Impact of Innovation Ambidexterity on Innovation Performance Moderated by IT Competence of SMEs

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Abstract **- This paper aims to explore the impact of innovation ambidexterity on innovation performance moderated by the IT competency of SMEs. In this research, the innovation ambidexterity variable serves as an independent variable, innovation performance serves as a dependent variable, and information technology knowledge and information technology operations support (IT competency) serve as moderating variables. An online survey was used to do a purposeful random sampling, and then the data from that survey were analysed using the structural equation modelling capabilities of SMART PLS. Innovation ambidexterity and innovation performance are positively correlated, but this research was unable to pinpoint the function that IT competency played in moderating this link. This finding is quite intriguing because it deviates significantly from earlier research, which primarily demonstrated that IT competencies acted in a complementary or co-specialized function to other resources. This research contributes to the literature on the antecedents of innovation performance. SMEs that want to enhance their innovation performance may find the research helpful in optimising the use of their limited resources to remain competitive in the current business landscape.**

Keywords **-** *Innovation Ambidexterity, Innovation Performance, IT Competency, Small and Medium Enterprise, Entrepreneurship*

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I. Introduction

The importance of innovation to the overall success of SMEs has grown significantly in recent years. The Asia-Pacific Economic Cooperation (APEC) has developed four priority areas of the APEC's Small and Medium Enterprises Working Group (SMEWG) Strategic Plan for 2017 - 2020. These four priority areas are as follows: (i) entrepreneurship, innovation, and the internet and digital economy; (ii) market access for SMEs; (iii) financing for business expansion and capability development; and (iv) inclusive business ecosystem that supports SME growth (APEC in Charts 2019). In addition, the ASEAN Secretariat, through its programme for entrepreneurship, particularly encourages productivity, technology, digitalization, and innovation for SMEs in the ASEAN region.

Much research on innovation conducted in Malaysia revealed conflicting conclusions about SMEs' innovative activities. According to Marmara et al. (2018)), one of the aspects that determine SMEs' success is information use, and creativity and innovation are critical survival skills for SMEs. Another study, it was found that SMEs are adapting and practising innovation in their entrepreneurial activities such as product and process

innovation (Khaskheli et al., 2017). This is reinforced by Hanifah et al.(2019), Noraisah et al. (2021) and Osman & Ngah (2016) who found that innovation strategy had a substantial impact on SMEs' innovation performance. However, Ismail et al. (2014) discovered that, while Malaysian SMEs management is aware of the importance innovation plays in business success, they lack the focus to use innovation to obtain a competitive edge. Looking at the gaps, it is vital to understand how SMEs are adjusting to innovative ambidexterity.

Balancing explorative and exploitative innovation ambidextrously has emerged as one of the most pressing issues in management study (Y. Chang & Hughes, 2012). Recently, innovation ambidexterity has gained recognition in helping SMEs perform better; however, there is a disproportionate gap in our understanding of how innovation ambidexterity can be achieved, particularly in small-to-medium-sized firms (SMEs) and about IT competency in Malaysia. This research looks at the link between innovative ambidexterity, IT competency, and the success of Malaysian SMEs in terms of innovation performance.

II. Literature Review

Innovation Ambidexterity in SMEs

The research on innovation ambidexterity defines innovation ambidexterity as the capacity for an organization to pursue exploratory innovation and exploitative innovation at the same time (Heavey et al., 2017). Exploration entails experimentation with alternatives laden with uncertain and distant returns (Levinthal & March, 1993), which is also associated with the creation of new markets or products that are often related to new emerging customers. Exploitative innovation, on the other hand, has relatively predictable returns and is frequently the refinement and expansion of existing expertise, competencies, paradigms, and techniques. It is geared toward meeting customer or market needs through the improvement of current products or services(Jansen et al., 2006). Innovation ambidexterity has gained momentum in research on organizations because it contributes towards the sustainable development of their business (Lubatkin et al., 2006). Gibson and Birkinshaw state that organization tends to fall either into the “success trap” or “failure trap” by emphasizing too much on one form of innovation over the other (Gibson & Birkinshaw, 2017). By emphasizing too much on exploitative innovation, a firm may enjoy short-term benefits but risks not being able to reorient itself (Levinthal & March, 1993). However, focusing too much on exploratory innovation, they may miss the opportunity to fully benefit their existing competencies commercially (Gupta et al., 2006). Focusing on both avoids these traps.

