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Prospector Owner-Manager and Innovation Performance of manufacturing SMEs: moderation role of technology turbulence

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The succes of small and medium-sized entreprises (SMEs) depends on innovation performance wich helps them to remain competitive. To be innovative in a technology turbulence context, SMEs have to adopt prospective strategy posture to create opportunities and transform them in innovative projects. Although several studies highlight the link between the entrepreneur profiles and innovation, there are a few studies that investigate the relationship between prospector owner-manager and innovation performance in a Canadian technology turbulence context. This study is concerned with conceptual model development, which examines the prospector owner-manager influence on the innovation performance of SMEs in Quebec. A total of 533 questionnaires were distributed to SMEs and 140 final questionnaires were usable. Using the structural equation modelling approach, the findings reveal that prospector owner-manager significantly influences innovation performance of SMEs in Quebec. Interestingly, the results had shown that the technological turbulence moderate the relationship between prospector owner-manager and innovation performance. It's also highlight that the young owner-manager of SMEs manufacturing is more innovative in technology turbulence context. Based on the results, it can be summarised that to innovate and be competitive, the managers of SMEs need to adopt a prospective and proactive strategy and give more attention to gather and analyse the technological information.

Keywords: *Prospector owner-manager, innovation performance, SMEs, technology turbulence*

1. Introduction

Small and medium-sized enterprises (SMEs) are important to any country's development (Liñán, Paul, and Fayolle 2020). They make a contribution to an economy developpement (McPherson and Holt 2007) and employment growth (Liñán, Paul, and Fayolle 2020). Despite these advantages, they face competition from large local and foreign firms. SMEs often confront some challenges related to slack resources. The large firm resources allow to respond better to trade barriers than SMEs and contribute to a competitive advantage in international markets (Wales, Gupta, and Mousa 2013; Wolff and Pett 2000). For SMEs, the slack resources are a limitation that can make them more vulnerable to large compagnies, and hinder their innovation performance, competitiveness and sustainability. To face these challenges in a hypercompetitive dynamic business environment context, SMEs need to take advantage of their quick and flexible decision-making processes, adopte an innovative attitudes and practices, favoring entrepreneurial orientation (Al-Jinini, Dahiyat, and Bontis 2019). Previous studies highlight that prospector owner-manager can play an important role to create a corporate culture of innovation and entrepreneurial orientation, which can lead to employee motivation and corporate performance (Kickul and Gundry 2002; Miller 1983). Indeed, the prospector owner-manager prioritize creativity and innovation through exploration of new market opportunities and developing new products (Hassani and Mosconi 2021; Yan 2021), specifically in a turbulence technology context (Yoshikuni and Albertin 2018).

Academic attention to owner-manager remains robust (Wang et al. 2016) and many studies have repeatedly drawn scientific inquiries in order to investigate their contribution in firm performance. Previous researchs have investigated the role of prospector owner-manager in innovation activity, however the generalizability of the knowledge limits the empirical studies due populations, settings and times, and frequently illuminate only one part of a larger explanatory puzzle (Davies 2000). To the best of our knowledge, there is no empirical study that exmined the relationships between the prospector owner-manager and innovation performance of SMEs in the technology turbulence context in Canada. In addition, although previous studies have tested the moderating role of turbulence on the relationship between several variables and performance (Wilden and Gudergan 2015), no study has determined whether the prospector owner-manager has an effect on innovation performance in a technology turbulence. This study also examines the owner-manager age that affects the choice of strategies for enhancing innovation within SMEs (Liem and Hien 2020).
The remainder of this paper is organised as follows: Sections 2 is concerned with a review of the literature, research framework and hypothesis development. In section 3, we present and clarify the research methods including measures of variables. Section 4 presents and discusses the results of the empirical data analysis. Section 5 represents the discussion and implications of our research; while Section 6 presents its main conclusions, limitations and outlines avenues for future research.

