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Bridging the Digital Gap: Factors Influencing Digital Economy Adoption in Small Enterprises

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ABSTRACT

The digital economy has emerged as an important driver of enterprise growth, productivity, and innovation across various industries in recent years. Nonetheless, the implementation of a digital economy presents numerous challenges for small and medium-sized enterprises, particularly in states such as Kelantan with low gross domestic product (GDP) growth. Additionally, the presence of web technology is among the lowest in Kelantan compared with other states in Peninsular Malaysia, especially in the small- and medium-sized enterprise sector. This paper examines the key determinants affecting the adoption of the digital economy by small enterprises in Kelantan. As digital technologies persist in transforming economic activities, comprehending the factors that facilitate or impede their adoption is crucial for maintaining small business competitiveness. A quantitative approach was utilized, and structured questionnaires were administered to small business proprietors across diverse industries in Kelantan. Data analysis was performed utilizing SPSS (version 29.0.2.0) and SmartPLS4 (version 4.1.1.4). This research, led by the Technology-Organization-Environment (TOE) framework, identified and studied the technological, organizational, and environmental aspects influencing adoption decisions. The findings indicate that organizational and environmental factors, including innovation culture, employee skills and knowledge, market competition pressures, government restrictions, and financial support from the government, greatly affect adoption levels. These findings provide important insights for policymakers, technology providers, and support agencies to formulate policies that might effectively advance digital transformation among small enterprises across the nation.

1. Introduction

The digital economy is transforming business operations, enhancing efficiency, expanding customer reach, and improving service quality (OECD, 2020). The Malaysian government has introduced programmes such as Malaysia Digital Economy Blueprint to encourage small and medium-sized enterprises (SMEs) to use digital technology in their operations (MDEC, 2021). Nonetheless, the implementation of

these technologies remains inconsistent, particularly in rural regions such as Kelantan, where numerous traders persist in utilizing conventional business practices (Faiz et al., 2024).

Kelantan, although a small state, has the potential to grow as a business hub for both small and large companies. Many traders, however, face problems such as poor internet access, low digital skills, and lack of awareness on government support programmes (Subramaniam, 2024; Low et al., 2022). While some traders become popular on social media, this attention is often short-lived and happens mainly during holidays. These challenges make it harder for businesses to grow and compete in today's digital market.

Previous research on digital adoption in Malaysia has predominantly focused on urban settings, resulting in a deficient comprehension of the obstacles encountered by rural enterprises. To fill this gap, this study aims to investigate the factors affecting the adoption of the digital economy by small businesses in Kelantan, utilising the Technology Organisation Environment (TOE) framework (Tornatzky & Fleischer, 1990). The study more specifically aims to identify the organization and environment factors that influence adoption and evaluate the relationships between these factors and the level of digital economy adoption among SMEs. The findings can help policymakers and support agencies create strategies that improve SME competitiveness in the digital age (Zhang et al., 2024).

2. Problem Statement

The digital economy has become a revolutionary force providing businesses huge possibilities to increase competitiveness, engage a wider audience, and improve efficiency. Nevertheless, small businesses in the Kelantan area are still adopting digital technologies at an unexpectedly low rate (Zabri, 2024). Many small businesses in the area are unable to fully take advantage of digital technology contribute from low levels of digital literacy, limited access to technology infrastructure, and lack of financial (Subramaniam, 2024). The lack of using digital tools slows down their growth and makes it harder for them to keep up in a market that depends more on technology. At present, there is a lack of detailed and comprehensive study on the digitalization process among company (Low et al., 2022). People have talked a lot about bigger cities and more developed areas, but less about the research on social, economic, and cultural aspects of Kelantan. This research gap makes it hard for policymakers and other stakeholders, like the government and policymakers, to come up with effective and focused solutions because it limits our understanding of the specific needs and challenges those small businesses in this area face. Clearly defining these problems and challenges requires identifying the underlying factors that influence digital economy adoption, which can be categorized into technological, organizational, and environmental dimensions as explained by the Technology-Organization-Environment (TOE) framework (Low et al., 2022). This research aims to explore the factors from the challenges faced by small businesses in Kelantan in adopting digital technologies, as well as the potential benefits of participating in the digital economy. The study aims to fill this gap in knowledge by giving small businesses real-world digitalization that can help them make the switch to digital and become more resilient and grow in the digital age.

