performance in the insurance industry are financial leverage, size, underwriting risk and solvency margin. Based on the results of Dogan's research (2013) that insurance companies in Istanbul have a significant positive relationship between size and profitability. The research results for insurance companies in Indonesia also have differences in research results, namely the results of research from Agustin et al (2018) concluded that the premium growth ratio has no significant effect on return on assets, while Sastri et al (2017) states that risk based capital has a significant effect on return on assets and the results of research from Apendi et al (2019) stating that risk based capital has no effect on return on assets and Noprika et al (2020) concluded that the claim expense ratio has no significant effect on return on assets as well as the results of Sorong's research (2019) shows that the claims expense ratio can mediate the ratio of premium growth to return on assets and the results of research by Sitompul et al (2021) state that the Debt to Equity Ratio and Receivable Turnover have a negative effect and the Current Ratio has a positive effect on the Return On Assets of conventional insurance companies listed on IDX. Barrezueta et al (2019) studied insurance companies in Ecuador which showed that the claims expense ratio had a significant effect on Return on Assets.

Based on the results of these studies, there are still different results, resulting in a research gap phenomenon from the results of the research that has been carried out. Based on the background that has been stated, the problems discussed in this study are the Determinants of Profitability of Insurance companies in Indonesia (Case studies of Insurance companies listed on the Indonesian Stock Exchange).

Literatur Review

Profitability is one of the factors to assess the merits of a company's performance. The factors that can affect the profitability of a company include ROA, ROE, NPM. In assessing company profitability Return on Equity (ROE) Return on Assets (ROA) and Net Profit Margin (NPM) are profitability ratios that are sufficient to represent other ratios in assessing company profitability, because in measuring the profitability of a company these three ratios have taken into account equity, assets and sales. ROA is important for Insurance because ROA is used to measure a company's effectiveness in generating profits by utilizing its assets.

According to Horne & Wachowics (2012: 37) that profitability consists of Gross Profit Margin, Net Profit Margin, Return On Assets. Syamsudin (2016), Return On Assets is an indicator for measuring a company's ability to generate profits from all the assets available in the company while according to Kasmir (2019), return on Assets is a ratio that shows the rate of return on assets used by the company.

Liquidity relates to the ability to meet financial obligations in the short term. Based on Harahap (2012) the liquidity ratio is a ratio that describes a company's ability to meet short-term obligations.

The Debt to Equity Ratio is one of the financial ratios that fall into the category of debt ratios. The debt position in a company indicates the amount of money from various entities (groups of people) used to generate profits. DER is used to measure the proportion of total company liabilities and common stock equity to finance the company's total assets (John D: 2017

Claim expense in an insurance company is an obligation that must be paid to a customer if a customer suffers a loss so that when an insurance company has a high claim burden, the obligation to pay claims will also increase which can affect the income received by the company.

Premium income at the insurance company is the fund paid by the insured in return for services from the protection provided by the insured in accordance with the agreement. In the Financial Accounting Standards No. 36 the definition of premium is insurance company income other than investment returns,

Company size is a measure that represents the size of a business entity based on several conditions such as total assets. According to Brigham & Houston, company size is the size of a company as assessed by total assets, total sales, total profits, tax expenses and other factors.

Methodology

In this study, the research variables are divided into dependent variables, namely Return On Assets and independent variables consisting of Debt to Equity Ratio (DER), Current Assets (CR), Claim Expenses, Premium Income and Company Size (Size). The population in this study are all banks in Indonesia that are listed on the Indonesia Stock Exchange

The procedures and methods used in collecting research data are using secondary data. The analysis model used is multiple linear regression analysis with panel data (pooled data). The equation model used to test the hypothesis is as follows:

$$\text{Prof} = \propto + \beta 1\text{CR} + \beta 2\text{DER} + \beta 3\text{Claim Expenses} + \beta 4\text{Premium Income} + \beta 5\text{Size} + \varepsilon$$

Result and Discussion

To select the most appropriate model to use in managing panel data, there are several tests that can be carried out according to Gujarati (2012: 253) in Sandra Dewi (2018), namely the Statistical F Test (Chow test), Hausman Test, Lagrange Multiplier Test. After selecting the model, then the classical assumption test is carried out.

The objects in this study are insurance companies listed on the Indonesia Stock Exchange and 9 insurance companies that meet the criteria are as follows:
1. Panin Financial (PNLF)
2. Panin Invest (PMN)
3. Tugu Insurance (TUGU)
4. Victoria Insurance (VINS)
5. Multi Artha Guna Insurance (AMAG)
6. Harta Aman Pratama Insurance (AHAP)
7. Mitra Dayin Insurance (ASDM)
8. Ramayana Insurance (ASRM)
9. Bintang Insurance (ASBI)

Before carrying out the regression, in this study an analysis of the best model assumptions was carried out using 3 methods, namely the common effect, fixed effect, and random effect. The following are the stages.