2. Literature review and hypotheses

2.1 Innovation

Innovation can be defined as a transformation of knowledge into new products, processes and services and actions using something new (Sutarno 2012). Innovation refers to the invention of new ideas, new knowledge and technologies, the introduction of new techniques of production, new products, and revolutionised business processes (Wang et al. 2020). In order to be competitive, organisations must achieve innovation performance. To do this, these organisations need to innovate and improve what currently exists or create something new that is significant and useful, which requires new voices, new ideas, new processes and interactions, and renewed passion to make a difference in the world (Broadstock et al. 2020). Innovation is the most important factor of strategic development which helps SMEs to increase their competitiveness (Raymond et al. 2018). Organisations with high innovation capacity can increase their productivity growth or other innovative processes, products and/or services (Hamidi, Zandiatashbar, and Bonakdar 2018). More specifically, in context of technology turbulence, innovation is considered as one of the most important factors in explaining sustainable growth (Wang et al. 2020). It also contributes to improving the economic growth of countries, and sustainable development (Liet al. 2020; Lucas 2009; Hassani et al., 2022).

2.2 Prospector owner-manager and innovation performance

Previous litarture (Merz and Sauber 1995; Miles and Snow 1978) divided organisational strategies into four categories: defender, prospector, analyzers, and reactors. In the context of SMEs, involvement of owner-managers is important due of their great responsibility at the strategic level. Hence, the set and implementation of strategy depend heavly on its profile (Miller 1983). Technology turbulence context requires a prospector owner manager due to its characteristics, sush as autonomy, risk taking, proactiveness, innovativeness, and competitive aggressiveness (Dess and Lumpkin, 2005; Saha et al. 2017). Previous literature hightlights that prospector owner-manager is more dynamic, responds quickly to environment needs, searchs the marketplace for new products, services, and technologies. Miles and Snow (1978) argue that prospector rely on high levels of environmental scanning and long-range forecasting to identify new opportunities that are critical to their success. The prospector owner-manager is also flexible, and he can be considered as a source of the change to which their competitors must follow (Blumentritt and Danis 2006). The prospector manager is constantly searching for new ideas to introduce innovation that improves and enhances their product or service, their operation and production methods, marketing tactics, organisational structure, information technology, and financing methods (Kickul and Gundry 2002). According to Effendi, Suteja, and Amallia (2020), the prospector owner-manager helps the organisation use a higher level of generative learning, which in turn affect the organisation's performance. The prospector may step outside the conventions of their field, to discover and proposes innovative and creative ideas (Nugent 2011; Nicolás, Rubio, and Fernández-Laviada

2018), which can contribute to innovation within organisation. Similaraly, prospector owner-manager uses imagination to make less obvious connections, leading to new insights, and bringing together ideas more creatives (Breslin and Gatrell 2020).

Characterized by risk-taking and proactivity, prospector owner-manager focuses more on innovation (Miles and Snow 1978), new product development and market research (Varadaraj et al. 2021). The prospector owner-manager encourages flexible and innovative behaviour within organisation that will enable the exploit opportunities. Managers with a prospective orientation contribute to a greater impact on proactivity, autonomy, and innovativeness (Chirico and Nordqvist 2010). Bertrand and Schoar (2003) argue that higher or lower firms' performance depends on the success of the prospective strategy choice. In the context of SMEs, the research of Ndubisi and Iftikhar (2012) shows that innovation and creative thinking have been found to be associated with small business prospective strategy. Similirally, the study of Kickul and Gundry (2002) demonstrates that there a positive relationship between prospector owner-manager and many types of innovations, which can be developed and implemented within the small business environment. Hassor (2013) studied the personality traits of Chief Executive Officer (CEO), and he found that its profile has a positive impact on innovative performances of SMEs. Thus, this discussion leads to the following hypotheses:

H1: Prospector owner-manager has a positive and significant effect on the innovation performance of SMEs.