3. Literature Review

3.1 Socioeconomic Activity in Kelantan

Kelantan is a small state that can function as a business hub, accommodating consumers of all sizes, from small businesses to large enterprises. However, all traders encounter various barriers and challenges, primarily due to several responsible agencies neglecting the digital economy. Consequently, a literature review has been conducted to explore the barriers and challenges small traders face in this country, aiming to align them with the current digital economy. Several factors influence the obstacles and challenges that need to be studied and understood to address the issues faced by small traders in Kelantan when starting a

business (Paramesvaran, 2023). This matter should be taken seriously because many well-known traders in Kelantan go viral but receive little attention except on holiday days.

3.2 Understanding the Digital Economy: Origins and Expansion

The term "digital economy" refers to a broad spectrum of business dealings, professional relationships, and economic activities that rely heavily on digital information for production and operation (Loh et al., 2021). By using the Internet and other digital technologies like cloud computing, big data analytics, the Internet of Things (IoT), and artificial intelligence (AI), the digital economy creates benefits and efficiency that could aid in a country's economic development. The definition of the digital economy can be more as stated as it begins with “digital” which means one must have an Internet connection. The internet, which emerged in the early 1990s as a significant technical advance in the economy, is the main emphasis of the first definitions (Williams, 2021). This is why the term "digital" will encompass all forms of technology, including big data, cloud storage, mobile technology, the internet, and information and communication technology (ICT), when addressing the economy.

The transformation from analog devices to digital technology in the late 20th century is referred to as the third industrial revolution, or the "digital revolution." As modern technologies continue to connect the physical and virtual worlds, the fourth industrial revolution expands upon the digital revolution. Since the late 18th century, the Industrial Revolution has had a profound impact on economies and cultures, and it is usually separated into different stages. Starting in Great Britain, the First Industrial Revolution around the year 1760 until 1840 was marked by an evolution from manual to mechanical production, especially in the textile sector. During this period, innovations like Out with the Old and In with the New became crucial because they boosted productivity and allowed factories to be established. As a result, workers moved from rural to urban regions in large numbers in search of industrial jobs (Mohajan, 2019). After that, new energy sources like gas and electricity were developed during the Second Industrial Revolution about the year from 1870 until 1914, thus making mass production methods easier. Global trade networks were further strengthened throughout this age by significant improvements in manufacturing processes, such as the assembly line, and in communication and transportation technology (Papula & Papulova, 2019).The Third Industrial Revolution, which began in the late twentieth century, concentrated on electronics and information technology, resulting in the automation of manufacturing processes. Artificial intelligence and the Internet of Things are examples of digital technologies that are being incorporated into industrial processes to define the Fourth Industrial Revolution, or Industry 4.0. During this phase, production techniques are made more sustainable and customized, and modern issues including environmental concerns and evolving consumer wants are addressed (Apriliyanti & M, 2022). Each phase has not only altered economic structures but has also had a substantial impact on labour markets and society standards, illustrating the ongoing interaction between technology innovation and social transformation.

The skill of using the internet and other online activities is important because the emergence and evolution of digital divisions rely heavily on it (OECD 2020). It is important to note that the Internet and digital infrastructures are becoming more and more essential to society and the economy. Digital transformation highlights how important it is to have access to and provide broadband communications and cloud infrastructures to support businesses to become successful in terms of social and economic engagement. Based on a new Organization for Economic Cooperation and Development (OECD) model that uses big data and machine learning techniques, ICT sector estimates give policymakers timely, comparable, and accurate data on the ICT industry's economic growth (OECD 2024). These revised projections assist in addressing -an absence of up-to-date information on the performance of the ICT industry and are essential for assessing how well sector-related policies are works.

3.3 Theoretical Framework in Digital Economy

The past studies have looked at the theoretical framework that the researchers are using. The two most popular frameworks for examining how small and medium-sized enterprises (SMEs) embrace new technologies and go digital are the Technology-Organization-Environment (TOE) and Technology Acceptance Model (TAM). Using the Technology-Organization-Environment (TOE) framework, the researchers of this study looked at how Malaysian SMEs have adopted digitalisation (Low et.al, 2022). Based on the past study, the last targeted paper that using the TOE framework to investigate how well people accept digitisation, focussing on how Malaysian MSMEs are using e-commerce (Zabri, 2024). The TAM framework puts more weight on perceived utility and usability than on outside factors like the size and complexity of an organisation. The study found that the main barriers to using this framework to adoption were a lack of knowledge and money. On the other hand, the main benefits were a competitive edge, flexibility, and low cost. In the meantime, the TOE framework has been very helpful in looking at the many internal and external factors that affect digitalisation in developing countries. The analysis from the TOE framework highlighted the significance of organizational resilience, proficiency with technology, and outside variables like competitive pressure and regulatory support.