4.1 Common Effect Model

Table of Common Effect Model Test Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.257109	5.503720	0.228411	0.8205
X1	-0.000170	0.002013	-0.084675	0.9330
X2	-0.039435	0.006755	-5.837548	0.0000
X3	-6.812612	2.762200	-2.466372	0.0181
X4	1.624601	0.721329	2.252233	0.0300
X5	0.096206	0.048408	1.987401	0.0539

R-squared	0.517328	Mean dependent var	2.282222
Adjusted R-squared	0.455446	S.D. dependent var	4.249695
S.E. of regression	3.136014	Akaike info criterion	5.247348
Sum squared resid	383.5488	Schwarz criterion	5.488236
Log likelihood	-112.0653	Hannan-Quinn criter.	5.337149
F-statistic	8.360027	Durbin-Watson stat	2.082002
Prob(F-statistic)	0.000019		

From the results of data processing that has been done, the results obtained $R2$ seen from R-squared are worth 0.517328, this value means that the dependent variable or X can explain 51.73% of the independent variable or Y. Then the rest is explained by other variables that are not involved in in models.

4.2 *Fixed Effect Model*

Table of Fixed Effect Model Test Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.922307	6.489540	-0.604404	0.5501
X1	0.001293	0.003621	0.357049	0.7236
X2	-0.007195	0.010655	-0.675315	0.5046
X3	-3.772939	4.402262	-0.857046	0.3982
X4	5.161514	2.468742	2.090746	0.0451
X5	0.055886	0.047651	1.172822	0.2501

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.718079	Mean dependent var	2.282222
Adjusted R-squared	0.586516	S.D. dependent var	4.249695
S.E. of regression	2.732669	Akaike info criterion	5.109636
Sum squared resid	224.0244	Schwarz criterion	5.711857
Log likelihood	-99.96681	Hannan-Quinn criter.	5.334138
F-statistic	5.458061	Durbin-Watson stat	3.433083
Prob(F-statistic)	0.000049		

From the results of data processing that has been done, the results obtained $R2$ seen from R-squared is worth 0.718079 this value means that the dependent variable or X can explain 71.80% of the independent variable or Y. Then the rest is explained by other variables that are not involved inside models.

4.3 Random Effect

Table of Random Effect Model Test Results

			S.D.	Rho
Cross-section random			0.000000	0.0000
Idiosyncratic random			2.732669	1.0000
Weighted Statistics				
R-squared	0.517328	Mean dependent var		2.282222
Adjusted R-squared	0.455446	S.D. dependent var		4.249695
S.E. of regression	3.136014	Sum squared resid		383.5488
F-statistic	8.360027	Durbin-Watson stat		2.082002
Prob(F-statistic)	0.000019			
Unweighted Statistics				
R-squared	0.517328	Mean dependent var		2.282222
Sum squared resid	383.5488	Durbin-Watson stat		2.082002

Based on the results of data processing that has been carried out, the results obtained $R2$ seen from R-squared are worth 0.5173 this value means that the bound ustaka or X can explain 51.73% of the independent ustaka or Y. Then the rest is explained by other ustakas who are not involved in in models.

In the Common Effect Mode table, Random Effect and Fixed Effect Model data shows that the one with the highest R-squared level is in the Fixed Effect Model which is equal to 71.80%. The next stage of data processing in this study is to test this selection with the Chow test and the Hausman test.

4.4 Selection of the Regression Model

In the panel data regression model, there are three types of models, namely the regression Common Effect Model, Fixed Effect Model and Random Effect Model. So it is necessary to do a model selection test in order to obtain efficient estimates. The results of the model selection test are as follows:

4.4.1. Chow Test

This test is processed to see which model is better between the Common Effect Model and the Fixed Effect Model using hypothesis testing

Chow Test Table

Effects Test	Statistic	d.f.	Prob.
Cross-section F	2.373617	(9,30)	0.0366
Cross-section Chi-square	24.197038	9	0.0040

The Chi-Square distribution value of the results obtained using Eviews 12 is 24.197038 with a probability of 0.0040 (≤ 5%) the model used is the Fixed Effect Model

4.4.2. Hausman Test

This test is processed to see which model is better between the Fixed Effect Model and the Random Effect Model by using hypothesis testing, namely:

Hausman Test Table

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	19.829565	5	0.0013

** WARNING: estimated cross-section random effects variance is zero.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
X1	0.001293	-0.000170	0.000010	0.6441
X2	-0.007195	-0.039435	0.000079	0.0003
X3	-3.772939	-6.812612	13.586577	0.4096
X4	5.161514	1.624601	5.699609	0.1385
X5	0.055886	0.096206	0.000491	0.0689

The Chi-Square distribution value from calculations using Eviews 12 is 19.829565 with a probability of 0.0013 less than 5%) so the model used is the Fixed Effect Model.

4.5. Regression Test

Overall the results of panel data regression testing using the Fixed Effect Model method are as follows:

Table of Fixed Effect Model Test Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.257534	7.165494	-0.315056	0.7531
X1	0.486873	0.998393	0.487657	0.6263
X2	-0.901988	0.610927	-1.476426	0.1414
X3	0.343140	0.084293	4.070779	0.0001
X4	-0.022437	0.049465	-0.453588	0.6506
	Effects Specification			
Cross-section fixed (dummy variables)				
R-squared	0.668142	Mean dependent var	23.77203	
Adjusted R-squared	0.595336	S.D. dependent var	13.69440	
S.E. of regression	8.711452	Akaike info criterion	7.331296	
Sum squared resid	14874.32	Schwarz criterion	7.969414	
Log likelihood	-835.7556	Hannan-Quinn criter.	7.588411	
F-statistic	9.177050	Durbin-Watson stat	1.960046	
Prob(F-statistic)	0.000000			