2.3 Moderation role of technology turbulence

Technology turbulence is defined as the degree and predictability of change associated with product and process technologies in an industry (Wilden and Gudergan 2015). Technology turbulence refers to the change of information and technology development in several areas (Celtekligil and Adiguzel 2019). It's characterized by the frequent change of information and the accumulation of knowledge related to customer needs, competitor strategies and activities as well as technological changes (Liao, Welsch, and Stoica 2008). Technology turbulence is a critical context factor for innovation performance. It contributes to the new product developmnent, and process technologies, which in turn enhance rapid innovation conjunctures (Celtekligil and Adiguzel 2019). Under high technology turbulence, managers need to be creatives and innovatives to achieve performance (Jiménez-Jiménez and Sanz-Valle 2011). According to Broadstock et al. (2020), firms' technological change levels enhance firms' innovation capacity levels. Hanvanich, Sivakumar, and Hult (2006) suggest that technology turbulence enhances learning capabilities and encourages firms to take advantage of new opportunities. In a similar vein, technological learning capabilities contribute to the refinement of process and product improvements (Zhou et al. 2021), and drive firms to be more proactive, which implies on prospective behavior to identify and achieve opportunities (Pratono, Al-Mashari, and Del Giudice 2016). Technology turbulence encourages firms to take risk aversion behavior by setting a prospective strategy (Pratono, Al-Mashari, and Del

Giudice 2016). Previous literature considers environmental turbulence, including technology turbulence, as exogenous variable, which provides moderating effect (Chi and Sun 2013; Pratono, Al-Mashari, and Del Giudice 2016; Wang and Fang 2012). Ultimately, in context of SMEs, there is a relationship between technology turbulence affects and innovation practices (Pratono, Al-Mashari, and Del Giudice 2016). Based on the above arguments, the researchers have proposed the following hypothesis:

Soltanifar, Hughes, and Göcke (2021) point out that technology turbulence influences digital entrepreneurship, creates new digital business opportunities and enhance performance. The degree of technology turbulence influences greatly the information processing requirements, which promotes a prospector behavior in top team (managers).

H2: technology turbulence moderates the relationship between prospector pwner-manager and innovation performance.

2.1 Age of owner-manager: Control variable

The rise of age can conduct to flexibility fall, the rise of conservatism and resistance to change (Wiersema and Bantel 1992). In context of technology turbulence where the uncertainty is higher, managers of higher ages are not able to implement the risky strategies due to their limited capacity to assess new ideas quickly and integrated to make decisions to actions (Liem and Hien 2020). However, younger upper managers have propensity to take risk and are more suited to higher risk strategies (Hambrick and Mason 1984). The owner manager with a lower age will favor to choose a prospective strategy (Liem and Hien 2020). Hambrick and Mason (1984) point out that the younger CEOs take more risk, which manifests in more or larger-scale strategic actions. Focused on prospect of large financial returns, the younger CEOs initiate aggressive strategic actions to generate more economic growth (Yim 2013). The younger CEOs have greater difficulty in understanding the possibility that their strategic choices might generate returns below what they envision due to their limited experiences (Wang et al. 2016). However, older CEOs have had more time to learn, accumulate knowldge and develop their cognitive schema, which allow them to implement limited strategic actions (Wang et al. 2016). Thus, this discussion leads to the following hypotheses:

H3: As prospector owner-manager age increases, firm innovation performance decreases.

2.2 Conceptual model

Building on the concepts of prospector owner-manager and innovation performance, supported by the above-described theoretical background, Figure 1 illustrates the conceptual framework of this research.