According to the analysis, since the TOE framework fully integrates technological, organizational, and environmental aspects, this framework to be used seems to the most appropriate for studies looking at deeper digitalization processes such as the TOE framework (Low et.al, 2022). A good approach for gaining information about how small and medium-sized businesses adopt technology is the TOE framework. The TAM framework is still useful but only for research that focuses on behavioural and attitudinal aspects of technology adoption. To guarantee relevance and robustness, the framework selection should be in line with the goal and nature of the study.

In the context of small businesses in Kelantan, the TOE framework provides a more comprehensive understanding. When it comes to small businesses in Kelantan, the TOE framework gives a better overall picture. This study's findings suggest that organisational and environmental factors, including innovation culture, employee skills, government regulation, and market competition, are more significant in facilitating digital economy adoption than entirely technological factors. This supports the finding of (Faiz et al., 2024), which indicated that the efficacy of small and medium enterprises in implementing digital systems is dependent upon internal capability and external influences, rather than technology in isolated.

3.3.1 Technology-Organization-Environment (TOE) framework

One well-known strategy for analyzing how businesses embrace and employ new technologies is the Technology-Organization-Environment (TOE) framework. This study is based on the Technology-Organization-Environment (TOE) concept, which provides a thorough understanding of the internal and external aspects influencing Kelantan small enterprises' adoption of the digital economy. This framework suggests that the adoption of technology in any organization is constructed by three key elements including:

Organization

In the organizational context, the internal capabilities and attitudes of SMEs toward digital innovation emerge as decisive factors. The study from (Zhang et al., 2024) underlined the importance of employee digital skills and leadership support. Their research concludes that digital transformation is more achievable when an organization possesses a competent workforce and proactive management willing to champion change. A similar conclusion is presented by (Raymond et al., 2018), who explore top management support, employee capability, and management innovativeness. These organizational elements highlight the need for not only technical skills but also visionary leadership to overcome internal resistance and uncertainty. Moreover, (Faiz et al., 2024) incorporate digital culture as a core variable, along with human resource

strength and managerial support. The study finds that organizations with a culture that embraces technology and encourages innovation are significantly more prepared for transformation. Furthermore, the presence of international orientation is found to enhance the influence of digital culture, especially in contexts where cross-border operations necessitate rapid digital adaptation. Across these studies, it becomes evident that leadership commitment, employee readiness, and organizational mindset are fundamental to facilitating the adoption of digital technologies.

The instrument reflects these constructs for this study under Innovation Culture, with items such as proactive search for ideas (O_INCU1), openness to innovation (O_INCU2), and cross-functional collaboration (O_INCU3–O_INCU5). Employee Skill and Knowledge is measured through indicators like IT device proficiency (O_SAK1), training adequacy (O_SAK2), adaptability (O_SAK3), and the ability to generate digital solutions (O_SAK4–O_SAK5). These measures substantiate the organizational readiness required to successfully implement and sustain digital economy initiatives.

Environment

Environmental factors also contribute substantially to digital transformation outcomes. (Zhang et al., 2024) introduce environmental uncertainty as a significant external influence. They propose that dynamic and unstable market conditions, along with policy shifts and competitive pressure, serve as catalysts for SMEs to explore and implement digital strategies. Meanwhile, (Faiz et al., 2024) examine trading partner pressure, noting that SMEs often face external expectations from clients, suppliers, and industry partners to adopt technology in order to maintain credibility and integration within the value chain. In a different national context, (Raymond et al., 2018) consider the roles of government support, competitive pressure, and vendor assistance. Their results indicate that although these environmental elements are recognized by SMEs, their impact on adoption intention is less significant than internal organizational readiness. This finding suggests that policy incentives and external support structures may be insufficiently aligned with SMEs' actual needs in certain regions. Despite the variation in findings, each study reinforces the idea that the external business environment plays an important context to dependent role in shaping adoption behaviours.