The Fixed Effect Model test table can show the regression equation as follows:
Y = C + X1 + X2 + X3 + X4 +X5
Y = -3.922 + 0.001 X1 -0.007 X2 -3.77 2X3 + 5.161 X4+0.055X5

Y = Return On Assets
C = Coefficient
X1 = Liquidity Coefficient
X2 = Debt to Equity Ratio Coefficient
X3 = Claim Expense Coefficient
X4 = Premium Income Coefficient
X5 = Firm Size Coefficient

4.6. Hypothesis testing

4.6.1 Partial Test

The partial test results in this study are listed in the following table:

Partial Test Table

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Description
C	-3.922307	6.489540	-0.604404	0.5501	Not significant
X1	0.001293	0.003621	0.357049	0.7236	Not significant
X2	-0.007195	0.010655	-0.675315	0.5046	Not significant
X3	-3.772939	4.402262	-0.857046	0.3982	Not Significant
X4	5.161514	2.468742	2.090746	0.0451	Significant
X5	0.055886	0.047651	1.172822	0.2501	Not signifcant

a. Test on Liquidity (Current Ratio)

The statistical test for the Liquidity variable (Current Ratio) is 0.357049 while the probability is 0.7236 > 0.05 (α) which means statistically Liquidity has no significant and positive effect on Return On Assets. Furthermore, the coefficient value is 0.001293. This result is the same as the results of research from Rafi & Syaichu (2019) which states that liquidity does not have a significant effect on the profitability of Islamic insurance companies in Indonesia but contradicts research conducted by Isayas et all (202o) which states that there is a positive and significant effect between liquidity and profitability in insurance companies in Ethiopia

b. Testing on Leverage (Debt to Equity Ratio)

The statistical test for the Debt to Equity Ratio (DER) variable is -0.675315 while the probability is 0.5046 > 0.05 (α) which means statistically the DER data has no significant and negative effect on Return On Assets. Furthermore, the coefficient value is -0.007195. This has a conflicting effect with the results of research from Alshadadi et all (2021) which states that the debt ratio affects the profitability of insurance companies in Saudi Arabia and Isayas et all (2020) which concludes that there is a positive and significant relationship between leverage and profitability

c. Testing of Claim Expenses

Statistical test for Claim Expense variable is -0.857046 While the probability is 0.3982 > 0.05 (α) which means statistically Claim Expense has no significant and negative effect on Return On Assets. Furthermore, the coefficient value is -3.772939. This result contradicts the results of research from Irene et all (2020) which states that claims burden has a significant effect on Profitability

d. Test on Premium Income
The statistical test for the premium income variable is 2.090746 while the probability is 0.0451 <0.05 (α) which means that statistically the premium income has a significant and positive effect on return on assets. Furthermore, the coefficient value is 5.161514. This contradicts the results of research from Rivaldo & Wahasusmiah (2021) which states that premium income does not have a significant effect on the profitability of general insurance companies registered with the Financial Services Authority.

e. Test of Company Size
Statistical test for the variable company size is 1.172822 while the probability is 0.2501 > 0.05 (α) which means statistically company size has no significant and positive effect on return on assets. Furthermore, the coefficient value is 0.055886 The results of this study are the same as the results of research from Irene et all (2020) which states that company size has no effect on company profitability Isayas et all (2020) which concludes that there is no significant effect between company size and company profitability Insurance in Ethiopia

4.6.2. F Test (Simultaneous)

F Test Table

Cross-section fixed (dummy variables)			
R-squared	0.718079	Mean dependent var	2.282222
Adjusted R-squared	0.586516	S.D. dependent var	4.249695
S.E. of regression	2.732669	Akaike info criterion	5.109636
Sum squared resid	224.0244	Schwarz criterion	5.711857
Log likelihood	-99.96681	Hannan-Quinn criter.	5.334138
F-statistic	5.458061	Durbin-Watson stat	3.433083
Prob(F-statistic)	0.000049		

The results of the hypothesis test show a Prob (F-statistic) of 0.000049, because the probability is <5%, the hypothesis is accepted, namely that there is a significant effect of Current Ratio, Debt to Equity Ratio, Claim Expenses, Premium Income and Company Size on Return On Assets.

Conclusion

Based on the results of the discussion, it can be concluded that partially what determines the profitability of insurance companies listed on the Indonesia Stock Exchange is premium income which is the main operational and business income of insurance companies so that insurance companies are advised to innovate products and services and increase synergies between insurance industry players. with its ecosystem so that it can increase the amount of insurance premium income. Simultaneously the level of liquidity. Leverage, claim expenses, premium income and company size affect the profitability of insurance companies.

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6th Langkawi International Multidisciplinary Conference 2023 (6th LIMC 2023)
eISSN 2976-3223
9th – 10th September 2023
Bayview Hotel, Langkawi, Malaysia

