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HARNESSING INNOVATION FOR BUSINESS COMPETITIVENESS IN ACHIEVING SUSTAINABLE DEVELOPMENT GOALS

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ABSTRACT

This study examines the impact of technological, social, and environmental innovations on the competitiveness of Malaysian SMEs, focusing on how firm characteristics such as age, size, and type of activity moderate these effects. Data from 480 SMEs were analyzed using Partial Least Squares Structural Equation Modeling. The findings reveal that technological innovation positively impacts competitiveness, particularly when influenced by a firm's age, size, and activity type. Social innovation also has a direct positive effect on competitiveness, highlighting its importance in addressing social problems to boost business performance. Environmental innovation, however, showed an insignificant effect on competitiveness. The study emphasizes the need for integrating business innovations with supportive infrastructure and fostering a culture of social and environmental innovation to enhance competitiveness. It provides valuable insights for strengthening SMEs and encourages a more holistic approach to innovation for long-term competitive advantage.

JEL Classification: O120, O320, O440, P310

Keywords: Technological Innovation (TI), Social Innovation (SI), Environmental Innovation (EI), SMEs competitiveness, Open Innovation Theory

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1. INTRODUCTION

The competitive advantage of small and medium enterprises (SMEs) has been recognized as a fundamental step necessary for potential business growth (Falahat et al., 2020). Since the SME consolidation process, SME growth in Malaysia has increased by more than 10%, thus attracting global investors with strong technological innovation capabilities (Department of Statistics Malaysia, 2018). Given the 2017 SME development, 97.3% of business establishments were small and medium enterprises, thus directly contributing about 37% to the Gross Domestic Product (GDP). This statistic also represents 66% of employment, with a significant improvement in the standard of living (Jaafar, 2018). Since the GDP performance depends on exports, the government encourages local SMEs to export. Business competition, however, requires a business competitive advantage that can initiate innovations (Falahat, Knight, and Alon, 2018). Over the years, innovation capabilities in the business environment have been elevated, improving people's lives (Wang et al., 2019). Subsequently, with the help of innovation, more social and technical problems are resolved to improve living standards.

In Malaysia, a huge gap exists between technological, social, and environmental innovations. Technological innovation is significantly improving with advanced solutions (Falahat et al., 2020; Low, 2018). Nonetheless, the government's relentless effort to increase social and environmental innovation is ongoing (Islam and Wahab, 2021; Falahat et al., 2020). When it comes to social and environmental innovation, gaps still can be filled by SMEs (Wong et al., 2020). Therefore, good expansion of resources can overcome the huge gap in SME innovativeness (Islam and Wahab, 2021; Wong et al., 2020).

Most of the SME performance literature has investigated the innovation variables and their impact on growth. Consequentially, literature (Soni et al., 2019; Masocha, 2018) on SME innovation competitiveness only focuses on investigating the impact of technological innovation. On the contrary, only a few studies have highlighted the influence of firm type on innovation and competitiveness (Schaefer et al., 2020). Therefore, this paper examines the impact of innovations on SME competitiveness, thus focusing on technological innovation and the inclusion of social and environmental innovation. In addition, this paper will explore the

moderating role of variables (firm's age, size, and activity types) between innovations in enhancing SME competitive advantage.

2. LITERATURE REVIEW

2.1 THEORETICAL BACKGROUND

This study employed Open Innovation Theory (OI) as the underlying element of our conceptual framework. Hence, both internal and external ideas involve strategies to create outstanding business models. OI further assumes that to be innovative, a firm should possess the resources needed (Gassmann, Enkel, and Chesbrough, 2010; Chesbrough Vanhaverbeke, and West, 2006). Research and development (R&D) is considered a 'Progressive Innovation' whereby a company's innovativeness arises from both internal and external resources thus further building competitiveness. According to the OI concept, businesses should not rely solely on internal R&D efforts to spur innovation; instead, they should make use of outside sources (Gassmann et al., 2010). The function of OI in promoting environmental and social sustainability as well as the difficulties of fusing OI with technological innovation have been the subject of recent discussions (Chesbrough et al., 2014).

According to Basile, Tani, and Troise (2021), OI can be a potent tool for encouraging social and environmental sustainability. To ensure that businesses can keep innovating and remain competitive, others have emphasized the significance of integrating OI with technological innovation (Adro and Fernandes, 2022). We, therefore, look to integrate the OI with social, environmental, and technological innovation. Jenson (2015) defines social innovation as the creation that addresses societal issues. As consumers become more aware, social innovation is becoming increasingly important (Table 1). Businesses are under increasing pressure to create sustainable practices and products. Other studies (Ferreira, Fernandes, and Ferreira, 2020; Lee et al., 2019) emphasized that technological innovation ensures key strategies, systems, and processes in technology applications. Studies (Hamzah et al., 2022; Islam and Wahab, 2021) have suggested that a company's ability to innovate remains competitive.