For this study, environmental aspects are captured through Market Competition Pressure (for example, risk of losing customers if digitalization is not adopted through E_MCOP2 and E_MCOP4), Government Regulation (for example, clarity and sufficiency of laws through E_GORE3, E_GORE4), and Government Financial Support, including grants (E_GOFN1), subsidies (E_GOFN2), and consultancy services (E_GOFN3). These constructs reflect how regulatory clarity, financial incentives, and competitive dynamics interplay to either motivate or hinder SMEs in their digital transformation efforts. By applying the TOE model, the research can categorized and measured the relevant factors systematically and helps to identify which areas are most critical for improving digital transformation among small enterprises.

3.4 The research Model

The research model for this study on digital economy adoption among SMEs in Kelantan illustrates the relationships between various factors influencing the adoption process, which are divided into three categories: technological factors, organizational factors, and environmental factors. Technology elements that improve the ability of smaller businesses to adopt digital strategies include those of technology infrastructure, digital skills, and innovation capability. Organizational factors include managerial support, organizational culture, and resource availability, all of which have a significant impact on digital transformation efforts. Environmental elements include customer expectations, regulatory environment, and market competitiveness that could inspire SMEs to use digital technology to remain competitive and satisfy market needs. The study's design will be descriptive correlational, allowing for the investigation of correlations between the selected variables as conceptual framework shown in Figure 1.

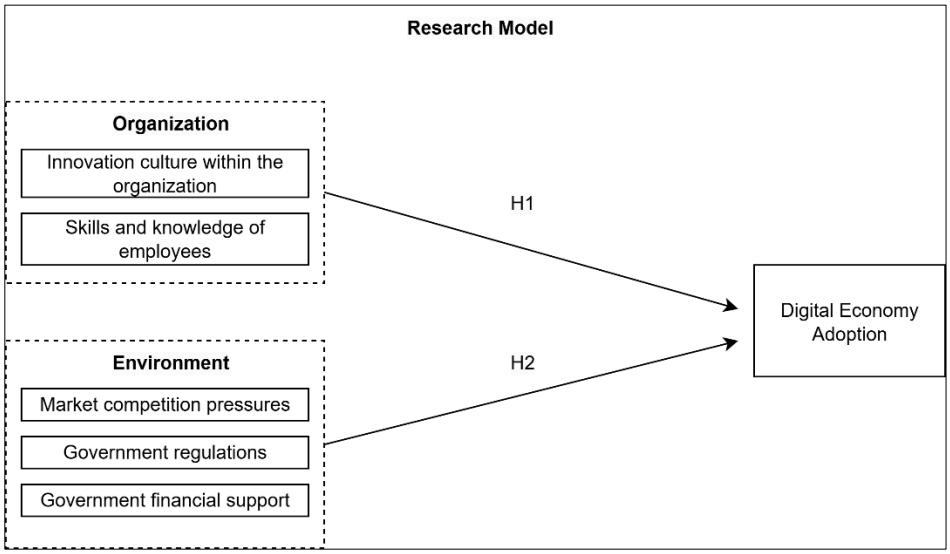


Figure 1. The Research Model

Based on the research objectives and research model, specific hypotheses were developed to explain the expected correlations and differences between variables;

H1: organizational factors have a strong influence on digital economy adoption.
This relates to internal aspects of a business such as management support, employee digital skills, and company culture that may affect the level of digital adoption. The null hypothesis assumes that organizational factors do not significantly influence digital economy adoption among small businesses in Kelantan, whereas the alternative hypothesis indicates that they do.

H2: environmental factors have a strong influence on digital economy adoption.
This hypothesis highlights the importance of external influences such as government policies, market competition, and financial support in driving or hindering digital adoption. The null hypothesis assumes that environmental factors do not significantly influence digital economy adoption among small businesses in Kelantan, while the alternative hypothesis asserts that these factors do have a significant influence.

These hypotheses were tested using appropriate statistical analysis techniques to determine the correlations and associations between variables. The results are expected to provide meaningful insights into the research questions and contribute to a deeper understanding of the factors that affect digital economy adoption among small businesses in Kelantan.

4. Methodology

This study focuses on identifying the key factors that influence the adoption of digital economy practices among small enterprises in Kelantan. It is fulfilled with the Technology-Organization-Environment (TOE) framework that examines how these factors affect the digital adoption. The framework has been commonly used in previous research and provides a strong foundation for this study. A quantitative research approach is applied, where data is collected using a structured questionnaire. The research design includes selecting relevant variables, developing clear hypotheses, and applying appropriate data collection and analysis methods.