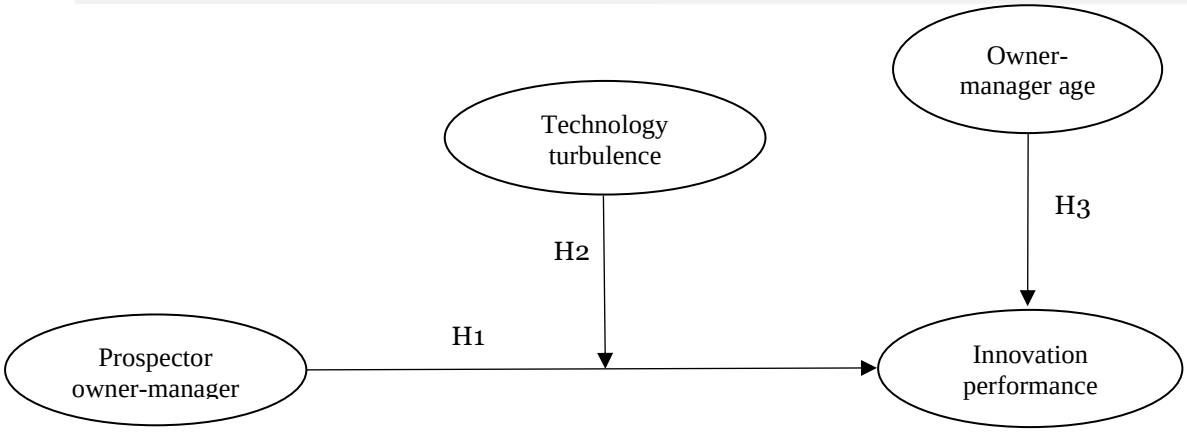


Figure 1: Prospector owner manager and innovation performance

2.3 Sample

In this study, we used survey research as it's recommended for explanatory and predictive theory in order to ensure greater confidence in the generalisability of the results (Straub, Boudreau, and Gefen 2004). More specifically, we used a cross-sectional survey to collect the data and test the research model. We developed a list of chief executive officers (CEOs), and other directors (R&D, marketing, sellers, engineering) from the manufacturers SMEs that are registered in the database of Centre de Recherche Industriel au Québec (CRIQ). In this study, CEOs were the primary informants because they represent an essential source of information for the evaluation of variables in this study. We sent 533 inquiries, and we received 155 responses from which we excluded 15 responses that miss data. In total, 140 questionnaires were usable. According to Hoyle (1995), a sample size between 100 and 200 should be sufficient to test the research model using structural equation modelling. The rate of response corresponds to 26%. Taking into account the time slack of SME managers, this reponse rate can be considered a good manager online survey (Hausberg and Leeflang 2019).

2.4 Measures

To measure the constructs, we developed and validated scales based on the extant literature. Before to send the survey, we adapted the scales and carried out a pilot study in order to ensure that the measures were valid and reliable. We validated the content of scales in collaboration with practitioners and academics (Hambrick 1981). After evaluating the questionnaire, we conducted a pilot study to ensure the measurement was reliable (Churchill 1979). We carried out the purification of all measures to ensure that Cronbach's alpha values are greater than 0.7 (Hair et al. 2016). Measurements are made using 7-point Likert-style scales where the scale items range from 1 (Strongly Disagree) to 7 (Strongly Agree).

To measure prospector owner-manager, we adopted Covin et Slevin (1988) scale (6 items), which covers the dimensions of proactivity, aggressiveness and risk taking. We measured technology turbulence, we utilised Wang and Miao (2015) scale (4 items) by assessing developments in industry, opportunities generated by changing technologies, innovative ideas created by technological advances and significant technological developments. To measure innovation performance, we adapted Ortega et Garcia-Villaverde (2011) scale (5 items), which covers both objective and subjective measures.

3. Data analysis and results

3.1 Demographic profile of respondents

The results exhibit some demographic profiles of respondents. 37.85 % of participants were in the age group of 45-54 years, followed by 25.00% of participants which were in the age group of 55-64 years, and 18. 57% of participants were in the age group of 45-54 years. The results also highlight that 37.85% of respondents were the chief executive office followed by 22.00% of participants were the director-general.