Literature on OI and technological innovation concentrates on the technologies and industries. The transformation in the business model to fully embrace the integration of technological innovation has

yet to have an impact in Malaysia (Islam and Wahab, 2021). The integration of OI with social, environmental, and technological innovation is the subject of literature, but there are relatively few empirical studies, particularly in a developing country (Hamzah et al., 2021; Omar, Ishak, and Jusoh, 2020). Understanding how OI is implemented and how it impacts social, environmental, and technological innovation is difficult (Basile et al., 2021; Chesbrough et al., 2006).

TABLE 1
Construct Definition and Description

Variables	Authors	Definition
Innovation	Gault (2018)	Refers to implementing a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practice.
Technological Innovation	Archibugi and Iammarino (2002)	Refers to a new, improved product or process whose technological characteristics differ significantly from before. New inventions are derived from research developments, technical knowledge, and tools independent of product and service initiatives.
Social Innovation	Jenson (2015)	Social innovations are new solutions (products, services, models, markets, processes, etc.) that meet a social need (more effectively than existing solutions) and lead to new or improved capabilities and relationships and better use of assets and resources.
Environmental Innovation	Kemp and Pearson (2007)	Refers to new products and processes that provide customer and business value but significantly decrease environmental impact.
SMEs Competitiveness	Poufinas, Galanos, and Papadimitriou (2018)	

Source: Authors' Conception

Consequently, based on the reflection of the theory on business innovation and firm competitiveness, studies (Chesbrough et al., 2014; Gassmann et al., 2010) have pointed out the significance of incorporating variables including environmental innovation, social innovation, technological innovation, firm's characteristics, and SME competitiveness. Therefore, this study aims at investigating the impact of Environmental Innovation, Social Innovation, and Technological Innovation on SME competitiveness, the effect of a firm's characteristics (age, size, and type of activity) on SME competitiveness, and the moderating role of firm's characteristics (age, size, and type of activity) on the relationship between innovations and SME competitiveness.

2.2 HYPOTHESIS DEVELOPMENT

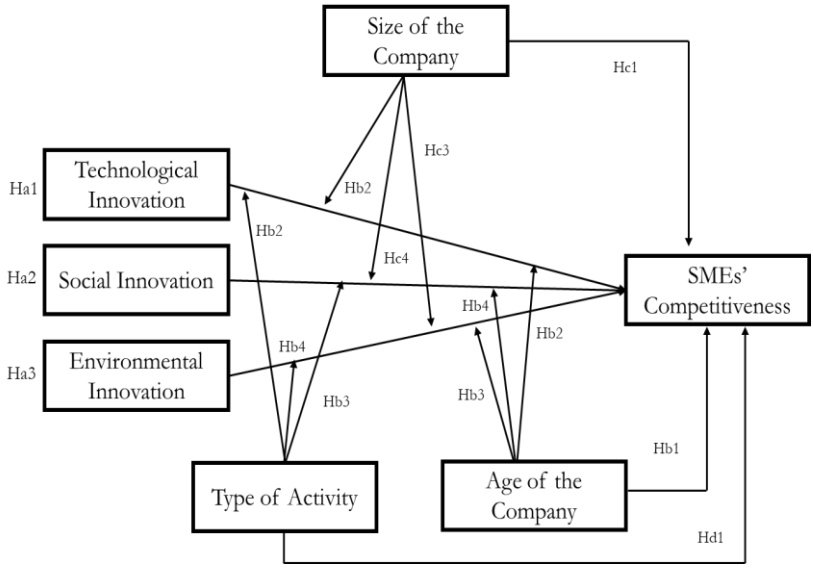
Since the Industrial Revolution necessitated technology integration to accelerate business operations, SMEs today are more likely to maximize production and compete effectively because of technological advancement (Radicic and Djalilov, 2019). Meanwhile, Bernardini Papalia, Bertarelli, and Mancinelli. (2018) stressed that successful SMEs are categorized as those that introduce not only technological innovation but also social innovations. According to Carfora, Scandurra, and Thomas (2021), social innovation revolves around improving social problems. Social innovation initiatives could improve people's lives (see Table 1). For instance, employees with sufficient training enhance their performance. SMEs with good social innovation are more likely to improve business performance. Few studies (Bodlaj and Čater, 2019; Uzkurt et al., 2018) have highlighted how SMEs innovate measures to impact positive environmental changes. Not many businesses are environmentally friendly (Bodlaj and Čater, 2019). Therefore, we hypothesize the following:

Ha1: Technological Innovation predicts a positive effect on SMEs' competitiveness.

