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TECHNOLOGY CAPABILITY AND E-COMMERCE ADOPTION IN SMES: HOW DOES GEOGRAPHICAL LOCATION PLAY A ROLE?

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Abstract: *This study explores the nexus between technological capability and e-commerce adoption among SME entrepreneurs alongside the potential influence of geographic location on such relationship. A questionnaire was distributed to 260 SMEs (150 rural and 110 urban) within the state of Selangor, Malaysia. The results showed that geographic location had no moderating effect on the relationship between technology capabilities and e-commerce adoption. This suggests that the geographical location factor will become less important if there are efforts to enhance technological capability in promoting the adoption of e-commerce among SMEs. Future research can expand this study by focusing on other developed and under-developed states in Malaysia.*

Keywords: *E-commerce adoption, rural entrepreneurs, SMEs, technological capability, urban entrepreneurs*

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Introduction

E-commerce is one of the main drivers of the Malaysian digital economy. The government has offered various assistance and support to enhance the adoption of e-commerce among local businesses, including small and medium-sized enterprises (SMEs). It includes the implementation of programs such as the SME Digital Transformation Grant, the SME Technology Financing Fund, the eUsahawan program by the Malaysia Digital Economy Corporation (MDEC), and the Digital Training Program by the SME Corporation Malaysia. Furthermore, the government has built innovation centres and business incubators equipped with technology to help SMEs start and grow their online businesses. The government has also launched the National Digital Network (JENDELA) to improve internet coverage and speed throughout the country, including in rural areas, hence providing SMEs with good and stable internet access to run their e-commerce business. The government also partners with major e-commerce platforms, such as Lazada, Shopee, and Alibaba, to offer programs that can help SMEs sell their products online, including training, marketing support, and incentives to reduce operating costs.

As of 2021, the Department of Statistics Malaysia reported that the total income for e-commerce transactions reached RM1.09 trillion, marking a 21.8% growth compared to RM896 billion in 2020. This significant increase indicates a substantial rise in e-commerce adoption among Malaysian businesses, including SMEs. Additionally, the Malaysia Digital Economy Corporation (MDEC) reported that by the end of 2021, over 890,000 micro, small, and medium enterprises (MSMEs) had adopted e-commerce, surpassing the initial 2025 target of 875,000 under the National E-Commerce Strategic Roadmap (NESR). According to the World Bank's 2022 report, "Digitalizing SMEs to Boost Competitiveness," approximately 77% of SMEs in Malaysia remain at the basic digitalization stage. This indicates that while there has been progress in digital adoption, a significant portion of SMEs are still in the early stages of integrating digital technologies into their operations. Furthermore, the same report highlights that only 53.9% of Malaysian businesses had a web presence in 2019, up from 37.8% in 2017, and a mere 6.3% had explored advanced technologies like data analytics.

According to the Malaysian Communications and Multimedia Commission (MCMC), despite efforts to improve digital infrastructure through JENDELA, many rural areas still face slow internet connectivity, thus preventing SMEs in the area from using e-commerce. The Ministry of Entrepreneur Development (2021) also reported on the low participation rate and effectiveness of the training and awareness programs that were held by the government. These indicators suggest that most SMEs are yet to benefit from e-commerce due to the lack of information and limited access.

Therefore, it is important to understand the problems and obstacles faced by urban and rural enterprises in adopting e-commerce technology. Such knowledge will help stakeholders devise better strategies to increase the adoption of e-commerce across the country, thereby stimulating economic growth and ensuring that Malaysia remains globally competitive. It will also assist Malaysia in steering away from adverse economic issues, such as a larger digital divide, lost economic opportunities, and less effective policies. Therefore, this study aims to address such gap by exploring how technological capability influences the adoption of e-commerce among SMEs in Malaysia and how geographical location affects the relationship.