3.2 Measurement model analysis

To assess the hierarchical research model, we used SmartPLS (v. 3.3.3) (Ringle, Wende, and Becker 2015). to estimate the parameters in the outer and inner models. We used the repeated indictors approach with a path weighting scheme and nonparametric bootstrapping (Chin 2010) with 1000 replications (Hair et al. 2016). To assess the research model, we evaluated the measurement model in terms of construct reliability, unidimensionality, convergent validity, and discriminant validity. To do this, the loadings, Crombach's alpha, convergent validity (AVE) and composite reliability of constructs were confirmed, and we have deleted the item POM3 and INP1 due their values were less than 0.7. The results in the Table 1 indicate that the unidimensionality of the measurement model is validated by the internal consistency of the items which have loadings values greater than 0.7 (Chin 2010), the reliability constructs with Cronbach's Alpha, which exceeds 0.70 (Hair et al. 2016) and the AVE of each construct which are greater than 0.50 (Chin 2010).

Table 1 - Standardised loadings, reliability, and validity (***p < 0.001).

constructs	Indicators	Loadings	Cronbach's Alpha	Composite reliability	AVE
Prospector owner-manager	POM1	0.72***	0.88	0.95	0.67
	POM2	0.89***			
	POM4	0.74***			
	POM5	0.88***			
	POM6	0.87***			
Innovation performance	INP1	0.76***	0.87	0.89	0.66
	INP2	0.80***			
	INP3	0.89***			
	INP4	0.83***			
	INP5	0.81***			
Technology turbulence	TTC1	0.87***	0.94	0.96	0.86
	TTC2	0.91***			
	TTC3	0.95***			
	TTC4	0.96***			

We ensured discriminant validity as recommended by Hair et al. (2016) to test if a construct is truly distinct from other constructs by empirical standards. Hair et al. (2016) suggest comparing the square root of the AVE values with the latent variable correlation. As we can see in the Table 2, the square root of AVE of a construct was higher than its correlations with other constructs, which means that the latent constructs have different items, and they are conceptually distinct from each other (Chin 2010).

Table 2 -Inter-correlations of constructs

	PRI	INP	TTC
PRI	**0.803**		
INP	0.344	**0.777**	
TTC	0.400	0.334	**0.917**

3.3 Common Method Variance (CMV)

To assess common method variance in PLS approch, Kock and Lynn (2012) propose to test both vertical and lateral collinearity for all latent variables in a model, and the occurrence of a VIF must be less than 3 (Kock and Lynn 2012). In our case, all the VIF values were 1.160, which is less than 3. This indicates that the research model does not present common method bias (Kock 2015). Finally, we estimated the goodness of fit as proposed by Hair et al. (2016). To do this, we used the

following formula: GoF = $\sqrt{(AVE \times R2)}$, and the results show that the GoF value is 0.39, which is greater than 0.36 proposed by (Hair 2009).

3.4 Structural model analysis

In this section, we analysed the research hypotheses by testing the path coefficients. Table 7 presents the results of the structural model, including the path coefficients values, and significance values related to paths. We used the bootstrap re-sampling (1000) process (Hair et al. 2016) to assess the structural model.

Table 3 – Hypotheses testing.

Paths	Path coefficients	t-value	Support
Prospector owner-manager → Innovation performance	0.350***	3.368	Yes
Prospector owner-manager **x** technology → turbulence innovation performance	0.326***	2.641	Yes
SMEs age → Innovation performance	0.259***	2.985	Yes

