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RESEARCH NOTES AND COMMENTARIES

INNOVATION PRACTICE AND ITS PERFORMANCE IMPLICATIONS IN SMALL AND MEDIUM ENTERPRISES (SMEs) IN THE MANUFACTURING SECTOR: A RESOURCE-BASED VIEW

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Small and medium enterprises (SMEs) in the manufacturing sector make a significant contribution to economic growth, yet most of the research into innovation management in the manufacturing sector has focused on large organizations. This article, however, identifies innovation drivers and their performance implications in manufacturing SMEs. Its study gathered survey data from a sample of 600 Australian SMEs and found that SMEs are similar to large firms with respect to the way that innovation strategy and formal structure are the key drivers of their performance, but do not appear to utilize innovation culture in a strategic and structured manner. This study therefore concludes that SMEs' performance is likely to improve as they increase the degree to which they mirror large manufacturing firms with respect to formal strategy and structure, and to which they recognize that innovation culture and strategy are closely aligned throughout the innovation process. Copyright © 2010 John Wiley & Sons, Ltd.

INTRODUCTION

Small and medium enterprises (SMEs) are different from large organizations. These differences primarily relate to such defining SME characteristics as a reactive, *fire-fighting* mentality, resource limitations, informal strategies, and flexible structures (Hudson, Smart, and Bourne, 2001; Qian and Li, 2003). As a consequence, they tend to have a failure rate higher than that of large organizations. The United States Small Business Administration (SBA) found that 24 percent of all new businesses in the United States failed within two years, and that 63 percent failed within six years (Wheelen and Hunger, 1999). Lu and Beamish (2001) observed similar failure rates in Australia, the United Kingdom, Japan, Taiwan, and Hong Kong. Wheelen and Hunger (1999) found the high failure rate to be largely due to informal strategic planning processes and a lack of systems to keep track of the SMEs' performance.

SMEs in the manufacturing sector are also confronted with increased competition from cheaper manufactured products from such countries as

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China and India (Bessant and Tidd, 2007), and are consequently struggling to develop appropriate strategies for competing with them. In light of the SBA's findings noted earlier, it is reasonable to assume that SMEs need to formalize their structures and systems in order to become more competitive (Bessant and Tidd, 2007), yet a long-running debate has been taking place in the innovation literature on the relative strengths and weaknesses of formality and informality in SMEs (Wheelen and Hunger, 1999; Qian and Li, 2003).

The supporters of formality have argued that SMEs need to improve their organizational capabilities by formalizing their structures and systems in order to become more efficient (Bessant and Tidd, 2007; Prakash and Gupta, 2008). Innovation in the manufacturing sector generally focuses on process improvements, for which formal structures and systems are necessary to squeeze costs out, and large manufacturing firms have generally succeeded with this strategy by focusing on process improvement (Wheelen and Hunger, 1999; Bessant and Tidd, 2007).

Supporters of informality, however, argue that SMEs do not need to formalize their structures and systems due to the limited range of products that they develop for niche markets. They base this argument on the premise that flexible structures are a significant source of SMEs' competitive advantage over large firms (Fiengenbaum and Karnani, 1991; Appiah-Adu and Singh, 1998; Narayanan, 2001; Qian and Li, 2003). This contradiction gives rise to a theoretical tension between formality and informality for manufacturing SMEs. This tension needs to be explained by identifying the elements of formal and informal structures that have an effect on SMEs' competitiveness and why these are important.

First, assuming that formal structures do not matter for manufacturing SMEs when they actually do, could lead to poor implementation of the firms' strategies, given that implementation occurs through such structural mechanisms as standard operating procedures (Aysegul, 1997). The main elements of formalization that past studies have found to be important for manufacturing SMEs are procedures and organizational standards (Prakash and Gupta, 2008). These elements are important because they enhance the clarity of the employees' roles and lead to employee commitment, involvement, and organizational effectiveness (Patel, 2005; Prakash and Gupta, 2008).

Next, assuming that formal structures do matter for manufacturing SMEs when they actually do not, could lead to decisions with a negative effect on innovation. Narayanan (2001 : 86) found that formalization and centralization stifle innovation. The elements of informality that are important for manufacturing SMEs are flexible structures and systems that enable them to respond quickly to market uncertainties (Appiah-Adu and Singh, 1998; Damanpour, 1992).