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Literature Review

Technological Capability and E-Commerce Adoption

Past studies have looked at the factors influencing the use of e-commerce among Malaysian SMEs. However, limited focus has been invested on how technological capability affects the adoption of e-commerce, particularly among local SMEs. The technological capability of an SME involves technology that is available within and outside the company (Oliveira & Martins, 2011). This includes equipment and procedures that exist within the organisation as well as technology from outside (Tornatzky & Fleischer, 1990). Some aspects of technology that are often considered in research include the advantages of the technology, its suitability to the company's needs, and the ease of use (El-Gohary, 2012a; Ghobakhhloo et al., 2011; Ramdani, Kawalek, & Lorenzo, 2009; Thong, 1999). The present study focuses on two components: relative advantage and compatibility.

Relative advantage refers to the projected benefits that a company can expect from adopting e-commerce (Roger, 2003). Previous work has shown that relative advantage can be observed in two ways, namely directly and indirectly (Duan et al., 2012; Kuan & Chau, 2001; Teo et al., 2009). Direct relative advantage means that technological capabilities provide benefits that can improve the company's internal efficiency, while indirect relative advantage can improve the overall quality of services. Previous studies reported that relative advantage is one of the important parameters for adopting new technologies (ElGohary, 2012a; Khemthong & Robert, 2006), including the use of e-commerce (AbouShouk, Megicks, & Lim, 2012; El Gohary 2012a; Ghobakhloo et al., 2011; Almoawi & Mahmood, 2011; Sin et al., 2015). This empirical evidence hence denotes on the prominence of relative advantages as among the elements that can influence the use of e-commerce in SMEs.

Compatibility is defined as the extent whereby innovation is deemed compatible with the existing values, needs, and prior experience of the prospective recipient (Rogers, 1995). It stands as one of the important measures for new technology acceptance (Grandon & Pearson, 2004; Zhu et al., 2006). According to Rogers (2003), compatibility has been widely used as an innovative research feature. Ghobakhloo et al. (2011) found that compatibility had a favourable and significant influence on the first adoption of e-commerce by Iranian manufacturing SMEs. Other studies also advocate the impact of compatibility towards the use of different information systems. For instance, Wang et al. (2010) found that RFID compatibility has a significant influence on RFID usage. Whereas, a study by Gangwar et al. (2015) revealed that compatibility influences the adoption intention of cloud computing among Jordanian SMEs, subsequently encouraging them to embrace e-commerce technologies. Hence, the following hypothesis is proposed:

Hypothesis 1: There is a significant influence of technological capability (relative advantage and compatibility) on e-commerce adoption among SMEs in Malaysia.

Geographical Location

Past studies have reported the differences in technological challenges and barriers between enterprises in urban and rural areas in adopting e-commerce. Enterprises in urban area often have better access to technology, such as high-speed internet and modern equipment. Studies by Chong et al. (2022) and Lertwongsatien and Wongpinunwatana (2019) confirm that urban enterprises can access technology resources more easily, allowing them to integrate e-

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commerce into their operations. On the other hand, enterprises in rural areas often face problems with internet access and technological infrastructure, which impose significant difficulty for them to implement e-commerce effectively. This is supported by Rahayu and Day (2015) and Tan and Eze (2022) who found that lack of infrastructure is one of the major obstacles for rural enterprises.

Enterprise owners and managers in urban areas are typically more knowledgeable about the latest technology because they have access to the latest information through various communication channels. A study by Hashim and Ahmad (2023) reported that urban enterprises are more aware of the benefits of e-commerce than rural enterprises. Kurnia et al. (2015) also pointed out that owners and managers in urban areas are usually more familiar with new technologies and e-commerce because they often have training and workshops. Whereas, owners of rural enterprises may be less exposed to the necessary technology training. A study by Hashim and Ahmad (2023) showed that lack of digital skills is a major challenge in rural areas, while Zolait (2014) stated that rural enterprises often lack tech skills due to having limited access to education and training.