Ha2: Social Innovation predicts a positive effect on SMEs' competitiveness.

Ha3: Environmental Innovation predicts a positive effect on SMEs' competitiveness.

FIGURE 1
The Conceptual Framework



Source: Authors' Conception

Uzkurt et al. (2018) stipulated that technological innovation is sustained by older firms' ability. Therefore, the evolution of innovation is predetermined by the company's age (Islam and Wahab, 2021). Old companies have a relatively robust innovation structure. Di Vaio et al. (2020) argued that without consistency in innovation (which occurs over time), the dimension of business operation enhancement would be low. A study by Bodlaj and Čater (2019) revealed that firms with an average age of 25 years relatively develop a core standard business operation over time. Lee et al. (2019), however, argued that in some cases, new firms inculcate a culture of innovation in competitiveness. The firms that can achieve such initiative directly reflect their resource capability. Hence, we hypothesize the following:

Hb1: Firm's age predicts the positive impact on SMEs' competitiveness.

Hb2: Firm's age moderates the positive relationship between Technological Innovation and SMEs competitiveness.

Hb3: Firm's age moderates the positive relationship between environmental innovation and SMEs competitiveness.

Hb4: Firm's age moderates the positive relationship between social innovation and SMEs competitiveness.

According to Bodlaj and Čater (2019), larger companies can survive stronger competition compared to small companies. Firms' innovativeness could be influenced significantly by direct exposure to technology and social and environmental impact (Laforet, 2013). Laforet (2013) revealed that SMEs normally compete largely in the domestic market due to the size of their businesses. Bodlaj and Čater (2019) argued that SMEs with higher exports are mainly oriented to B2B markets. Other studies (Olander, Hurmelinna-Laukkanen, and Mähönen, 2018; Laforet, 2013) reveal that business operations are significantly influenced by the size and type of activity. Therefore, we hypothesize the following;

Hc1: The firm's size positively impacts SMEs' competitiveness.

Hc2: The size of the firm moderates the positive relationship between Technological Innovation and SME competitiveness.

Hc3: The size of the firm moderates the positive relationship between environmental innovation and SME competitiveness.

Hc4: The size of the firm moderates the positive relationship between social innovation and SME competitiveness.

Further research has implicated that one of the key drivers of a firm's innovativeness is the type of activity. For SMEs, operation capacity usually involves low-level production activities (Bodlaj and Čater, 2019). For example, Laforet (2013) highlighted that manufacturing requires large resources to be innovative. Arguably, in the manufacturing sector, some medium companies possess sufficient resources to innovate strategies for a highly competitive advantage. Olander et al. (2018) also emphasized that some firm activities significantly depend on a large group of workers to achieve effectiveness and efficiency. Therefore, we hypothesize the following;

Hd1: Type of activity predicts a positive impact on SMEs' competitiveness.

Hd2: Type of activity moderates the positive relationship between Technological Innovation and SME competitiveness.

Hd3: Type of activity moderates the positive relationship between environmental innovation and SME competitiveness.

Hd4: Type of activity moderates the positive relationship between social Innovation SME competitiveness.

Consequently, based on the above literature dimensions, a research model is developed to study the impact of environmental innovation, social innovation, and technological innovation on SME competitiveness and the moderating effect of a firm's age, size, and type of activity on the relationship between the types of Innovation and SMEs competitive advantage (as shown in Figure 1).

3. METHODOLOGY

3.1 DEFINING THE POPULATION AND SAMPLE SIZE

The study focused on the SME population in Malaysia, which totals 1,173,601 as reported by SME Corporation Malaysia (2023). A sample of 480 participants (which includes business owners, entrepreneurs, CEOs, managers, and directors) from major Malaysian states such as Kuala Lumpur, Penang, Johor, and Selangor was selected. Defining a target population and determining a representative sample size are crucial for ensuring that the findings can be generalized to the entire population. The sample size was determined using the Krejcie and Morgan (1970) formula, which helps in calculating a statistically significant sample size from a given population.