Both formality and informality are therefore important for SME competitiveness. Schumpeter's (cited in Narayanan, 2001: 85) two-phase innovation theory explains the conditions under which formality and informality are likely to be important for manufacturing SMEs. The *entrepreneurial innovation* phase relates to new product development, for which informal structures are necessary. The *managed innovation* phase relates to cost efficiencies through process improvement. Schumpeter argued that as markets mature, SMEs' competitive environments shift to price, creating the need to reduce costs through process improvements. It is therefore reasonable to predict that formality is likely to be more important for manufacturing SMEs in the managed innovation phase, in which cost strategies and formal structures are necessary to achieve cost efficiencies (Bessant and Tidd, 2007; Moore and Tushman, 1982). This article will therefore investigate two research questions: (1) What are the key drivers of innovation in manufacturing that lead to improved SME performance? and (2) How do the innovation practices of SMEs differ from those of large firms in the manufacturing sector?

This study's major contribution is the method used to identify the effects of innovation practices on SME performance and how an innovation theory can be tested. It also contributes to our understanding of how innovation practices in SMEs differ from those of large firms in the manufacturing sector.

LITERATURE REVIEW AND THEORETICAL MODEL

This study reviewed the literature relating to innovation in manufacturing SMEs in order to identify relevant constructs to form the basis for the development of a theoretical model, and uses the resource-based view (RBV) of the firm to explain

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the manner in which manufacturing SMEs develop competitive advantage compared to the manner in which large firms do (Barney, 1991). The RBV focuses on the link between strategy and firms' internal resources through the *VRIO* framework. This consists of *value* (V), or whether it provides competitive advantage, *rareness* (R), or whether competitors possess it, *imitability* (I), or whether it is costly for competitors to imitate, and *organization* (O), or whether the firm is organized to exploit the resource (Barney, 1991).

SMEs in the manufacturing sector develop competitive advantage through their staffs' creative potential to develop differentiated products for niche markets (Damanpour 1992; Fuchs *et al*., 2000). Large manufacturing firms, however, develop competitive advantage based on cost efficiencies gained through formalized structures and systems (Porter, 1990; Benner and Tushman, 2003; Bessant and Tidd, 2007). The discussion about the manner in which SMEs and large companies compete is consistent with Schumpeter's (cited in Narayanan, 2001: 85) innovation theory noted earlier. Several innovation-related constructs have emerged as potential independent variables for inclusion in the theoretical model. These are knowledge, routines, strategy, technology, structure, and culture (Rouse and Daellenbach, 2002).

This study has therefore adopted the integrative definition of innovation proposed by Freeman (1982) in Bessant and Tidd (2007 : 12), which defined innovation in the manufacturing sector as, 'the technical, design, manufacturing, management and commercial activities involved in the marketing of a new (or improved) product or the first commercial use of a new (or improved) process or equipment.' The constructs in the theoretical model should measure Freeman's view of innovation practice in manufacturing SMEs.

Development of a theoretical model and hypotheses

The review of the innovation literature on manufacturing SMEs revealed a large number of anecdotal and empirical articles. I reduced these to approximately 20 articles by rejecting those that did not comply with acceptable standards of methodological rigor (Flynn, Schroeder, and Sakakibara, 2004). I then utilized criteria based on comprehensiveness and parsimony to reduce these into five independent constructs and one dependent construct (Whetten, 1989). Figure 1 illustrates the

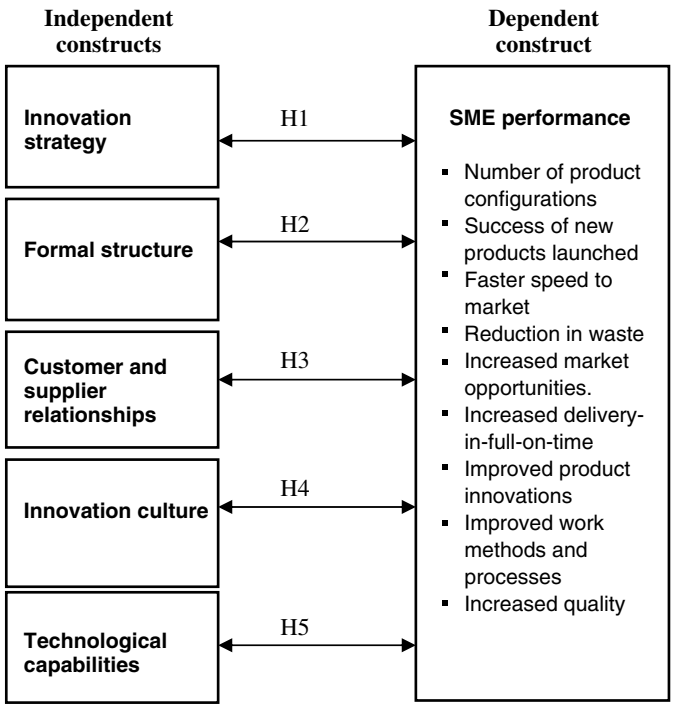

Figure 1. Theoretical model: relationship between independent constructs and dependent construct SME performance

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independent constructs of innovation strategy, formal structure, customer and supplier relationships, innovation culture, and technological capabilities, and how these relate to SME performance as the dependent construct, leading to the formulation of the research hypotheses.