BUSINESS INCOME TAX COMPLIANCE BEHAVIOR AMONG SOLE PROPRIETORSHIPS IN PENANG

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Abstract: *Throughout the COVID-19 pandemic, the Malaysian government has consistently supported Small and Medium Enterprises (SMEs) by ensuring that they are resilient and growing. The 2021 Budget represents the largest allocation to date that benefits SMEs, totalling RM38.7 billion as incentives to SMEs for sustaining their businesses. Hence, SMEs have an obligation to support the government by voluntarily and accurately paying their taxes. According to the literature, this group of taxpayers appears to be at a high risk of engaging in tax evasion and believes that paying taxes is a burden. Thus, this paper aims to focus on sole proprietorship, the small-scale sector known to be tough when it comes to paying taxes. The objective of this study is to examine the relationship between five independent variables; attitude, subjective norm, perceived behavioural control (probability of audit and licensed tax agent), and the dependent variable; intention to comply. The research framework of this study was developed based on five variables and employed the Theory of Planned Behaviour (TPB) which was developed by Ajzen (1991). The questionnaires were distributed to taxpayers in Penang. A total of 135 samples were collected from taxpayers through simple random sampling techniques. According to the analysis, TPB is relevant to this study because it helps to explain how taxpayers behave to be aware of and obedient to tax. If taxpayers have strong intentions and beliefs, they will obey the tax. Taxpayers also think about the effects of their actions before acting in a particular way. Surprisingly, the findings ruled out the validity of audit probability in tax intention behaviour. This study contributes to the current literature by adding a new variable of the licensed tax agent to the tax compliance model. Hence, the suggestion for future research is to increase the sample size so that future research can generalise the whole population and come out with a stronger regression model.*

Keywords: *Theory of Planned Behaviour; probability of audit; licensed tax agent; tax compliance behaviour.*

Introduction

Taxes are a fundamental way to generate public revenues and earn public funds, enabling them to finance investments in human capital, infrastructure, and the delivery of services to citizens and businesses. However, many individual taxpayers continue to misunderstand the importance of taxes. Non-compliance with the law is unavoidable due to the taxpayer's actions, whether due to illiteracy, ignorance, irresponsibility, or intentional evasion, as well as inefficiencies in tax administration. As a result, the Organisation for Economic Co-operation Development (OECD) (2004) emphasises the importance of the tax administration by having plans and procedures in place to minimise non-compliance with tax law. Nonetheless, all revenue authorities nationwide are facing a major problem in ensuring full compliance from every taxpayer. Despite maintaining public trust while maximising tax collection efficiency, the government continues to face continual non-compliance and the issue became more challenging once the self-assessment system (SAS) was implemented (Alm, Clark, & Leibel, 2016). The self-assessment system was implemented by the Malaysian government in 2001 to improve and modernise the tax system. During that year, SAS was introduced for corporations for the first time, and in 2004, it was expanded to include other categories of taxpayers, including sole proprietors, partnerships, cooperatives, and employees. Between 2001 and 2004, the Official Assessment System (OAS) was replaced with the SAS, which had a number of unexpected and unsatisfactory problems. The SAS mandates that taxpayers compute their taxable income and determine their liability using a "do-it-yourself" method to promote voluntary compliance by taxpayers (Hanapi, 2022).

Even though the majority of taxpayers are aware of their obligations, some nonetheless will try to avoid or delay paying them. Prior studies have also found that self-assessment taxpayers are the most likely to avoid paying taxes since the tax system is mainly focused on self-reporting. Due to their higher chances of flexibility in reporting their income, they tend to do everything required to organise their financial affairs so that they pay the least amount of tax possible (Slemrod, 2019). On the other hand, the extent to which a taxpayer deviates from the law is measured by the taxpayer's tax knowledge in manipulating the tax liability, either legitimately or illegally (Hanapi, 2022). During the mid-1990s, the issues of tax compliance generated considerable attention among Malaysian researchers. Although these issues were the focus of numerous studies, there was surprisingly little focus on business taxpayers, especially sole proprietors and partnerships. This type of business taxpayers, known as small and medium enterprises (SMEs), is a major economic contributor to many countries throughout the world, including Malaysia (Yusoff, Wahab, Latiff, Osman, Zawawi, & Fazal, 2018). According to the Department of Statistics Malaysia (DOSM) (2022), SMEs made up 98.9% of all businesses and contributed 37.4% to Malaysia's 2021 gross domestic product (GDP). From 2015 to 2021, SMEs, which are a significant player in Malaysia's business sectors, contributed over half of the country's labour force. The World Bank estimates that 600 million new jobs will be needed by 2030 to cope with the world's rising labour population. Therefore, the growth of SMEs is a top priority for many governments around the world. Throughout the coronavirus disease (COVID-19) pandemic, the government of Malaysia has consistently supported SMEs by ensuring that they are resilient and growing. The 2021 Budget represented the largest allocation to date that benefits SMEs, totaling RM38.7 billion as incentives to SMEs for sustaining their businesses. Hence, SMEs have an obligation to help the country by voluntarily and accurately settling their tax obligations.

SMEs seemed to be high-risk taxpayers because of their unstable income, limited financial resources, and tax ignorance (Delloite & MICPA, 2021), and as a result, they tend to be chosen for a tax audit. Evidence suggests that small businesses may be more likely to commit tax evasion (ChePa, & Razali, 2019). Moreover, this group of taxpayers also believed that paying taxes was burdensome since it would lower their income, and implementing a new digital tax was not necessary at this time (Hamid, Ismail, Yunus, Jali, & Rosly, 2022). Small business online retailers too still refused to file tax returns, despite the fact that they can generate additional revenue without having to pay taxes (Yeo, Lim, & Azhar, 2019). The Inland Revenue Board of Malaysia (IRBM) uses a variety of strategies to combat the issue of underreporting income. The IRBM Corporate Plan 2016–2020 highlighted the techniques as illustrated in the tax compliance model (LHDNM, 2016). The tax compliance strategies are further outlined in the IRBM Corporate Plan for 2021-2025 (LHDNM, 2021). To reduce the risk of non-compliance, one of the most useful strategic strategies is to promote voluntary tax compliance. To attain a high degree of voluntary compliance awareness, IRBM must apprehend group taxpayers' tax compliance behaviour. As a result, there is a disparity in the "intention for tax compliance" measure. The gap is in addition to the theoretical and practical gaps, which should be investigated to determine the causes of non-compliance behaviour in assisting tax authorities by concentrating on the areas that require immediate attention to raise tax awareness. Furthermore, the purpose of this is to help bridge the gap by investigating the factors that influence tax compliance intentions and behaviour among sole proprietors.