3.2 SAMPLING TECHNIQUE AND DATA COLLECTION

Purposive sampling was used to select participants who are experts and experienced in managing SMEs. Data was collected using a

structured questionnaire between January and March 2021. Out of 500 distributed questionnaires, 480 completed ones were received, representing an 80% response rate. Purposive sampling allows for the selection of participants who are best suited to provide relevant information, enhancing the quality of the data collected. A high response rate improves the reliability and validity of the data. Using experts as the respondents ensures that the data accurately reflects the experiences and perspectives of those directly involved in SMEs.

3.3 QUESTIONNAIRE DESIGN AND MEASUREMENT SCALE

The questionnaire covered demographic information of the respondents, innovation measurement, and competitiveness, using a 5-point Likert scale (ranging from strongly disagree to strongly agree). This scale is widely used in a similar study by Arsawan et al. (2022) for measuring attitudes and perceptions. The application of a Likert scale provides a standardized way to measure respondents' feedback, facilitating quantifying and analysis of subjective data. It allows respondents to express the degree of their agreement or disagreement, enabling collection of nuanced data. To ensure the validity of the instrument, "Context and Face validity" was used to examine and evaluate the questions under each variable.

3.4 DATA ANALYSIS USING SMARTPLS SOFTWARE

The collected data were analyzed using SmartPLS 4.0 software based on Partial Least Squares Structural Equation Modeling (PLS-SEM), a variance-based method. The analysis included two stages: (1) the measurement model and (2) the structural model, which involved bootstrapping analysis to evaluate correlation effects, r-square, f-square, and q-square (Hair et al., 2019; Kock, 2015). PLS-SEM is well-suited for complex models and is widely used in social science research because of its ability to handle multiple relationships simultaneously. It is particularly useful for exploratory research and theory development, where predictive accuracy and the analysis of complex models are needed.

3.5 ADDRESSING COMMON METHOD BIAS (CMB)

To minimize CMB, different rating scales were applied, reverse-scored items were incorporated, and several methods such as collinearity testing (VIF values), and convergent and discriminant validity checks, were applied. Addressing CMB is essential to ensure unbiased results from the data collection method. Techniques such as varying response scales and reverse scoring help reduce response biases. Statistical methods such as VIF confirm that the findings are not significantly influenced by CMB, enhancing result validity and relevance (Kock, Berbekova, and Assaf, 2021; Chuang, 2020).

3.6 MULTICOLLINEARITY AND VARIANCE ANALYSIS

The study conducted a multicollinearity test (VIF < 3) and examined both exploratory and confirmatory factor analysis to ensure that variance explained by a single factor was less than 30%, which is below the 50% threshold. Testing for multicollinearity and variance is necessary to ascertain the independence of model variables.–High multicollinearity can distort the results, while variance analysis confirms that no single factor dominates the models, ensuring a balanced and accurate representation of relationships.

4. DATA ANALYSIS

The data analysis reveals key demographic and structural characteristics of the surveyed Malaysian companies and respondents. Approximately 57.71% of participants are aged 46 and above, indicating a predominance of middle-aged to older respondents. Educational qualifications show that 51.67% hold a diploma or equivalent, while 48.33% possess master's or PhD/DBA degrees, reflecting a well-educated sample. The firms were relatively young, with 42.29% being one to 10 years old, 33.33% have been operating for 10-20 years, and 24.38% are well-established with over 20 years of experience.

Wholesale dominated in terms of business activities, representing 49.38% of firms, followed by "Service" at 23.33%, "Manufacturing" at 17.29%, and "Retail" at 6.46%. The majority of firms (51.46%) are classified as large, employing 200 or more people,

while medium-sized firms (100-199 employees) account for 38.75%. Small (10-99 employees) and micro firms (1-10 employees) represent 6.25% and 3.54%, respectively. Legal status analysis shows that nearly half (48.54%) of the firms operate as partnerships, followed by close corporations (26.46%), sole proprietors (14.58%), and others such as public corporations and franchises (10.42%). This comprehensive analysis provides critical insights into the composition and structure of surveyed firms.

4.1 MEASUREMENT MODEL ANALYSIS

The data analysis reflects on both the measurement model and the structural model analysis. To ensure measurement model reliability and validity, an internal reliability assessment was conducted (including Cronbach's alpha and Composite reliability), convergent validity (CV), and discriminant validity (DV) on all constructs. Internal reliability was evaluated by examining Cronbach's alpha and Composite reliability, while the CV was evaluated by evaluating the average variance extracted, respectively (Ringle and Sarstedt, 2016; Hair et al., 2019). All item loadings for each construct are represented in Figure 2.