The conditions or antecedents necessary to produce ambidexterity in a small and medium firm have received significant interest from researchers and have been gaining a lot of momentum lately. According to a study on the external and internal determinants of ambidexterity, Chang, et al. (2011) found that internal organisational structures in a highly dynamic environment can encourage the appearance of innovation ambidexterity in SMEs. Also, through the creation of proper international organisational structures and utilising the relevant leadership philosophies, SMEs can develop ambidexterity (Y. Chang & Hughes, 2012). Additionally, it has been discovered that SMEs' innovative ambidexterity is strongly correlated with their ability to use information technology, knowledge management, and environmental dynamism (Soto-Acosta et al., 2018). Another study on knowledge management also found that innovation ambidexterity mediates the relationship between knowledge management capability and firm performance (Shafique et al., 2022). The use of business intelligence and analytics systems helps maintain a healthy balance between exploratory and exploitative innovation activities within a company (Božič & Dimovski, 2019). This is accomplished by increasing a company's absorptive capacity, expanding the opportunities for faster experimentation with product or service offerings, and improving the predictability of the value of new products or services.

In a study on broiler poultry SMEs, technological capability and owner-manager characteristics have a positive influence on innovation ambidexterity (Wiratmadja et al., 2020)while within the fashion industry innovation ambidexterity is influenced by the firm’s social media platform’s structure, the relational behaviour, the cognitive dimension and the knowledge transfer practices of within a firm (Scuotto et al., 2019). Having a diverse mix of the top management team that includes externally recruited managers and multiple generations of family members encourages innovation ambidexterity, particularly in family-based SMEs (Röd, 2019).

Concerning the innovation ambidexterity’s specific impact on innovation performance within SMEs, there is little research done exploring this matter. One of the studies addressing this topic is a study of Bulgarian IT companies, which found that innovation ambidexterity was positively linked to the performance of product innovation but is mediated by the level of decentralization of the firm (Ceptureanu & Ceptureanu, 2021). In another study on small US firms, IT infrastructure is found to enable innovation ambidexterity while Social media capability moderates the relationship to create knowledge ambidexterity (Benitez et al., 2018).

IT Competency

The study of IT Competency has its roots in RBV where it attempts to address the shortcomings of IT in being a resource to achieve strategic competitive advantage. According to Barney (2001), for an organisational resource to have the potential to produce a sustainable competitive advantage, it must possess the following characteristics.:

- Valuable - The resource makes it possible for a company to think of or implement ideas that will improve its effectiveness or efficiency.
- Rare - The valuable resource must not be held by a big number of companies that are in direct competition with one another.
- Imperfectly imitable - The valuable resource should not be easily imitated.
- Non-substitutable - The valuable resource should not be easily replaced by other substitutes

Many RBV experts believe that IT, which is typically used to refer to programmes, computers, and telecommunications, cannot be regarded as a source of competitive advantage in and of itself. This is because IT may be quickly commoditized through imitation and acquisition by competitors(Clemons & Row, 2015; Kmieciak et al., 2012; Soto-Acosta et al., 2016; Soto-Acosta & Meroño-Cerdan, 2008). A much broader scope is required to qualify the usage of IT as a competitive advantage that impacts a company's success. To answer this broader demand, Tippins and Sohi(Tippins & Sohi, 2003a) propose the inclusion of the following dimensions which are then named IT Competency:

- IT knowledge - The amount of technical knowledge a company has about objects such as computer-based systems.
- IT operations - the extent to which a company uses technology to manage market and customer information.
- IT objects - Computer-based hardware, software, and support personnel are examples of IT objects.