Furthermore, urban enterprises often receive more financial support for technology projects from governments and financial institutions, which helps them overcome the initial cost of implementing e-commerce. Research by Al-Debei et al. (2017) shows that urban enterprises are more likely to receive financial support and incentives, which are essential for starting e-commerce. On the other hand, rural enterprises often lack support, such as grants, mentors, and funding, that can assist them in implementing e-commerce. Chong et al. (2022) found that rural enterprises are less supported than urban enterprises, while Irefin et al. (2012) reported that they often lack professional networks and access to necessary mentors, causing them to face difficulties in obtaining financing and financial assistance. Therefore, the following hypothesis is proposed:

Hypothesis 2: Geographical location moderates the influence of technological capabilities on e-commerce adoption among SMEs in Malaysia.

Methoodology

Research Framework

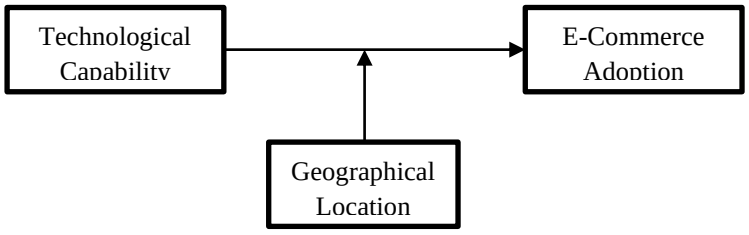

Figure 1: Conceptual Framework

Insights from the literature review suggest on the possible nexus between technological capability and geographical location with e-commerce adoption. Therefore, this study proposed a conceptual framework (Figure 1) to explain the relationship between technological capability and e-commerce adoption and the moderating role played by geographical location. The

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conceptual framework stands as a theoretical foundation of this study, hypothesising that the impact of technological capability on SMEs' e-commerce adoption may differ depending on geographical location.

Research Design and Data Collection

This quantitative investigation involved the population of small and medium-sized enterprises (SMEs) in Selangor, Malaysia. The decision of choosing Selangor as the main sample was prompted by the fact that it has a higher number of SMEs compared to other states in Malaysia. The data was collected using a questionnaire, which encompassed several sections such as demographic details, measures of technological capability, and measures of e-commerce adoption. These measures were assessed via 12 statements using a 10-point Likert scale where the respondents were asked to state their level of agreement from "strongly disagree" to "strongly agree". The questionnaire was distributed via registered mail to 350 entrepreneurs in Selangor, Malaysia who were selected using the cluster sampling technique. A total of 260 completed questionnaires were returned and used for analysis, making a response rate of 90 percent. Subsequently, the data analysis procedure was done via Structural Equation Modelling (SEM) using the AMOS software version 28.0

The demographic data of the respondents were analyzed using descriptive statistical tools within the Statistical Package for the Social Sciences (SPSS) software. This software allows for an efficient and accurate summary of various characteristics of the respondents, such as gender, age, education level, and industry type. The analysis provides an understanding of the distribution of the sample and ensures that the demographic profile is suitable for the study's objectives. Descriptive statistics, such as frequencies, percentages, and means, were used to represent the demographic data in a structured manner.

Data Analysis

Respondents' Profile

The sample of this study consisted of 260 SMEs in Selangor, Malaysia. The gender distribution showed a dominance of female respondents (92.3%) as opposed to males (7.7%). Half of the respondents were between 22 to 30 years old (50%) while the remaining were between 31 to 40 years old (19.2%). There is a slightly equal proportion of single (51.9%) and married (48.1%) respondents. The majority of the respondents were Malay (73.5%), followed by Chinese (15.8%) and Indian (10.8%). Also, their levels of education vary across bachelor's degrees (36.9%), diplomas (32.3%), and SPM (18.5%). Regarding their work experience, some of the respondents have been working at their current job for more than 5 years (26.5%) while others have been working for one to three years (21.9%). They are mainly involved in several types of industries, including health and beauty (21.2%), fashion (18.5%), and electronics (13.85%). Most of the respondents were small companies with five to fifty employees (48.5%) and micro companies (40.4%). Furthermore, a majority of them own a company website (74.6%), a company social media (73.1%), and a company online business platform such as Shopee and Lazada (61.9%). All of them were SME owners (100%) and located in rural (57.7%) and urban (42.3%) areas. These demographic variables are important in this research as it denotes the moderating effect of geographic location on the factors that influence the use of e-commerce among SMEs in Selangor, Malaysia.