Data is collected through online and face-to-face surveys through owner, manager or staff of small enterprises. Tools such as SPSS and SmartPLS are used to conduct descriptive and inferential analyses, including regression testing to explore relationships between variables and the level of digital adoption. Ethical standards such as acknowledged consent, voluntary participation, and data confidentiality are strictly followed. This research approach is designed to overcome limitations such as response bias and sampling issues. The goal is to provide reliable and practical insights to help small enterprises in Kelantan overcome barriers to digital transformation and benefit from the digital economy. Kelantan consists of 46,260 small and medium-sized enterprises (SMEs) (Paramesvaran, 2023). For this study, a sample size of 382 small enterprises is decided upon, computed with a confidence level of 95% and a margin of error of 5%. This is to guarantee that the results reflect the populations. The sample method used is random sampling, which ensures representation from a variety of industries, including retail, services, and manufacturing. This method lets one have a more complex knowledge of how adoption of the digital economy varies among a range of SMEs.

5. Finding

Descriptive analysis was used to summarise the frequency and percentage of each participant's response, offering an overview of the data distribution. Table 1 shows the results in a way that makes them easier to understand. A total of 382 questionnaires were sent out to small business owners and workers in different fields in Kelantan. All 382 questionnaires were filled and then well received, which is remarkable as it means that 100 percent of the responses were valid. The researcher got this high rate by using proactive engagement strategies, such as collecting data both online and in person. Respondents with internet access could easily take part in the survey using digital platforms like Google Forms. For businesses in areas with poor internet access, printed copies were personally given. Also, constant follow-ups through WhatsApp, along with direct visits to business locations, encouraged quick responses and decreased reduce non-response bias. All of these efforts made sure that all of the responses were collected, checked for completeness, and found to be valid for analysis.

Table 1. Descriptive Analysis

Demographic Variable	Category	Frequency	Percentage (%)
Job Position	Management	199	52.1
	Non-Management	183	47.9
Age Group (years)	18 – 24	90	23.6
	25 – 64	208	54.5
	65 and above	84	22.0
Gender	Male	195	51.0
	Female	187	49.0
Company Age	Less than 5 years	180	47.1
	5 – 10 years	121	31.7
	More than 10 years	81	21.2
Industry Type	Food & Beverage	81	21.2
	Manufacturing	31	8.1
	Wholesale Trade	58	15.2
	Retail Trade	74	19.4
	Services	104	27.2
	Others	34	8.9
Organization Size	Micro (1–9 employees)	109	28.5
	Small (10–18 employees)	273	71.5
	Medium (>18 employees)	0	0.0
Total Respondents 382			

Table 1 shows the demographic profile of 382 respondents. Most of them (52.1%) were in management positions, and most of them (54.5%) were between the ages of 25 and 64. This group of people is the engaged working group that runs small businesses. There were almost equal numbers of men and women who answered the survey: 51.0% were men and 49.0% were women. Almost half of the businesses (47.1%) had been open for less than five years, which means that many of them were recently established. Most of them worked in the services (27.2%) and food and beverage (21.2%) sectors. The demographic data show that the small business owners in Kelantan are a diverse and representative group. Most of them are young, active, and service-oriented.

The reliability of the questionnaire was examined by Cronbach's Alpha using SPSS tools which measures the internal consistency of items within a construct. In the initial analysis, all 30 items were included, and the Cronbach's Alpha value obtained was 0.351 as shown in Table 2. This result indicated a low level of internal consistency among the items.

Table 2. Reliability Statistics

Cronbach's Alpha	N of Items
.351	30

To improve the reliability of the instrument, four items were identified as contributing to the low score and were removed. These items were O_SAK2 from the employee skills construct, E_MCOP2 from the market competition construct, and DEA3 from the digital economy adoption indicators as shown in the Table 3.

Table 3. Reliability Statistics– Excluded Item

Cronbach's Alpha	N of Items
.099	3

Following the removal of these items, the reliability analysis was conducted again using the remaining 27 items. The revised Cronbach's Alpha value increased to 0.354 as shown in the table 4.