IT Competency shifts the focus from the mere existence of IT infrastructure as a strategic competitive advantage to how an organisation uses technology to manage its information efficiently (Mithas et al., 2011).

Early research by Tippins and Sohi (2003) tries to see how the expanded view of IT implementation as mentioned above impacts firm performance. It was discovered that IT competency does not directly contribute to an organization's performance but rather it is mediated by the presence of organizational learning within a firm. Their discovery demonstrates that having IT competency alone is not enough despite its expanded scope. It should be paired with another source of competitive advantage; in this case - organizational learning, to have an impact on an organization's performance. Later conceptually similar research done by Perez-Lopez and Alegre (2012) also yield the same result; that IT competency had no direct effect on a firm's performance. This time, instead of organizational learning, it was found that knowledge management processes mediate the relationship between IT Competency and Firm Performance. This study further stresses that the question is not whether a firm should deploy IT resources or not but rather the manner in how IT resources are deployed helps in determining the effectiveness of knowledge management processes that impact a firm's performance. They later conclude that firms must invest in a comprehensive framework that supports the multi-facet nature of IT including IT Knowledge, IT Supported Operations and IT infrastructure to ensure its role as a strategic resource. Interestingly, another study seems to contradict the direct relationship IT competency has to knowledge management processes. According to this study by Susana Pérez-López and Beatriz Junquera, there is no direct relationship between IT competency and knowledge management, and their relationship is mediated by a firm's openness and level of empowerment (2013).

Beyond the sphere of learning and knowledge management, IT Competence is found to impact a firm's supply chain agility when it is mediated by a supporting organizational culture (Jermsittiparsert & Wajeetongratana, 2019a). A firm's innovation is also positively affected by IT competence but does not positively and significantly affect competitive advantage (Khristianto et al., 2021a). It also drives knowledge sharing and job satisfaction more strongly among IT knowledge workers compared to other industries(Kucharska & Erickson, 2020a).

Overall, the literature tends to support the co-specialization and complementary nature of IT for it to be a resource for competitive advantage (Clemons & Row, 2015). According to Powell and Dent-Micallef (1997), complementarity occurs when the value of one resource is increased by the existence of another resource, while co-specialization occurs when one resource has little to no value without the other (Clemons & Row, 2015). IT by itself is not a resource for a long-term competitive advantage. To truly become a source of advantage, it must be mediated by or mediating another resource.

The construct of IT Competency is not without those whose opinion differs. Kucharska and Erikson (2020) found that between the three dimensions of IT Competency, IT Infrastructure does not significantly add value to

knowledge sharing, whereas IT knowledge and IT operations do – indicating that infrastructure should be perceived as a necessary but not sufficient factor to ensure knowledge sharing flows in organizations.

Innovation Performance

Innovation begins with the creation of new ideas on how to do things better and Rogers (1995) describes innovation as "an idea, commodity, or method, process, system, or tool that is regarded as new to a person, an institution, or company, or an industrial sector, or a society as a whole." Innovation is characterized not only as technological innovation but also as processes of organizational learning and change to promote and stimulate innovation (Heffner & Sharif, 2006)sees innovation as a means of retaining a competitive advantage from the start of the industrial revolution. Scholars refer to matters relating to performance to effectiveness and productivity (Liu et al., 2016). Combined with innovation, innovation performance refers to the effectiveness and productivity of a firm in doing innovation, which involves the comprehensive evaluation of the activities of organizational innovation and is a key driver of business performance (J. Chang et al., 2015).