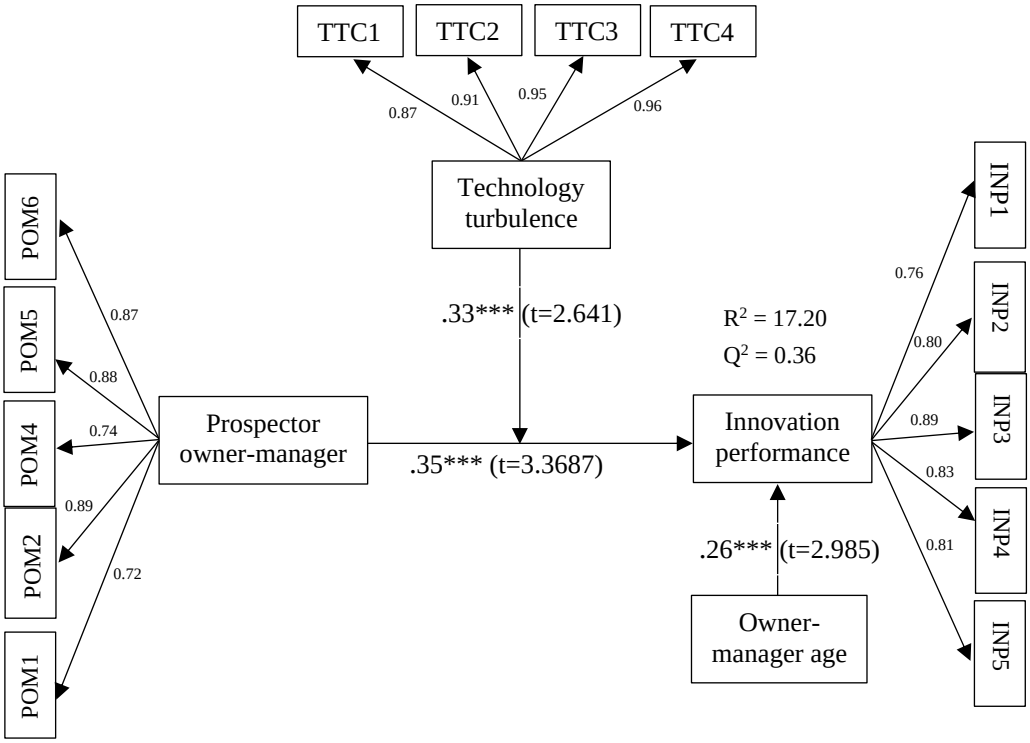
***$p < .001$, **$p < .005$

The structural model indicates that prospector owner-manager has a positive effect on innovation performance (β = 0.35, t = 3.368, p < 0.001); this result provides support for H1. For moderating role in H2 as shown in Table 3, the interaction between prospector owner-manager and technology turbulence on the SMEs innovation performance was statistically significant (β = 0.326**, t = 2.641, p < 0.001). Therefore, H2 supported. Finally, the SMEs age is a control variable for innovation performance (β =0.259, t = 2.985, p < 0.01), provides support for H3.
The evaluation of structural model requires checking variance R^2 and Stone-Geisser coefficient Q^2, which present the relevance and the predictive power of the research model (Hair, Ringle, and Sarstedt 2011). In this study, the R^2 calculated was 17.20% (t = 3.780, p < 0.001), which is positive and significative. To assess Q^2, we used Blindfolding technique as recommended by (Hair et al. 2016). The Q^2 value was 0.36, which indicates that our research model presents a large prediction due to the fact that the Q^2 value is greater than the threshold of 0.35 (Hair et al. 2016).

4. Discussion

The objective of this research has been to study the relationship between prospector owner-manager and innovation performance of SMEs in the technology turbulence context. The results show the positive effects of prospector owner-manager on innovation performance. Overall, the empirical results of this study demonstrate that SME with prospective strategy are able to seize the opportunities created by technology turbulence in order to transform them into innovation. This finding is in line with previous results showing that SMEs which operate in a technology turbulence

and have a prospective strategic posture are able to achieve innovation performance (Alexy, George, and Salter 2013; Raymond et al. 2018).



Hassani's (2020) thesis results highlight that information technologie capabilities allow to SMEs to understand customer needs, technology trends and competitors strategies. Soltanifar, Hughes, and Göcke (2021) point out that technological turbulence helps the digital prospector entrepreneur to seeks the adoption of new technologies in order to create a competitive advantage and remain competitive. However, when working in less technology turbulence, it is more beneficial to take advantage of traditional technological capabilities. In the same vein, the results of Raymond et al. (2018) study show that SMEs with prospective strategy and technologie capabilitie configurations can achieve product innovation performance. King (2007) and Westerman and Curley (2008) point out that information technology supports innovation processes which in turn contributes to innovation performance of organisations. Moreover, the firms that operate in technology turbulence and using tools as business intelligence can improve their dynamic capabilities and achieve sustainable innovation (Hassani & Al Halbusi, 2023).