The next section discusses the potential impact that each construct would be likely to have on SME performance, leading to the formulation of research hypotheses (see Figure 1).

Innovation strategy

The literature generally agrees that organizations with formal strategies performed better than those without strategies (O'Regan, Ghobadian, and Gallear, 2005). However, SMEs typically have informal strategies, largely driven by their chief executive officers (CEOs), compared to large organizations, which generally have separate strategic-planning units (Hudson *et. al*., 2001). Kraus, Reiche, and Reschke in Terziovski (2009 : 112) summed up SMEs' perceptions of strategic planning as, 'Formal planning is often regarded as limited to large enterprises and thus not transferable to the requirements of the fast-moving and flexibly structured SMEs.' Therefore:

Hypothesis 1 (H1): The relationship between innovation strategy and SME performance is positive and significant.

Formal structure

The variable most closely related to structure is organizational size (Meijaard, Brand, and Mosselman, 2002). However, the literature on the relationship between organizational size and innovation is inconsistent (Camison-Zornoza *et al*., 2004). For example, an organic structure facilitates both a high level of responsiveness to customer needs and collaborative efforts toward team development (Saleh and Wang, 1993). It may, however, be inadequate with respect to taking advantage of efficiencies, given that manufacturing firms rely on functional specializations in order to improve their level of cost efficiency (Benner and Tushman, 2003; Camison-Zornoza *et al*., 2004). Therefore:

Hypothesis 2 (H2): The relationship between formal structure and SME performance is positive and significant.

Customer and supplier relationships

Developing partnerships with customers and suppliers allows manufacturing SMEs to maximize the use of their limited resources (Appiah-Adu and Singh, 1998). Developing such partnerships can provide them with opportunities to acquire new skills and improve existing ones. This also allows them to pursue cooperative joint ventures as a means of sharing risk (O'Regan *et al*., 2005). However, due to their limited resources, SMEs may not have the time and expertise to develop partnerships and to pursue cooperative joint ventures. Therefore:

Hypothesis 3 (H3): The relationship between customer and supplier relationships and SME performance is positive and significant.

Innovation culture

O'Regan *et al*. (2005) considered culture to be one of the most common impediments to the implementation of innovation. SMEs tend to have flexible innovation cultures, which are typically characterized by relatively low resistance to change, low risk aversion, and tolerance of ambiguity (Acs *et al*., 1997; Saleh and Wang, 1993). Damanpour (1992) found that innovation cultures in large organizations tend to be more formalized and based on research capabilities and operating procedures. Therefore:

Hypothesis 4 (H4): The relationship between innovation culture and SME performance is positive and significant.

Technological capabilities

Manufacturing SMEs are typically established around a single breakthrough technological capability and tend to direct most of their resources toward commercializing their technology (Qian and Li, 2003). Large manufacturing organizations, however, often receive recognition for being innovative due to their ability to redesign their work processes continuously by taking advantage of advanced technology and such continuous improvement methods as total quality management and just-in-time (O'Regan *et al*., 2005; Samson and Terziovski, 1999). Therefore:

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Table 1. Bivariate correlation matrix of independent and dependent constructs

Factor	F1: Innovation strategy	F2: Formal structure	F3: Customer and supplier relationships	F4: Innovation culture	F5: Technological capabilities	F6: SME performance
F1	1.000					
F2	0.241**	1.000				
F3	0.344**	0.163*	1.000			
F4	−0.070	−0.259**	0.124	1.000		
F5	0.101	0.021	−0.041	0.042	1.000	
F6	0.477**	0.566**	0.201*	−0.100	−0.064	1.000

* Correlation is significant at the 0.05 level (one-tailed). ** Correlation is significant at the 0.01 level (one-tailed).

Hypothesis 5 (H5): The relationship between technological capabilities and SME performance is positive and significant.