There are several ways of measuring innovation performance. One way is to look at the benefits of introducing technological innovation practices that include an enterprise's political, social and technological advantages (Ali et al., 2017). Innovation performance can also be measured by the number of new products, new product sales revenue and the number of patents (Nuruzzaman et al., 2019). However, the most comprehensive measurement of innovation performance spans process and product innovations. Product innovations refer to the latest goods and services produced for customer satisfaction, while process innovations are about improvements in manufacturing or service operations (Damanpour, 1991). The performance of these innovations is evaluated based on the number of innovations, the speed or the rate at which these innovations are produced, the novelty or creativity of innovations and whether they are the first to market or not (Deshpande et al., 1993; Prajogo & Sohal, 2004; Subramanian, 1996). These four dimensions encompass the whole spectrum of innovations coming from small incremental improvements up to radical innovations that provide wide-ranging and transformative changes in the market. The positive relationship between innovation and firm performance is well-researched (Birkner & Máhr, 2016; Leitner et al., 2016). Despite the extensive research done on innovation and performance, scholars have yet to explore the role of innovation ambidexterity on innovation performance. This paper will attempt to address this issue.

Looking at the literature on the impact of innovation ambidexterity on innovation and the complementarily and co-specialized nature of IT competency, this research proposes the following hypothesis:

- H1: Innovation Ambidexterity has a positive relationship to Innovation Performance
- H2: Innovation Ambidexterity has a positive relationship with IT Knowledge
- H3: Innovation Ambidexterity has a positive relationship with IT Support
- H4: IT knowledge has a positive relationship to Innovation Performance
- H5: IT-supported operations have a positive relationship to Innovation Performance
- H6: IT Knowledge moderates the relationship between Innovation Ambidexterity and Innovation Performance
- H7: IT Support moderates the relationship between Innovation Ambidexterity and Innovation Performance

III. Research Methodology

In this study, innovation ambidexterity is an independent variable, innovation performance is the dependent variable while IT knowledge and IT operations support are the moderating variables. The items of the innovation ambidexterity were adapted from He & Wong (He & Wong, 2004), Hernández-Espallardo, Sánchez-Pérez, & Segovia-López(2009), Hughes et al. (2021), Lisboa et al. (Lisboa et al., 2011). Innovation Performance measurement is adopted from Roberts & Grover (Roberts & Grover, 2012). IT Knowledge and Operations Support measurements were adapted from Tippins and Sohi (2003)and Lopez and Alegre (2012). IT Infrastructure is excluded from the construct of IT Competency following the findings of (Kucharska & Erickson, 2020).

Purposive random sampling was deployed through an online survey. Samples were initially taken from the database of the Malaysian Academy of SME and Entrepreneurship Development (MASMED) and associated organizations such as SME Corp and SME Bank. This method of non-probability sampling was selected due to the characteristics of a population and the objective of this study. Since this study is to explore the innovation ambidexterity and innovation of SMEs, therefore it is focused on average members of this specific segment of the population. The online survey was administered due to ease of distribution and convenience on the part of the respondents as they can use their mobile devices to respond to the survey. On top of that, the data collected via online survey can be easily exported to a statistical analysis software as it avoids the need to key-in data from paper to the software – minimizing data entry error on the part of the researchers. Data was then analysed using Structural Equation Modelling of SMART PLS software version 3.2.6 (Hair et al., 2017).

IV. Results

Table 1 describes the demographic profile of the companies obtained from the survey. The vast majority (86.7%) of the respondents come from a sole proprietorship or in partnership with 60.1% of these respondents have been in operations for less than 5 years. 38.9% of these respondents employ between 6 to 30 people with their business while 33.9% have a yearly revenue within the RM300,000 – RM3Million range. For full results, please refer to the table below.

Structural equation modelling (SEM) is a multivariate statistical analysis technique commonly used to examine structural relationships. In this study, the SEM technique is employed to test the research hypotheses. There are two approaches to estimating the relationship in the structural equation model; covariance-based structural equation model (CB-SEM) and variance-based partial least square (PLS-SEM)(Hair et al., 2017). CB-SEM is used to confirm theories and PLS is used to explore the interactions. In this study, PLS is deemed suitable as the primary purpose of this study is to explore the interaction effects of antecedents and entrepreneurial endeavours (Ru et al., 2018). A two-step approach for data analysis as suggested by Hair et al. (2017) and Rigdon et al. (2017) was utilized. The first step analysed the measurement model, and the second step assessed the relationships among key constructs.