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Confirmatory Factor Analysis

Confirmatory factor analysis (CFA) was used to test the construct's reliability and validity in order to assess the suitability of the measurement model. The purpose was to validate the items' adequacy, confirm the number of dimensions included in the model, and adapt the model to the data set. Aside from the model fit analysis, the direct effects of each path (beta coefficient) were assessed during the full model testing for hypotheses testing purposes. Figure 2 illustrates the fitness indexes for this study. The absolute, incremental, and parsimonious fits achieved the required level with RMSEA < 0.08, CFI > 0.90, and Chisq/df < 3.00 (Zainudin, 2012).

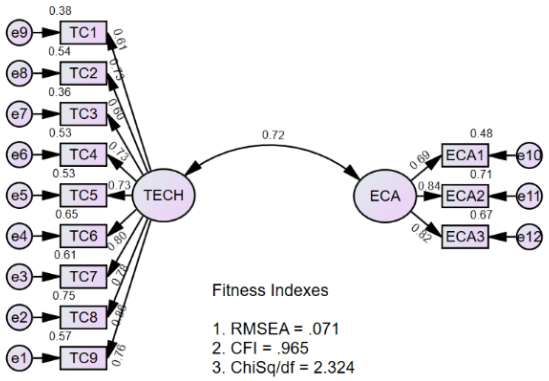

Figure 2: CFA Results Showing the Factor Loading for Items and Component

Figure 2 shows some of the indices used to assess the fitness of the models in this study. The three main indices observed were RMSEA, CFI, and the ratio of Chi-Square to degrees of freedom (ChiSq/df). These indices demonstrate that the estimated model has good fitness with the data. By achieving the level of fitness required by these indices, it can be concluded that the unidimensionality of the model is achieved. This means that the constructs studied (i.e., technological capabilities and e-commerce adoption) are well represented by this model, indicating that they are accurately and consistently measured in this study. In summary, the results of this evaluation show that the model used in this study is accurate and consistent with the data collected, confirming that the measured construct is consistent and reliable.

Confirmatory Factor Analysis

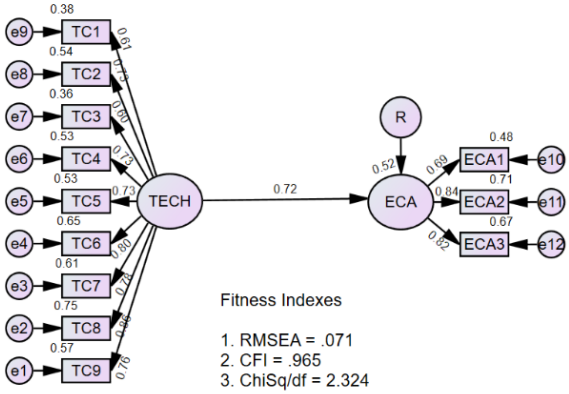

Figure 3: Estimating the Relationship between Technological Capability and E-commerce Adoption

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Figure 3 shows the standard path coefficient value obtained through the SEM method to show the strength of the relationship between technological capability and e-commerce adoption. This model estimates a determination coefficient (R2) value of 0.52, which means that 52% of the variation in e-commerce adoption can be explained by the capability of technology. It subsequently denotes that more than half of the changes that occur in the adoption of e-commerce are due to the technological capability factor. Other factors that may contribute to the variation in e-commerce adoption are not included in this estimate as the model only focuses on the relationship between technological capability and e-commerce adoption.