SME performance

I developed an SME performance construct according to Venkatraman and Ramanujam's (1986) organizational performance framework. It consists of several dimensions of business and operational performance, as outlined in Figure 1.

METHODOLOGY

This section addresses this study's methodology and data collection, which reinforce its unique aspects. I specifically designed and pilot tested a survey instrument for this study, and employed a systematic random sampling procedure to draw a sample of 600 manufacturing SMEs from a data file of 20,000 firms compiled by Dunn & Bradstreet. It gathered data about the Australian manufacturing sector using the Australian Standards Industrial Classification codes. More than 50 percent of the respondents were managing directors and CEOs. The rest of the respondents worked at the middle-management level. Eighty percent of the respondents worked in either the fabricated metal products, basic metal products, or tooling and machinery industries.

The organizations that responded to the survey ranged in size from 21 to 99 employees, with an average of 65 employees. I deleted each response that contained seven or more empty cells from the dataset, which accounted for 1.2 percent of the responses. Within the remaining sample, I substituted the variable mean for the missing cells. This approach yielded 195 responses, a response rate of 32.5 percent. I checked for response bias by conducting telephone interviews with 30 non-respondents. Analysis of this data revealed no significant response bias in the sample (Hair *et al*., 1992).

DATA ANALYSIS

Table 1 shows the bivariate correlation relationships between innovation practice and SME performance. I checked the multicolinearity of the independent variables by removing those with an intercorrelation coefficient above r=0.9 (Hair *et al*., 1992). Qian and Li (2003) found that causality is impossible to determine at a single point in time. This study makes the assumption that the independent variables have a causal relationship with SME performance, as it is reasonable to expect the model's explanatory variables to contribute to SME performance over time. It is possible that high SME performance could be driving the successful implementation of their product and process innovation practices (Qian and Li, 2003).

Table 2 shows the multiple regression analysis results of the SME performance construct that I regressed on the model's five explanatory constructs. As hypothesized, innovation strategy and formal structure demonstrated a positive and significant relationship with SME performance. These constructs were significant in the regression analysis, supporting Hypothesis 1 (r=0.477, p= <0.01, Sig T=4.554) and Hypothesis 2 (r=0.566, p<0.01, Sig T=5.226). However, the study found limited correlation support for customer and supplier relationships, which were not significant in the regression analysis, therefore only partially supporting Hypothesis 3 (r=0.201, p= <0.05, Sig T= −0.127).

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Table 2. Multiple regression analysis

Multiple R			0.616
R square			0.380
Adjusted R square			0.351
Standard error			0.768
Analysis of variance (ANOVA)	DF	Sum of square	Mean square
Regression	5	38.758	7.752
Residual	107		
F=13.115	Significant F = 0.000		

Factor	Variables	Beta	T	Sig T
F1	Innovation strategy	0.379	4.554	0.000
F2	Formal structure	0.423	5.226	0.000
F3	Customer and supplier relationships	−0.011	−0.127	0.899
F4	Innovation culture	0.048	0.597	0.552
F5	Technological compatibilities	−0.109	−1.414	0.160

Innovation culture and technological capability displayed an insignificant but negative correlation with SME performance, and were not significant in the regression analysis, therefore rejecting Hypothesis 4 ($r = -0.100$, $p > 0.05$, Sig T=0.552) and Hypothesis 5 ($r = -0.064$, $p > 0.05$, Sig T=0.160). The negative coefficients (β) in Table 2 can be explained by interpreting the least-squares regression scheme (Hair *et al*., 1992). The implications of such powerful explanatory variables as innovation strategy and structure caused the solution to be positioned so that the technological capabilities construct achieved a weaker significant negative position and innovation culture achieved a weaker positive and insignificant position (Samson and Terziovski, 1999; Hair *et al*., 1992). Reliability analyses revealed that the Cronbach alpha values meet the standard of reliability for survey instruments (Nunnally, 1978). I conducted content validity, structural validity, and criterion validity checks (Kaynak and Hartley, 2006) and found the constructs to have content validity, as I based the selection of the items for the theoretical model on the review of the manufacturing SME literature on innovation (see Tables A1 and A2 in the Appendix).

I then conducted a confirmatory factor analysis to check structural validity (Hair *et al*., 1992), using a factor loading of +0.35 to remove the constructs' weak indicators. The factor loadings for each of the items in Tables A1 and A2 in the Appendix were above +0.5. Hair *et al*. (1992) considered these values to be highly significant. I therefore judged the constructs in the theoretical model to have construct validity. The survey items and factor loadings demonstrate the robustness of these findings. I then checked criterion validity by examining the multiple R coefficient (R=0.616) and the adjusted R square (0.351) values (see Table 2). These values suggest that the model has an acceptable degree of criterion validity and explain 35.1 percent of the variance in SME performance.