Table 1: Demographic Profiling - Company Backgroun

Description		Frequency	%
Business Entity	Sole Proprietor	37	32.7
	Partnership	61	54.0
	Other	15	13.3
Length of time in which the company has been in business	less than 2 years	27	24.1
	2 – 5 years	41	36.6
	5 - 10 years	19	17.0
	More than 10 years	25	22.3
Number of full-time employees	less than 5	18	15.9
	6 -30	44	38.9
	31 - 75	22	19.5
	75 - 200	9	8.0
	More than 200	20	17.7
The firm's annual sales turnover	less than RM300,000	31	27.7
	RM301, 000 - RM3 Million	38	33.9
	RM 3 Million - RM 15 Million	27	24.1
	RM15 Million - RM20 Million	3	2.7
	More than RM20 Million	13	11.6
The Firm status	100% Bumiputra	66	58.4
	100% Non-Bumiputra	7	6.2
	Joint venture with foreign partner/business	23	20.4
	Joint venture with local partner/ business	13	11.5
	Other	4	3.5

Measurement model

There are three steps of procedures for evaluating the measurement model which are individual item

reliabilities, convergent validity and discriminant validity (Hair et al., 2017). Convergent validity is the extent that measures correlations of multiple items of the same concept, which was tested in assessing the measurement model. As suggested by Hair et al. (2017), the factor loadings, composite reliability and average variance extracted were used to assess convergence validity. Few items have been dropped due to low loadings. Table 2 presents that the composite reliability and AVE of all variables are more than 0.5; therefore, convergent validity has been achieved. In assessing discriminant analysis, the heterotrait-monotrait ratio of correlations (HTMT) was used as it is more robust. The result of HTMT was to confirm the real hypothesized structural paths. According to Henseler, Ringle and Sarstedt (2015), if the HTMT value is below 0.90; discriminant validity has been established between two reflective constructs. Table 3 presents that all the value is below 0.90 therefore discriminant validity has been established.

Table 2: Loadings, Construct Reliability and Validity

		Loadings	CR	AVE
Innovation Ambidexterity	Exploitation Innovation	0.806 0.843 0.871 0.828	0.904	0.701
	Exploration Innovation	0.83 0.851 0.875 0.863	0.916	0.731
Innovation Performance		0.895 0.917 0.884	0.927	0.808
IT Knowledge		0.882 0.846 0.841	0.892	0.733
IT Supported Operations		0.758 0.823 0.831	0.882	0.659

Table 3: Discriminant Analysis of HTMT

	1	2	3	4	5	6
Exploitative Innovation						
Explorative Innovation	0.917					
IT Knowledge	0.81	0.737				
IT Supported Operations	0.728	0.772	0.804			
Innovation Ambidexterity	1.065	1.056	0.792	0.769		
Innovation Performance	0.704	0.65	0.738	0.586	0.694	

Structural Model

Figure 1 shows the structural model of the study. The R^2 of Innovation Performance is 0.474 indicating a substantial level of predictive accuracy (Hair et al., 2017). About 47.4% of the variance explained in the Innovation Performance is contributed by the exogenous variables. Innovation Ambidexterity (β= 0.620, t= 9.559, p=0.00) is found to have a positive and significant relationship to Innovation Performance thus supporting H1. Innovation Ambidexterity (β= 0.0689, t= 15.106, p=0.00) is also found to have a positive and significant relationship to IT Knowledge, thus supporting H2. Next, it is found that Innovation Ambidexterity (β= 0.673, t= 13.977, p=0.00) has a positive and significant relationship to IT Support, thus supporting H3.