Table 1: Regression path coefficient and its significance

	Hypotheses Path	Estimate	S.E.	C.R.	P	Result
H1	ECA <--- TECH	.675	.077	8.748	***	Significant

Note: *** p < 0.001, N = 260, ECA = E-commerce Adoption, TECH = Technological Capability

Table 1 shows the hypothetical relationship and regression weight between technology capability and e-commerce adoption. The results show that when technological capability (TECH) increases by 1 unit, e-commerce adoption (ECA) increases by 0.675 units. It subsequently indicates a strong, positive link between technological capability and e-commerce adoption. The estimated weight of this regression is 0.675, with a standard error of 0.077. The z-test was then used to assess the difference of this estimate from zero (no correlation). It was achieved by dividing the regression weight with its standard error (0.675 / 0.077), giving a z-value of 8.766. This suggests that there is a high confidence that the increase in technological capability leads to an increase in the adoption of e-commerce. Therefore, the first hypothesis (H1) is supported. It shows that technological capability plays a crucial role in influencing the adoption of e-commerce.

Mediating Testing

The second objective of this study is to test the moderator construct, which is geographical location. According to Zainudin (2014), a moderator is a variable that either strengthens or weakens the relationship between two variables, whereby the nature of the predictor effect may vary according to the level of the moderator. This study used the analysis of the covariance structure of various AMOS groups to analyse the moderating effect of geographical location.

The data was divided into two groups, namely the "URBAN" and "RURAL" respondent groups, each satisfying the minimum sample size of 100 required for moderation testing using AMOS (Zainudin, 2014). The models were analyzed using the constrained and unconstrained approaches to compare the chi-square values. The estimation process began with the URBAN data followed by the RURAL data, and any differences in value between both models were compared. A simplification occurs on the path if the difference in value is greater than the value when squared by the degree of freedom. However, the moderation test is insignificant if the chi-square value between the constrained and unconstrained models is less than the degree of freedom. Once the moderation effect was established, it was confirmed using parametric tests to determine where these effects were more pronounced either in urban or rural areas. The results were derived from the standard estimates of the path of interest for both datasets. If one of the standard estimates is significant while the other is not, then this effect only occurs in one

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group and shows a full moderation effect. If both estimates are significant, then this effect applies in both groups followed by partial moderation (Zainudin, 2014).

Table 2: Results of chi-square value and the number of degrees of freedom for constrained model and unconstrained model for geographical location for URBAN between TC and ECA

	Constrained Model					Unconstrained Model				
Model	**NPAR**	**CMIN**	**DF**	**p-value**	**CMIN/DF**	**NPAR**	**CMIN**	**DF**	**p-value**	**CMIN/DF**
Default model	66	746.443	312	.000	2.392	66	67	743.347	311	.000
Saturated model	378	.000	0			378	378	.000	0	
Independence model	27	2904.303	351	.000	8.274	27	27	2904.303	351	.000

Table 3: The Moderating Test for Geographical Location on Technological Context for Urban

	Constrained Model	**Unconstrained Model**	**Chi-square Difference**	**Result of Moderation Test**	**Hypothesis**
Chi-square	746.443	743.347	3.096	Not Significant	Not Supported
DF	312	311	1		

According to Table 2, the constrained and unconstrained models recorded the chi-square and degree of freedom (DF) values of 746.443 and 312 and 743.347 and 311, respectively. As shown in Table 3, the difference in chi-square and DF values is 3.096 and 1, respectively. The difference in chi-square value (3.096, DF = 1) is lower than the required value of 3.84 (DF = 1). This means that the moderation effect is not significant for urban areas.

Table 4: Results of chi-square value and the number of degrees of freedom for constrained model and unconstrained model for geographical location for RURAL between TC and ECA.