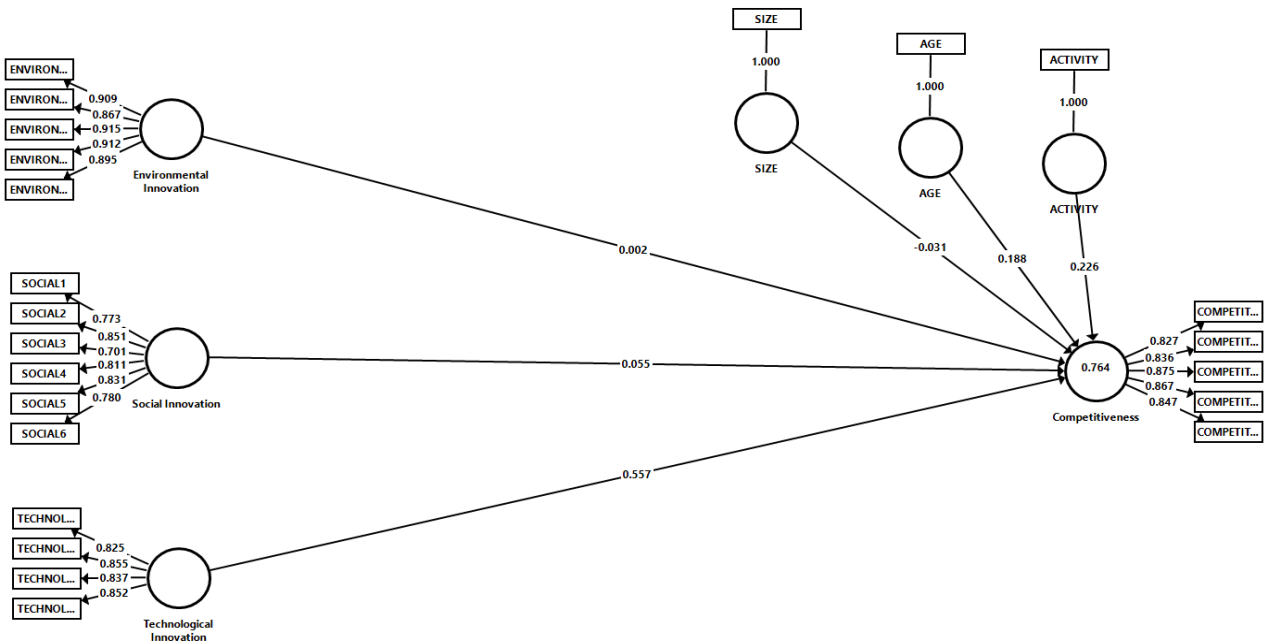
According to Table 2, all constructs' loadings range from 0.701 to 0.915, and this indicates that every item possesses a loading higher than the minimum threshold of 0.70 (Hair et al., 2019), despite a debatable analysis of a possible minimum threshold, which could also be 0.60 according to Hair et al. (2019). For instance, in construct (competitiveness), each item possesses loadings higher than 0.70, from 0.827 to 0.875, respectively. Meanwhile, for the bootstrapping analysis, Hair et al. (2019) suggest that for each item, loadings should be considered significant. The t-statistic must be ≥ 1.96 as the minimum threshold. For instance, in one construct (competitiveness), each item possesses loadings higher than 1.96, from 44,028 to 57,140, respectively. The loadings for each item have proven to be significant.

TABLE 2
Construct Reliability and Validity

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)	f-Square	VIF Values	R Square	Q^2
Activity	1.000	1.000	1.000	1.000	0.113	1.920		
Age	1.000	1.000	1.000	1.000	0.080	1.863		
Competitiveness	0.904	0.904	0.929	0.723	0.200	1.430	0.764	0.546
Environmental Innovation	0.941	0.942	0.955	0.810	0.035	1.994		
Size	1.000	1.000	1.000	1.000	0.162	2.253		
Social Innovation	0.881	0.885	0.910	0.628	0.590	2.228		
Technological Innovation	0.864	0.864	0.907	0.710	0.113	1.920		

Source: Based on PLS-SEM Analysis

FIGURE 2
Measurement Model



Source: Based on PLS-SEM Analysis

The Cronbach's alpha analysis on factor loadings indicates a significant value > 0.70. The values range from 0.881 to 1.000, respectively. Moreover, all loadings for rho A and composite reliability indicated values > 0.70; at least 70% of variance had been described by the construct's correlation (Ringle and Sarstedt, 2016). The average variance extracted (AVE) analysis shows that all the values achieved the minimum threshold of ≥ 0.50, and all the loadings have values > 0.50 (see Table 2). Consequently, all the variables possess significant Cronbach's Alpha, rho A, composite reliability, and average variance extracted, which means the reliability test is statistically significant for the model (Hair et al., 2019).