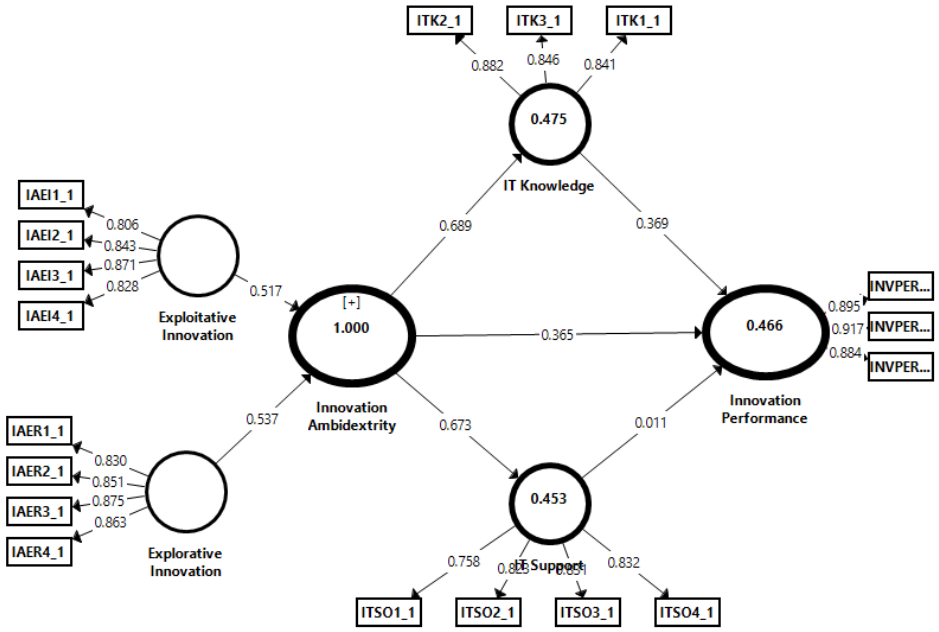

Figure 1: The Structural Model

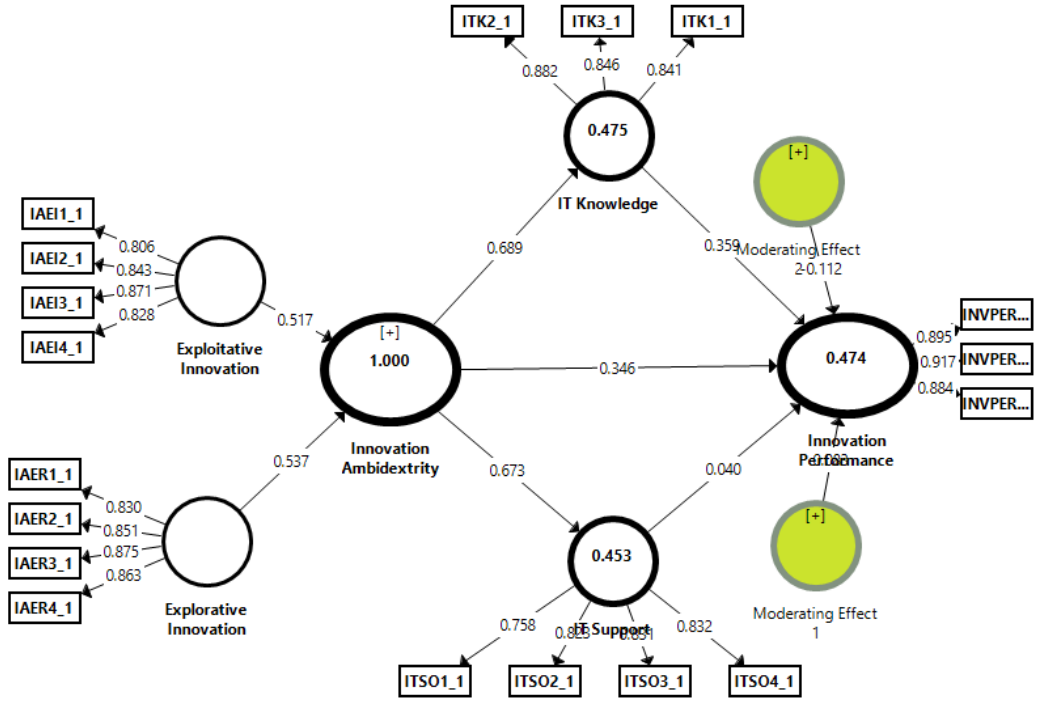

Figure 2: The Structural Model (Moderating Effects)