Table 4. Reliability Statistics – After Excluded Item

Cronbach's Alpha	N of Items
.354	27

Although this value remains below the generally accepted threshold of 0.70, the reliability assessment provided an initial understanding of the instrument's consistency. Given the limitations observed in both reliability and variance analysis, further investigation was carried out using SmartPLS. This tool was employed to assess the measurement model and structural relationships through partial least squares structural equation modelling.

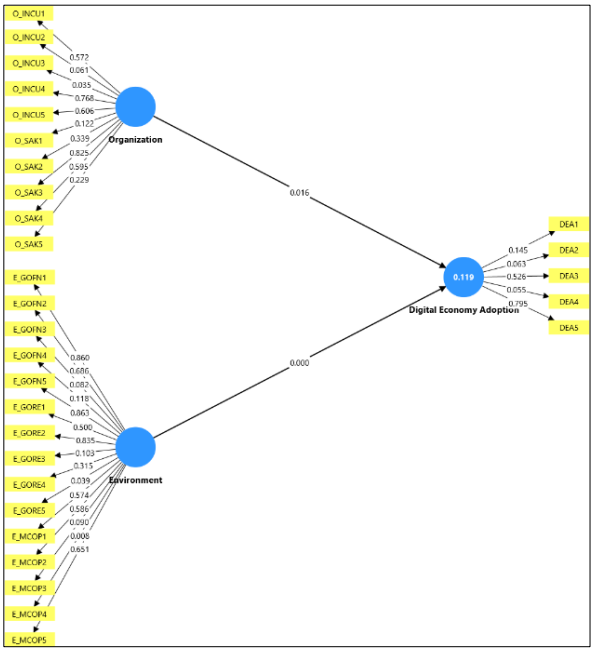


Figure 2. Structural Model Assessment

Based on the structural model with a sample of 382 respondents as shown in figure 2, the results show that environmental factors have the strongest and more significant influence on digital economy adoption, with a path coefficient of 0.245 (T = 3.728, p = 0.000). This suggests that elements such as government support, regulation, and market competition play a key role in driving adoption. Organizational factors, including innovation culture and employee skills, also show a significant but smaller effect, with a path coefficient of 0.217 (T = 2.410, p = 0.016). Overall, the findings highlight that environment and organization are the key drivers of digital economy adoption.

Table 5. Hypothesis and Decision

Hypothesis	Item	T-Statistic	P-Value	Decision
H1	Organization → Digital Economy Adoption	2.410	0.016	Supported
H2	Environment → Digital Economy Adoption	3.728	0.000	Supported

6. Discussion

The first objective was achieved through quantitative methods including descriptive statistics and regression analysis using SPSS and SmartPLS 4. The study identified that environmental and organizational factors significantly influence digital economy adoption among small businesses in Kelantan. Environmental aspects such as government support and market competition have the strongest impact, while organizational elements including innovation culture and employee skills also play a meaningful role in driving adoption. The second objective was accomplished using Structural Equation Modeling (SEM) with Partial Least Squares (PLS). The results showed that government support, regulation, and competition were the most important environmental factors that affected the adoption of the digital economy. Organizational factors, like the culture of innovation and the skills of employees, also had a big but smaller effect. But things like cost, complexity, and compatibility did not have a big effect on adoption. This shows that for small businesses in Kelantan to get involved in the digital economy, environmental and organizational factors are more important.

The use of data analysis software such as SPSS and SmartPLS consists of several difficulties throughout the research process. Although both tools are widely recognized for their ability to generate reliable statistical outputs, it is not intuitive for users without any experience. Considerable time was required to understand the procedures involved in constructing models, running tests, and interpreting results.

This study has helped to understand what affects the use of digital technology among small businesses in Kelantan. However, there are still some areas that need to be improved or explored further. First, the research only focused on one state. Future studies should include small businesses from other states in Malaysia to see if the results are the same or different. Businesses in other places might face different problems or have access to different types of support, so comparing results would give a better overall finding.

Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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Ethics Approval

Not applicable.

Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contributions

Izzul Aiman Halim: Conceptualization, Methodology, Software, Validation, Formal Analysis, Resources, Data Curation, Writing – Original Draft.
Jasber Kaur Gian Singh: Investigation, Writing – Review & Editing, Visualization.
Rozianawaty Osman: Supervision, Project Administration

Disclosure of AI Use

AI tools were not used in the preparation of this manuscript.

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