Literature Review

Theory of Planned Behaviour

Ajzen (1987), whose book was published in 1975, introduced the idea of continuous study that would become the idea of planned behaviour. Ajzen initially discussed the theory of reasoned action (TRA) in his 1975 book (Ajzen & Fishbein, 1975). TPB is the most widely used theoretical framework for interpreting human behaviour. It is an expanded form of the TRA (Ajzen, 1991). Before being applied to the field of taxation by Bobek (1997), the idea of planned behaviour was extensively employed in psychological research studies to explain how a person's perception of fairness influences their behaviour. Formerly known as TRA, this theory states that an individual's intention drives their behaviour and that individual's intention is catalysed by their attitude and subjective norms that motivate them to act in a certain way (Ajzen & Fishbein, 1975). The intention is the arbitrary likelihood that drives the decision to engage in the behaviour. Hence, the likelihood that a behaviour will be executed increases with the strength of the intention behind it. To overcome the limitations imposed by the TRA, Ajzen (1991) incorporated the TPB into his continuum study to bolster his earlier theoretical model. To accurately predict human behaviour, an additional component, PBC, was as an innovation incorporated into the TRA. The idea of adding the perception of PBC to the earlier theory is that people are inclined to participate if they lack control over it, even if there are positive influences and aspects of a favourable attitude towards it (Ajzen, 1991). Actual behaviour cannot be measured because it is either impractical or unavailable, so perceived behavioural control steps in to fill in the gap. If perceived behavioural control accurately represents actual control, the ability to anticipate future behaviour can be enhanced (Ajzen & Fishbein, 1975).

Attitude and Intention

The attitude towards adherence to tax laws and regulations is seen as an unclear definition since it lacks a precise definition (Eriksen & Fallan, 1996). Kirchler (2007), who discovered that the attitude towards paying taxes is riddled with complexity and stands for the norms and expectations surrounding taxation that have an impact on taxpayer behaviour, concurred with this. In this context, attitudes refer to the assessment of whether something is positive or not (Ajzen & Fishbein, 1975). Individual taxpayers will want to follow the rules when they are favourably evaluated; otherwise, they will take action to evade paying taxes. This view may be affected by several variables, including how fair the tax system is seen to be. The majority of people believe that they would be willing to pay for or even pay more to be a part of creating a society with them. If they obtain public benefits in exchange for their money, taxpayers may believe that taxation is an equitable system (Forest & Sheffrin, 2002). This suggests that people have a favourable opinion on tax compliance. On the other hand, people are less likely to co-operate with government officials if they believe that the tax system is treating them unfairly. Their attitude towards decisions related to tax compliance will ultimately be shaped by this view. Concerns regarding the justice of the current tax structure have also been connected to

attitudes towards tax compliance, according to Roth et al. (1989). In a related study, Bobek (1997) noted that a taxpayer's positive attitude towards paying taxes assures a higher intention to do so, whereas Bobek and Hatfield's findings from 2003, discovered a significant impact on how people feel about paying their taxes on time. According to a study by Bobek (1997), taxpayer's attitudes contributed to their compliance behaviour. According to the conclusions of the study, taxpayers' perceptions of fairness were primarily influenced by their interests, with how they personally profit from the tax system serving as their primary motivating factor. Researchers found that taxpayers' attitudes towards the tax system had a significant impact on their willingness to comply with tax laws (Saad, 2010). Those who see the tax system favourably are more likely to file and pay their taxes on time, whereas those who have a negative view are less likely to do so. The attitude constructs in the TPB are expected to be used in this study to justify the taxpayer's desire to follow the tax rules. Hence, the first hypothesis is presented as follows:
***H₁:** Attitude is positively related to the intention towards tax compliance behaviour among sole proprietor taxpayers.*

Subjective Norms and Intention
Peer influence (subjective norms) is regarded as a role in tax compliance according to Allingham and Sandmo's (1972) synthesis of past studies, which was revised by Richardson and Sawyer (2001). Societal standards are also a crucial predictor of people's tax compliance behaviour. Similarly, Fischer, Wartick, and Mark (1992) emphasised the significance of subjective standards in Fischer's ability to explain taxpayers' adherence to tax laws. Ajzen (1991) argues that subjective norms represent a form of worldwide social pressure resulting from a person's intimate friends and family members, who may have an impact on the person's ethical judgements, with what is widely seen as ethical being contradictory. It became extremely clear that someone would behave in a certain way if they believed that others around them shared their judgement on how they needed to behave. This is corroborated by research done in 2009 by Bidin, Idris, and Shamsudin, which found that behavioural intention to pay "zakah" on income from work is significantly influenced by subjective standards. Kirchler (2007) provided additional evidence for this claim by pointing out that the group affects individuals' tax compliance behaviour to which they belong. To put it another way, if the taxpayer believes that others are avoiding paying taxes, cheating, or abiding by the law, he will likely be influenced to do so too (Alm, 2012; Bergman, 2001; Sandmo, 2005).