Looking at IT Knowledge, we found that IT Knowledge (β= 0.359, t= 4.859, p=0.00) has a positive and significant relationship to Innovation Performance, thus supporting H4. However, IT Support (β=0.040, t= 0.496, p=0.620) has no significant relationship to Innovation Performance. Moreover, both IT knowledge and IT support didn't moderate the relationship between Innovation Ambidexterity and Innovation Performance (0.083, t= 1.202, p=0.230; β= -0.112, t= 1.795, p=0.073). It can be seen in the minute difference in β between Innovation Ambidexterity and Innovation performance when IT Support and IT Knowledge were included as moderators. Therefore, not supporting both H6 and H7. Table 4 presents the results of the Hypotheses.

Table 4: Results of Hypotheses

Hypotheses	B	SD	t-value	P-values	Remarks
H1: Innovation Ambidexterity has a positive relationship to Innovation Performance	0.62	0.065	9.559	0.00	Supported
H2: Innovation Ambidexterity has a positive relationship with IT knowledge	0.689	0.046	15.106	0.00	Supported
H3: Innovation Ambidexterity has a positive relationship with IT Support	0.673	0.048	13.977	0.00	Supported
H4: IT knowledge has a positive relationship to Innovation Performance	0.359	0.074	4.859	0.00	Supported
H5: IT support has a positive relationship to Innovation Performance	0.040	0.08	0.496	0.620	Not Supported
H6: IT Knowledge moderates the relationship between Innovation Ambidexterity and Innovation Performance	0.083	0.069	1.202	0.230	Not Supported
H7: IT Support moderates the relationship between Innovation Ambidexterity and Innovation Performance	-0.112	0.062	1.795	0.073	Not Supported

V. Conclusion

This paper aims to explore the impact of innovation ambidexterity on innovation performance moderated by the IT competency of SMEs. While there is a positive relationship between innovation ambidexterity and innovation performance, this research could not establish the moderating role of IT competency concerning these two variables. Certainly, this finding is of extreme interest as it is markedly different from previous literature that has largely shown that IT competency has consistently served as a complementarity or co-specialization function for other resources such as knowledge management, supply chain agility and business intelligence (Jermsittiparsert & Wajeetongratana, 2019b; Khristianto et al., 2021b; Pérez-López, 2013b; Pérez-López & Alegre, 2012b). Although the research in this area is still developing, this discovery is perhaps one of the areas in which the moderating effect of IT that seen does not apply. This discovery ought to pique the interest of small and medium-sized enterprises (SMEs) and entrepreneurs who are interested in using information technology (IT) to enhance their innovation performance because it would assist them in better optimising the use of their limited resources. At this point, we can only speculate what does this finding mean. Perhaps, this may indicate that the

reliance on IT as a tool for innovation performance has been overly emphasized and there is a possibility that there are other factors that can moderate innovation performance better than IT.

It is important to note that any form of generalization should be avoided as there are several limitations of this study that deserve attention and offer guidance for future research. First, sampling for this research was done using purposeful random sampling, which affects the generalizability of the research due to the nonprobability sampling method used. Second, this was done within the Malaysian context thus the findings may be unique to the condition that exists in Malaysia. Third, this is probably the first time such an incident is observed; thus, a more in-depth look may be needed to ascertain the cause. We cannot rule out flaws in the research design or a miscalculation on the part of the researcher may be the reason such a result is derived.

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