TABLE 3
Discriminant Validity (HTMT)

	Original Sample (O)
Age -> Activity	0.570
Competitiveness -> Activity	0.737
Competitiveness -> AGE	0.700
Environmental Innovation -> Activity	0.428
Environmental Innovation -> Age	0.433
Environmental Innovation -> Competitiveness	0.488
Size -> Activity	0.436
Size -> Age	0.473
Size -> Competitiveness	0.468
Size -> Environmental Innovation	0.343
Social Innovation -> Activity	0.498
Social Innovation -> Age	0.470
Social Innovation -> Competitiveness	0.601
Social Innovation -> Environmental Innovation	0.757
Social Innovation -> Size	0.372
Technological innovation -> Activity	0.683
Technological Innovation -> Age	0.651
Technological Innovation -> Competitiveness	0.739
Technological Innovation -> Environmental Innovation	0.493
Technological Innovation -> Size	0.520
Technological Innovation -> Social Innovation	0.625

Source: Based on PLS-SEM Analysis

Table 3 shows that all HTMT values for the constructs are significant since all the loadings are < 0.850. Hence, with the confidence interval, none of the values includes a value of 1. All constructs show discriminant validity using the HTMT method (Ringle and Sarstedt, 2016). According to Kock (2015), VIFs must be examined to detect any possible multicollinearity issues and CMB, and all values must not be > 5.0. Hence, Table 3 shows that the model is free from any possible multicollinearity because all the loadings for the constructs are < 3.0 (as in Table 2).

4.2 STRUCTURAL MODEL ANALYSIS

The report from Table 2 indicates that R-square and Adjusted R-square were 0.764 and 0.761, respectively. This represents a significant correlation between all constructs (including environmental Innovation, Social Innovation, Technological Innovation, firm age, firm size, and types of activity) and competitiveness. The correlation between all the variables is statistically significant, with a p-value less than 0.05. The predictive values for the f-square analysis are represented as a small predictive effect (0.02 but <0.15), medium effect (0.15 but <0.35), and significant effect (≥0.35). On average, the f-square analysis (see Table 2) shows that environmental, social, and technological innovation reflects a medium predictive influence. Therefore, the value of the reflective constructs on competitiveness is statistically significant, displaying beta values between 0.010 and 0.590 (Hair et al., 2019). Table 2 shows the predictive relevance Q2 of competitiveness, which shows a value of 0.546, proving that the model has considerable predictive relevance. This connotes that the model has Q2 values higher than zero, which provides support for the significance of the model's predictive relevance for all the rest of the constructs (Ringle et al., 2019).

5. DISCUSSION

Table 4 shows a positive correlation between technological innovation and SME competitiveness (p=0.000). This implies that technological innovation predicts a positive effect on SME competitiveness. The finding highlights several key perspectives. For society, it suggests economic growth, job creation, and improved living standards.

Environmentally, its impact depends on whether sustainable practices are prioritized (Di Vaio et al., 2020; Lee et al., 2019; Lee and Trimi, 2018). Governments should support technological advancement through favorable policies and incentives. Businesses are encouraged to invest in technology for enhanced productivity and market position. Academically, this finding invites research into effective innovation strategies and adoption barriers. For investors, technology-innovative SMEs represent promising investment opportunities because of their growth potential (Islam and Wahab, 2021).

Table 4 depicts that the correlation between constructs (age of a firm and its types of activity) and SME competitiveness is significant ($p<0.01$). The finding suggests that older, experienced firms in certain industries are better positioned for success, offering greater economic stability and job security. While established firms may be more capable of adopting sustainable practices, promoting eco-friendly initiatives across all business types is crucial. Government policies should support both young and mature firms, enhancing competitiveness and sustainability. For investors, these findings highlight the appeal of investing in well-established firms for stable returns (Di Vaio et al., 2020). That means the effect of constructs (age of a firm and its types of activity) on SME Competitiveness is positively significant. A study by Laforet (2013) revealed that older firms with strategic orientations and innovation patterns have a successful performance level to compete with other companies. A company's ability to expand its exploitative innovativeness does not necessarily depend on the age of the business.