	Constrained Model					Unconstrained Model				
Model	**NPAR**	**CMIN**	**DF**	**p-value**	**CMIN/DF**	**NPAR**	**CMIN**	**DF**	**p-value**	**CMIN/DF**
Default model	66	681.628	312	.000	2.185	67	680.156	311	.000	2.187
Saturated model	378	.000	0			378	.000	0		
Independence model	27	2811.272	351	.000	8.009	27	2811.272	351	.000	8.009

Table 5: The Moderating Test for Geographical Location on Technological Context for Rural

	Constrained Model	**Unconstrained Model**	**Chi-square Difference**	**Result of Moderation Test**	**Hypothesis**
Chi-square	681.628	680.156	1.472	Not Significant	Not Supported
DF	312	311	1		

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The results in Table 4 show that the constrained and unconstrained models recorded the chi-square and degree of freedom (DF) values of 681.628 and 312 and 680.156 and 311, respectively. According to Table 5, the difference in chi-square and DF values is 1.472 and 1, respectively. For the test to be significant, the difference in chi-square value (1.472, DF = 1) must be lower than the required value of 3.84 (DF = 1). This means that the moderation effect is not significant for rural areas, denoting that geographic location does not play a role in the relationship between technological capabilities and e-commerce use. Hence, the second hypothesis (H2) is not supported.

Discussion

This study explored the nexus between technological capability on e-commerce adoption among SMEs in Selangor, Malaysia. Results from the hypotheses testing found a positive influence of technological capability on e-commerce adoption. This agrees with the findings of previous studies (ElGohary, 2012a; Khemthong & Robert, 2006; AbouShouk et al., 2012; Gangwar et al., 2015; Ghobakhloo et al., 2011) whereby SMEs with high technological capabilities will tend to adopt e-commerce in their business operations. A multi-group covariance structure analysis was also conducted to analyse the moderation effect of geographical location on the relationship between technological capability and e-commerce adoption. The results show that geographical location does not moderate such relationship, which contradicts the findings of previous studies. For instance, Brima and Sesay (2019) found that technological barriers caused by geographical location have a prominent impact on the relationship between technological capabilities and e-commerce adoption among rural and urban SMEs in Sierra Leone. The different findings of this study can be accounted to several factors. First is technological capability as a universal factor. Past studies denote that technological capabilities, such as internet access, digital literacy, and IT infrastructure, can drive the adoption of e-commerce regardless of geographical location. For example, Sharma and Gupta (2021) found that technological capability serves as a key factor in the adoption of e-commerce in India, regardless of whether the consumers are in urban or rural areas. Meanwhile, Kshetri (2007) reported that technology preparedness is an important predictor of e-commerce adoption in various areas, with no significant differences between urban and rural. In developing countries, there are many instances where e-commerce has been accepted in rural areas in line with urban. A study by Molla and Licker (2005) revealed that technological capability plays a greater role in the adoption of e-commerce than geographical location in Ethiopia. Ali, Gibran, and Islam (2022) also support these findings whereby the increasing technological capabilities in Pakistani rural areas have equated the level of e-commerce adoption with urban areas.

The second factor is the increasing rural connectivity. Numerous efforts and initiatives have been implemented over the last decade to reduce the digital divide between urban and rural areas, including the continuous improvement of internet connectivity, the provision of broadband, and the development of communication infrastructure in rural areas. A study by Shahbaz, Gao, and Zhai (2019) found that the improvement of technology infrastructure in rural China has led to wider adoption of technology, including e-commerce. Similar finding was also reported by Ramdani, Chevers, and Williams (2013). This implies that the disparity between urban and rural areas in e-commerce adoption is decreasing with the increase in connectivity. The third factor is technology acceptance among rural users. Consumers in rural areas are increasingly aware of and embracing digital technologies. A study conducted in Taiwan by Lian and Yen (2017) found that with increased access to technology, rural