The second hypothesis is presented as follows:
***H₂:** Subjective norm is positively related to the intention towards tax compliance behaviour of sole proprietors.*

Perceived Behavioural Control and Intention
PBC determines the amount of difficulty based on an individual's performance. Occasionally, this factor can directly affect behaviour. It pertains to how a person perceives the level of difficulty or the ease of a task with which they may effectively execute the desired activity. When there are no limits on a given behaviour, an individual may have complete control over that behaviour. In contrast, if a behaviour requires resources or certain abilities that are unavailable, there could be a complete absence of control. The more control people sensed that they have over the activity, the more likely they are to believe they have that kind of resource or opportunity. In the findings reported by Kraft, Rise, Sutton, and Roysamb (2005),

behaviours that are considered difficult to perform may tend to measure self-efficacy and controllability compared to less difficult behaviour. Hence, individuals will be less likely to act in that manner until they are certain that they can do so effectively. In accordance with previous research, the PBC is divided into two important dimensions in this study. The first dimension is the probability of audit, and the second is the licensed tax agent.

Probability of Audit and Intention

There has been many research done on tax compliance, tax evasion, and tax audits. The deterrence theory of taxes, which is based on Becker (1968) and Allingham and Sandmo (1972), suggests that audit efforts have a significant effect on enhancing compliance. The influence of tax audit efforts on tax compliance was further studied. In practice, there are more elements that can influence the compliance levels of taxpayers. The empirical findings of Tan and Yim (2014) implied that the presence of strategic uncertainty can act as a deterrent to tax evasion. Santoro (2011) concluded that choices to comply with tax laws may be affected by the availability of information or by the anticipation of an audit. In an experiment with 86 individuals, However, among the compliant taxpayers who were audited, those who received rewards evaded less in the subsequent audit than those who did not. Moreover, Bruttel and Friehe (2014), through a path-dependence experiment showed that the likelihood of being audited and the amount of the tax evasion penalties had an ongoing effect on current income disclosures. This discovery has significant policy implications and can be explained by reference-dependent preferences. An inadequate audit could encourage a taxpayer to take risks; for example, if the audit missed undeclared money, the taxpayer may conclude that the agency is incapable of detecting fraud and underreporting future income (Andreoni et al., 1998). Allingham and Sandmo (1972) concluded that when the risk of being identified is high, a bigger share of income will be disclosed. Thus, the following theory was developed:

H_3: *Probability of audit is positively related to the intention towards tax compliance behaviour among sole proprietors.*

Licensed Tax Agent and Intention

For several reasons, taxpayers hire tax professionals to act on their behalf. Owing to their limited tax knowledge and the complexity of current tax law, these reasons can range from a desire to submit appropriate returns to a desire to pay as little tax as possible, fear of filing incorrectly and incurring penalties, or simply insufficient time to do their own tax return. Tax preparers have a major impact on their clients' decisions to ignore the tax laws. Previous research has shown that the function of tax preparers, such as the Certified Public Accountants [CPAs], is either connected to tax non-compliance (an aggressive technique) or tax compliance (a conservative approach). The expectations of taxpayers do not entirely bind tax preparers. Tax preparers can set standards because they belong to an elite profession (Gordon, 1988). Nonetheless, it's important to realise that not every tax preparer is prepared to jeopardise their moral character in order to be successful (Marshall, Armstrong, & Smith, 1998). Tax advisors have the ability to influence taxpayers. The involvement of tax preparers may affect a taxpayer's decision not to comply. Tax preparers can influence taxpayers to make compliant choices. In the past, research on tax preparers primarily focused on licensed tax preparers. The goal of engaging an authorised tax preparer and an unauthorised tax preparer is identical: to guide and advise taxpayers in meeting their tax responsibilities. Due to licencing requirements, licensed tax preparers will have a higher level of education than unlicensed tax preparers (Ayres, Jackson, & Hite, 1989). Hence, unauthorised tax preparers may be unable to provide

adequate counsel, leading to a rise in tax non-compliance among single owners. Tan (2011) discovered in a recent study that the sort of advice given to customers by tax agents was influenced by their risk profiles, demonstrating the impact of clients on tax agents' ethical decisions. According to the findings of a number of researchers, smaller businesses, such as SMEs and self-employed individuals, had higher costs to pay taxes than bigger companies since they had to hire tax preparers because the businesses did not have non-tax accounting or tax departments to handle the tax matters (Slemrod & Venkatesh, 2002). The following hypothesis is derived from these research results:
H₄: *Appointment of a licensed tax agent is positively related to the intention towards tax compliance behaviour among sole proprietors.*