Our analysis however found that the relationship between environmental innovation and SME Competitiveness is insignificant ($p=0.956$) (see Table 4). The findings suggest that entrepreneurs might prioritize technological or product innovations that offer direct competitive advantages, while consumers may not see immediate benefits in product quality or pricing from environmental practices. This suggests that environmentally friendly practices may not motivate firms purely based on competitiveness. Governments should emphasize other benefits, such as long-term sustainability and regulatory compliance, to encourage environmental innovation adoption. Businesses should incorporate environmental innovation into broader strategies for ethical practices risk management, and brand reputation. A similar finding from Radicic and Djalilov (2019) found that environmental innovation impact on SME business performance is insignificant. The growing environmental problem has

significantly urged companies to establish products capable of addressing environmental issues (Radicic and Djalilov, 2019; Bodlaj and Čater, 2019).

TABLE 4
Path Coefficient

	Original Sample	T Statistics	P Values
ACTIVITY -> Competitiveness	0.226***	6.336	0.000
AGE -> Competitiveness	0.188***	5.348	0.000
Environmental Innovation -> Competitiveness	0.002	0.055	0.956
SIZE -> Competitiveness	-0.031	1.072	0.284
Social Innovation -> Competitiveness	0.055*	1.768	0.077
Technological Innovation -> Competitiveness	0.557***	16.609	0.000
AGE_ENV -> Competitiveness	-0.018	0.532	0.595
AGE_SOC -> Competitiveness	-0.029	0.636	0.525
AGE_TECH -> Competitiveness	0.250***	6.695	0.000
SIZE_ENV -> Competitiveness	0.003	0.065	0.948
SIZE_SOC -> Competitiveness	0.019	0.383	0.702
SIZE_TECH -> Competitiveness	0.122***	6.753	0.000
ACTIVITY_ENV -> Competitiveness	-0.064	1.475	0.140
ACTIVITY_SOC -> Competitiveness	0.005	0.096	0.924
ACTIVITY_TECH -> Competitiveness	0.146***	6.692	0.000

Note: Level of Significance: ***p<0.01, **p<0.05, *p<0.10
Source: Based on PLS-SEM Analysis

The results show that the firm's age and size significantly moderate the relationship between technological innovation and SME competitiveness (p<0.01). This finding highlights the importance of tailoring innovation strategies based on a firm's characteristics, according to Hamzah et al. (2021). Larger and older firms, with more resources, may adopt technological and sustainable practices more readily, affecting product quality and service delivery. Governments should create targeted policies and support for businesses of different sizes and ages to enhance their competitiveness. The analysis reveals that age and size positively influence the impact of technological

innovation on competitiveness. Relevant studies (Islam and Wahab, 2021; Hamzah et al., 2021; Wong et al., 2020) also noted that, despite SME contributions to Malaysia's GDP, technological advancements primarily occur in medium and large firms, with large corporations dominating the technological market. The findings indicate that the moderating effect of a firm's age and size on the relationship between environmental and social innovation and SME competitiveness is insignificant ($p>0.10$). This suggests that innovation strategies, rather than firm demographics, are key to enhancing competitiveness. All firms, regardless of size or age, can contribute equally to sustainability and product diversity. Hence Governments should provide equal innovation support across firms (Hanifah et al., 2019; Radicic and Djalilov, 2019).

In Malaysia, the impact of environmental and social innovation on SME competitiveness is still limited, partly due to over-reliance on imported Chinese technology. Developing local innovations in IT and mobile technology could improve SME performance. Prior research also suggests that firm size and age do not necessarily affect competitiveness (Saeidi et al., 2018).

The study found that the moderation effect of a firm's types of activity on the relationship between technological innovation and SME competitiveness is significant ($p<0.01$). The result highlights that firm activity type significantly affects how technological innovation impacts its competitiveness. This means entrepreneurs must consider how their firm's activities influence their ability to leverage technological advancements. Consumers may benefit from improved and diverse products. Environmentally, firms in tech-intensive sectors might better adopt green technologies, while others may face different challenges. Governments can use these insights to tailor policies and support programs, and businesses should align their innovation strategies with their industry-specific needs for optimal competitive advantage. The result revealed that a firm's types of activity positively influence the impact of technological innovation on competitiveness. Consequently, when the set of technology successfully aligns with the SME, the company will be highly capable of maximizing its innovativeness, eventually increasing its competitive advantage (Laforet, 2013). The findings reveal that the firm's type of activity has an insignificant moderating influence on the relationship between social and environmental innovation and SME competitiveness ($p>0.10$) (see Table 4). This suggests that societal and environmental benefits from such innovations are not fully realized,

highlighting the need for stronger policies, incentives, and awareness around sustainability. Hanifah Halim et al. (2019) emphasized that social and environmental innovations are critical in Malaysia, yet they remain limited because of insufficient technological support, especially for SMEs. Large companies receive the majority of support, while SMEs face challenges from a lack of innovative culture. As a result, innovations in social, environmental, and technological areas are often imported from foreign businesses, limiting local competitiveness (Le, 2022).