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consumers showed a similar level of technology adoption to urban consumers. Meanwhile, Zhu and Thatcher (2010) said that rural consumers show a similar level of technology adoption as urban consumers as a result of increased access to technology. This suggests that when technological capability is high, geographic location is no longer a major factor in determining e-commerce adoption. In conclusion, the findings that geographical location (urban and rural) does not moderate the relationship between technological capability and e-commerce adoption can be supported by the argument that technological capability is a major factor influencing e-commerce adoption. These findings are also supported by recent studies showing improved rural connectivity, technology adoption among rural consumers, and case studies from developing countries. However, it should be noted that the sample of this study is limited to the state of Selangor where more advanced technological infrastructure may level the chances of e-commerce adoption across the state.

Conclusion

Investigating technology capability and its influence over e-commerce adoption and usage by Malaysian SMEs is important as it can provide broad benefits to various stakeholders. With the right approach, this study can contribute to the improvement of the digital economy, the reduction of the digital divide, and a more balanced development between urban and rural areas in Malaysia. By identifying the digital divide between urban and rural areas, governments and organisations can implement targeted measures to reduce these inequalities, ensuring that all enterprises have an equal opportunity to leverage e-commerce technology. The research also provides insights into the specific technological needs of enterprises in different regions. This will enable technology service providers and policymakers to plan and provide appropriate support to enhance technology capabilities among SMEs. Furthermore, the empirical evidence stands as a basis for recommending more effective financing policies and initiatives to support the adoption of e-commerce in SMEs. This includes the provision of grants, tax incentives, and specialised training programs aimed at improving technological knowledge and skills. This study is also important for the development of rural areas. By understanding the unique challenges faced by rural enterprises, authorities can formulate initiatives that can improve technological infrastructure and provide necessary training. This will help integrate rural enterprises into the digital economy, reduce migration to cities, and strengthen the local economy. With the wider adoption of e-commerce, companies in Malaysia can have easy access to a wider market and increase their competitiveness.

However, this study has a limitation that requires attention from future researchers. The research sample is limited to the state of Selangor, which might influence the generalisation of the findings. Selangor is a more developed state with good technological infrastructure in most of its areas, including rural areas. A study by Teng, Musa, and Anuar (2020) on the adoption of e-commerce in Selangor shows that good technological infrastructure across the state has equalised the chances of e-commerce adoption between urban and rural areas. Therefore, the finding that geographical location does not moderate the relationship between technological capabilities and e-commerce adoption may be influenced by the high level of development in the state of Selangor. Thus, further research can be conducted to confirm these findings by conducting studies in other states that have also received a high level of development such as Selangor. A comparative study can also be done to see the impact of technological capabilities on the willingness of entrepreneurs to adopt e-commerce in least-developed states. In conclusion, investigating the influence of technological capability on the use of e-commerce

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by SMEs in Malaysia is not only important for economic growth and technological development but is also relevant to several Sustainable Development Goals (SDGs). This study can potentially contribute towards the global efforts of achieving sustainable development by supporting inclusive economic growth (SDG8), strengthening digital infrastructure (SDG9), reducing inequalities (SDG10), and fostering quality education (SDG4).

Authors' Contributions

Conceptualization: [Nurul Nadia Abd Aziz]; Methodology: [Aisyah Nurain Salmizi]; Formal analysis and investigation: [Aisyah Nurain Salmizi, Nurul Nadia Abd Aziz]; Writing - original draft preparation: [Zaidatul Nadiah Abu Yazid, Mawarti Ashik Samsudin, Azeman Abd Majid]; Writing - review and editing: [Nurul Nadia Abd Aziz, Aisyah Nurain Salmizi]; Resources: [Zaidatul Nadiah Abu Yazid, Mawarti Ashik Samsudin, Azeman Abd Majid]; Supervision: [Nurul Nadia Abd Aziz].

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