Intention and Tax Compliance Behaviour
The TPB suggests that intent is a substitute for behaviour. It demonstrates a person's reason for doing something in terms of their conscious plan or decision to do it. In general, the greater the strength of the motivation, the greater the possibility that the activity will be carried out (Fishbein & Ajzen, 2011). Benk, Cakmak, and Budak (2011) employed the idea of planned behaviour to explain tax compliance behaviour, but their research indicated that the desire to comply does not result in action. Suhaila (2013) observed that Armitage and Conner's (2001) meta-analysis also showed that one of the TPB's advantages is its capacity to forecast behaviour across a range of academic disciplines. According to previous research, intention and behavioural variation were both significantly explained by TPB. Moreover, the TPB is among the most important models between attitudes and actions (Armitage & Christian, 2003). In their study model, Wu and Chen (2005) investigated the link between trust and the technology acceptance model on the taxpayer's e-Filing intent and discovered a substantial positive relationship between trust in authorities and e-Filing intentions. Consequently, this study aimed to identify and measure the tax compliance intentions of sole proprietor taxpayers. This leads to the following hypothesis, which is based on a prior discussion:
H₅: *Intention is positively related to tax compliance behaviour among sole proprietors..*

Methods
The study's population comprises all sole proprietors who operate enterprises in the state of Penang, and have registered files at the IRBM Penang Branch, filed their tax forms, and made their income tax payments. As of December 31, 2021, 769,869 sole proprietor taxpayers registered their files with the IRBM Penang Branch and filed their tax returns through the e-Filing system. The total number of sole proprietor taxpayers in Malaysia who registered their files as of December 31, 2021, was 11,143,936The purpose of this study is to identify the features that affect individuals' tax compliance intentions. Identifying information (identification and residences) was collected from a random sample of taxpayers who filed individual business and were stored in the database system of the IRBM Penang Branch. The present study utilised a quantitative methodology through the distribution of surveys to the participants. In this study, the variable's attitude, subjective norms, PBC (probability of audit and licensed tax agent), tax compliance behaviour and the dependent variable's intention to comply are all measured using an interval scale. The usage of an interval scale, which suggests a rating on a certain scale and measures between any two points on the scale, would clearly explain the reasons that contribute to non-compliance with taxation (Wu & Leung, 2017). All of the constructs were measured with a five-point Likert scale. The interval scale matches this study's Likert scale questionnaire (5-strongly agree, 1-strongly disagree). Twenty (20) items

were evaluated across all five (5) variables, with responses ranging from "strongly disagree" (1) to "strongly agree" (5).

Results

Results of Reliability And Validity

The results of Cronbach's alpha which examine the internal consistency was used for the reliability of each variable. For each of the six variables utilised in this investigation, the Cronbach's alpha coefficient was determined to the greatest value of 0.908 for the tax compliance behaviour variable and the lowest value of 0.652 for the intention variable. which exceeds the recommended minimum value of 0.60 as suggested by Sekaran and Bougie (2013). Also, Hair, Black, Babin, Anderson, and Tatham (2006) exploratory studies of Cronbach's alpha values exceeding 0.60 are acceptable.

In addition to the reliability test, factor analysis is required to evaluate whether or not items represent patterns of the same construct. The method of factor analysis was applied to every construct so that the validity of each variable that was used in this study could be determined. The analysis simplifies the variable into manageable elements or dimensions (Pallant, 2010). The test for the identity of the matrix, based on Bartlett's sphericity test, showed that each construct was significant ($p = 0.0000$). In order to establish whether the sample size is adequate or not, KMO-based validity analyses were carried out. The KMO score for each construct was within the range of 0.654 to 0.813 with a single factor. All of the constructs were discovered to have KMO values greater than 0.50, and based on Hair et al. (2006), these constructs are acceptable for further analyses. The items are intention, attitude, subjective norm, probability of audit, licensed tax agent, and tax compliance behaviour. The KMO is highest for the subjective norm with a value of 0.813. The intention construct, on the other hand, has the lowest KMO value at 0.654.

Results of Regression Analysis

Overall, the review of the four (4) basic assumptions of regression analysis did not reveal any violations. According to the multiple correlation coefficient value of $R = 0.603$, the degree of intention to comply with tax rules predicted by the independent factors was good. The coefficient of determination R^2 measures how well a model can explain and forecast future actions. The independent factors were responsible for 36.4% of the variation in the dependent variable, according to the coefficient of determination ($R^2 = 0.364$). As the dependent variable is the intention of Penang's sole proprietorship taxpayers to comply with the law on taxes, the model that was developed for the purpose of this investigation, which includes all four independent variables (attitude, subjective norm, probability of audit, and licensed tax agent) covers 36.4% of the dependent variable.

The F-statistic is a method for determining the variance's deviation from the mean. Whether the results are statistically significant or not depends on the F-statistic value and the P-value. Nonetheless, caution must be exercised because this does not necessarily imply that each of the four independent variables significantly influences the intention to comply with the legislation. The significance level ($\alpha = 0.01$) is reached by the F-statistic value of 18.568, which is less than the significance level with a p-value of 0.000. There is a statistically significant difference between the means of the variables, as demonstrated by the F-statistic and P-value results when combined. Further tests are conducted to evaluate whether variable means are significant, as shown in Table 1.1. The P-value demonstrated that the dependent variable, intention to comply, has been significantly affected by three independent variables: attitude, subjective norm, and licensed tax agent. This suggests that attitude, subjective norm, and a licensed tax agent all influence taxpayers' intention compliance behaviour. The remaining independent variable, the probability of audit has no significant influence on the dependent variable, intention to comply. This suggests that the likelihood of an audit has no effect on sole proprietor taxpayers' intention to comply. This leads to the conclusion that the independent variables; attitude (β = 0.269, P-value = 0.011), subjective norm (β = 0.239, P-value = 0.024) and licensed tax agent (β = 0.305, P-value = 0.036) have the most significant effect on the dependent variable; intention to comply.