6. CONCLUSION

This study offers valuable insights into how technological, social, and environmental innovations impact the competitiveness of Malaysian SMEs. It finds a significant positive correlation between technological innovation and SME competitiveness, indicating that businesses leveraging technological advancements tend to perform better and maintain a stronger market presence. Medium to large firms benefit more from these innovations than smaller firms, with firm age and size significantly moderating this relationship. Conversely, the study reveals an insignificant relationship between environmental innovation and competitiveness, suggesting that while sustainability is recognized, its practical impact on SME competitiveness in Malaysia remains limited. The age and size of firms do not moderate the effects of social and environmental innovations, pointing to a potential area for policy interventions to enhance these aspects. This study also highlights the importance of aligning a firm's business activities with its innovation strategy, particularly for technology-intensive firms, which gain more competitive advantages. The limited impact of social and environmental innovations, however, suggests a need for stronger policies and cultural shifts to foster innovation within SMEs. This research emphasizes a holistic approach to innovation that integrates technological, social, and environmental dimensions, calling for policymakers and business leaders to promote innovation strategies that can enhance SME competitiveness in the global market.

6.1 CONTRIBUTION OF THE STUDY

This study provides a novel contribution by examining the impact of technological, social, and environmental innovations on the competitiveness of Malaysian SMEs, highlighting the importance of

sustainability-driven innovation in a developing economy. Unlike previous research that focuses primarily on technological innovation, this study broadens the scope to include multiple forms of innovation, revealing that social and environmental innovations have limited impact given the cultural and technological barriers. It also explores how firm characteristics such as age, size, and business activity moderate the effectiveness of these innovation strategies. The findings underscore the need for targeted support for SMEs to overcome these barriers and enhance sustainability efforts. The study validates existing innovation theories in the context of developing economies and offers localized insights, providing valuable information for policymakers and business leaders. It calls for future research that adopts a comprehensive approach to understanding the relationship between innovation and competitiveness in diverse economic contexts.

6.2 POLICY IMPLICATIONS

The study emphasizes the crucial role of technological innovation in enhancing SME competitiveness over social and environmental innovation. Cultivating a culture of creativity within firms is essential for entrepreneurs aiming to gain a competitive edge. While environmental innovation may not immediately impact competitiveness, it aligns with consumer expectations for sustainability and ethical business practices, fostering long-term customer loyalty and market relevance (Di Vaio et al., 2020). Despite its minimal immediate effect, environmental innovation remains vital for achieving sustainable success and complying with regulations such as the Paris Agreement. Implementing green practices helps businesses contribute to global climate goals and secure a sustainable competitive advantage.

Policymakers should support technological innovation while also promoting environmental sustainability by offering incentives such as subsidies for green infrastructure. These efforts can help SMEs adopt environmentally friendly practices, aligning with international targets such as the 2050 Net Zero goal. To foster sustainable economic growth, policies must integrate technological, social, and environmental innovation. Businesses should prioritize technological advancements to enhance competitiveness, while also incorporating environmental and social innovations into their strategies (Tu and Wu, 2021). Green innovation in supply chains can prompt broader

environmental strategies, helping companies meet regulatory standards and stakeholder expectations. This holistic approach allows firms to address societal challenges, remain competitive, and contribute to achieving the Sustainable Development Goals (SDGs), according to Le (2022).

7. LIMITATIONS AND RECOMMENDATIONS

This study has some consequential limitations to be discussed. First, we take into account the characteristics of a firm that influence business competitiveness (Laforet, 2013); our study includes the age, size, and type of activity of a firm, which eventually conforms to our findings that those characteristics do have a direct influence on firms' business competitiveness. Second, the COVID-19 restrictions hindered the structured procedure for carrying out face-to-face interviews. Therefore, all responses were acquired online. Because of these limitations of this study and the continuously evolving nature of the business structure, this study recommends further investigation of the direct relationship between innovations and SME competitiveness and the moderation effect of age, size, and types of activity on innovation. Future researchers may consider extending the investigation on the moderation influence of SMEs' resources and reputation on the relationship between innovation (technological, social, and environmental) and competitiveness. Researchers may also consider investigating the constructs to examine the possible impact of SME competitiveness and their characteristics on innovation.

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