Otherwise, Bommer and Jalajas (1996) point out that, due the conservative culture, Canadian companies are less aggressive and less proactive concening competitivity. Contrary to these assertions, our results show that owner-managers of Canadian SMEs are proactives, agressives and take the risk. Our finding also reinforces Tanev's (2004) study highlighting that the leaders of small Canadian companies give more importance to environment scanning by adopting prospecting tools, as competitive intelligence, in order to be more innovatives. The presented finding also suggest that the younger owner-manager of SMEs working in a technology turbulence with a higher intensity, are more innovative (Liem and Hien 2020).

5. Theoretical contribution and managerial implications

There are many of research implications that emanate from this study. First, although the results cannot be generalized to all firms in Canada, at least the results show that a significant portion of SMEs have forward-looking strategic postures, which contradicts some previous studies. Second, as the results show, the Stone-Geisser coefficient is important, which means that our research model has been empirically validated and could predict the innovation performance of SMEs based on proactive and prospective strategies. Third, this study also shows that in a context of technology turbulence, young entrepreneurs are more innovative, may be to their familiarity with technology. Fourth, the measurement of innovation performance with an objective and subjective approach (example: satisfaction of the CEO regarding innovations) could be considered as a methodological contribution in this study.

This study also has some implications for owner-managers of industrial SMEs. It has become important to be attention of strategic posture whitin SMEs in order to set up an appropriate strategy which allow them to be more innovative. More specifically, the choice of a forward-looking strategy allows SMEs to capture the opportunities created by the technology turbulence, in terms of creative ideas, adoption of new technologies and technological product development. The changing of technology creates altered operating spheres and thus a new range of methods for generating value (Wilden and Gudergan 2015). Therefore, the prospector owner-managers confronted to technology turbulence may reconfigure their technological capabilities to counter the threat and seize the opportunities. Managers should enhance their innovation performance by adopting product development technologies (Raymond et al. 2018). Moreover, CEOs with a non-prospector profile and who cannot take the risk to innovate, should involve external partners and internal managers with intrapreneur profiles in the decision-making process. This allows them to share risk and support the innovation process.

6. Conclusion, limitations, and future research

Our empirical study was tested with reliable questionnaire survey and data. It highlights how SMEs with a prospective strategy could improve their innovation performance in a technology turbulence where the uncertainty is higher. Nevertheless, this study has certain limitations that must be mentioned. First, the sample contents many products and services SMEs of the manufacturing

sector, which presents a large characteristic heterogeneity. We believe that the replications of the conceptual model in a specific context would enhance its generalisability. The further study could focus on a particular industry sector to consider other profiles of owen-managers. Second, this study adopted cross-sectional data which have criticised by Rindfleisch et al. (2008) for several reasons including common method variance bias. Future research should use a longitudinal design to collect data during different periods. Third, according to the research model, the prospector owner-manager explains only 27.90% of innovation performance. To understand better how SMEs with a prospective strategy achieve innovation performance, the future research could integrate other variables as absorptive capacity and dynamic capabilities. Indeed, according to the dynamic view, enterprise capabilities should be incorporated to advance thinking on organisational strategy with an emphasis on reconfiguring those capabilities when technology turbulence is high. Alexy, George, and Salter (2013) and Rehman et al. (2020) underline that SMEs which operate in very high technology turbulence require a better absorption capacity to seize the opportunities. Similarly, Hassani and Mosconi (2022) suggest that in the high technology turbulence, SMEs need to have technologies dynamic capabilities to face challenges and be more competitive. Finaly, future studies could include other control variables related to the firm's IT organisation.

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