Table 1.1*: Linear Regression Model 1 (Coefficient)*

		Unstandardized Coefficient		Standardized Coefficient	t	Sig
Model		**B**	**Std. Error**	**Beta**		
1	Constant	1.215	1.771		0.686	0.494
	Attitude	0.269	0.105	0.241	2.571	0.011*
	Subjective Norm	0.239	0.105	0.212	2.287	0.024*
	Probability of Audit	0.100	0.085	0.108	1.178	0.241
	Licensed Tax Agent	0.305	0.144	0.188	2.123	0.036*

*p<0.05

As shown in Table 1.2, further tests are done to consider variables that affect tax compliance behaviour. The P-value in Model 2 suggested that the dependent variable, tax compliance behaviour, revealed a positive and significant relationship with intention to comply. Therefore, the variable, intention to comply (β = 0.432, P-value = 0.000), is significantly influenced by the dependent variable, tax compliance behaviour. This indicates that a taxpayer's behaviour with regard to tax compliance is affected by their willingness to follow the law.

Table 1.2*: Linear Regression Model 2 (Coefficient)*

		Unstandardized Coefficient		Standardized Coefficient	t	Sig
Model		**B**	**Std. Error**	**Beta**		
2	Constant	8.357	1.090		7.665	0.000
	Intention to Comply	0.432	0.074	0.451	5.826	0.000*

*p<0.01

Discussion

The first research objective is to determine the influence of attitude, subjective norm, probability of audit, and licensed tax agent on tax compliance intention among sole proprietor taxpayers. The second research objective is to determine the influence of intention on tax compliance behaviour among sole proprietor taxpayers. The study's results showed that individual taxpayers are likely to have attitudes that lead them to be in compliance with the tax laws. Previous research has proven the importance of attitude on intention (Bobek, 1997; Saad, 2010; Bobek & Hatfield 2003). In addition, previous research has shown that a person's attitude significantly affects how they act in relation to their intentions. Consequently, the TPB model proposed by Ajzen (1991) is consistent with the attitude variable. Thus, the results of this study are compatible with the TPB, which reveal that a changing attitude influences an individual's intentions. The objective has been achieved, and the results show that among sole proprietor taxpayers, attitude and intention to comply with laws are strongly positively correlated. This study examined the hypothesis that the intention to comply with tax laws is positively correlated with the subjective norm. Tax intention to comply with tax laws was found to have a strong relationship with the subjective norm. This result lined up with several prior tax studies, including the studies by Saad (2010), Bidin, Idris, and Shamsudin (2009), Bobek et al. (2007), Kirchler (2007), and Alm (2012). Importantly, the results of this study matched the predictions made by the TPB, which postulates that an individual's intentions are affected by the subjective norm variable. Hence, the objective has been accomplished, and it has been demonstrated that, among sole proprietor taxpayers, there is a significant connection between individual norms and the intent to comply with the law.

The current study has split PBC into two main components or characteristics. The first is the internal factor while the second is the external factor. This study uses the TPB to explain how the frequency or number of audits has an impact on taxpayers' compliance. Several past results indicated that the probability of audit was significant on tax compliance (Bruttel & Friehe, 2014; Kastlunger et al., 2011 Tan & Yim, 2014; Slemrod et al., 2001). In conclusion, different levels of detection will likely result in varying degrees of compliance. For instance, increased compliance may result from a high likelihood of detection (Bergman, 2001). However, the researcher in this study examined the potential for being audited and the sole proprietor taxpayer's responses towards tax compliance intention; different taxpayer demographics (such as employees) may yield varying outcomes and interpretations. In addition, the time of the data collection itself may be a significant contributor to the mixed findings. Therefore, the objective of determining the relationship between the probability of audit and the intention to comply with tax laws has been met, and it has been demonstrated that there is an insignificant but positively related correlation between the probability of an audit and the intention to comply with tax laws among sole proprietor taxpayers.

Due to the requirements for professional certification, licensed tax preparers have higher levels of education than unapproved tax preparers (Ayres, Jackson, & Hite, 1989). As a result, unlicensed tax preparers may not be able to effectively guide sole proprietors, potentially leading to a rise in tax non-compliance. The appointment of a licensed tax agent demonstrated its strong importance, with each item having a high range of mean values. According to the results of this investigation, there is a strong correlation between the construct of a licensed tax agent and their intention. The significance of licensed tax agents on intention was consistent with the findings of previous research by Ayres, Jackson, & Hite, (1989) and Arachi & Santoro, (2007). Thus, the findings of this study support the hypothesised positive relationship between variable licensed tax agents and the intentions of sole proprietor taxpayers. The aim has been met, and the significance of the relationship between a licensed tax agent and the objectives of a sole proprietor taxpayer to comply with tax rules have been confirmed.

In this study, it was found that intention was significant for tax compliance behaviour. This result was consistent with prior research by Armitage and Christian (2004) and Wu and Chen (2005). They discovered that intention was significant in their studies of behaviour. Wu and Chen (2005), on the other hand, tested the relationship between trust and the technology acceptance model on the taxpayer's e-Filing intention and discovered a strong positive correlation between trust in authorities and e-Filing intentions. With regards to the study's objectives, as a conclusion, it is shown that there is a high correlation between intention and tax compliance behaviour among sole proprietor taxpayers.

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