I then used the residual method to check the assumptions underlying the use of multiple regression analysis in order to ensure that the results were an accurate representation of the sample (Hair *et al*., 1992) and checked the constant variance of the error terms, which includes the independence of the error terms and the normality of the error-term distribution. Based on these findings, I concluded that the linearity of the phenomenon measured was not violated (Hair *et al*., 1992). The theoretical model is therefore reliable and valid and explains an acceptable level of variance in SME performance. These findings warrant an in-depth theoretical evaluation, which the next section presents.

DISCUSSION OF RESULTS

The results show that innovation strategy and formal structure are positive and significant predictors of the performance of SMEs in the manufacturing sector. Formalization is therefore important for manufacturing SMEs in order to improve their performance. However, only limited correlation support exists for customer and supplier relationships, which were not significant in the regression analysis. This leaves innovation strategy and formal structure as the key drivers of innovation leading to high SME performance.

Schumpeter's (cited in Narayanan, 2001: 85) two-phase innovation theory may be used once again to explain why innovation strategy and formal structure are the key drivers of SME performance. Strategy in the entrepreneurial

innovation phase is based on new product development and is reliant upon organizational slack to drive innovation as environmental uncertainty increases (Narayanan, 2001; Bessant and Tidd, 2007). However, as markets mature and as SMEs survive the liability of newness, their competitive environment shifts to price (Bradley and Rubach, 1999), and they consequently need to reduce costs during the managed innovation phase (Bessant and Tidd, 2007; Bradley and Rubach, 1999; Porter, 1985). This study concludes that the adoption of a cost-based strategy in the managed innovation phase is likely to enable manufacturing SMEs to increase their performance (Kraus *et al*., 2009). The results in large organizations should mirror these findings.

Empirical evidence from the literature explains why formal structure represents a key driver of innovation leading to successful SME performance. Prakash and Gupta (2008) found a positive and significant relationship between formalization and the implementation of innovation in SMEs. In addition, Khan and Manopichetwattana (1989) posited that formalization addresses resistance to change during implementation. However, these findings contradict the traditional view that formalization varies inversely with innovation (Acs *et al*., 1997; Damanpour, 1992).

It is therefore necessary to provide an alternative explanation of the findings in regard to the relationship between structure, firm age, and innovation. It may be assumed that formal structure is a proxy for firm age (Patel, 2005), and that the performance of relatively older firms in the manufacturing sector is higher than that of younger firms (Camison-Zornoza *et al*., 2004; Damanpour, 1992).

A further review of the literature revealed mixed results. For example, Patel (2005) concluded that firms' performances decline with age. Fiengenbaum and Karnani (1991) supported this by finding that young firms with flexible structures have a significant source of competitive advantage over large firms. This may be true in industries in which timely adaptation to changes in environmental conditions is paramount (Damanpour, 1992). It is, however, still necessary for SMEs in the manufacturing sector to develop more formal structures during the managed innovation phase in order to increase cost efficiencies (Narayanan, 2001). Indeed, Damanpour (1992) also found that large firms in the manufacturing sector are more innovative than SMEs. Furthermore, flexibility could have a negative effect during the implementation of an innovation (Patel, 2005; Prakash and Gupta, 2008).

Formal systems and procedures are also important because they tend to add clarity to employees' roles, lead to employee commitment, and ultimately lead to organizational effectiveness (Patel, 2005; Prakash and Gupta, 2008). This is consistent with Bradley and Rubach (1999), who argued that young, flexible firms need to formalize quickly in order to avoid the liability of newness and smallness. Still, some SMEs operating in a dynamic environment can have complex structures (Damanpour, 1992), and some notably large firms operating in less-complex environments can have informal structures (Damanpour, 1992). Drucker (1998) reinforced the view that structure is strongly dependent upon the nature of the task and should be managed simultaneously with strategy and innovation culture (Ozsomer, Calantone, and Di Benedetto, 1997).

This study's correlation and regression analyses did not find a significant relationship between innovation culture and SME performance. This finding is surprising, given that the innovation culture construct consists of such soft items as rewards, informal meetings, and knowledge sharing (see Table A1 in the Appendix), and O'Regan *et al*. (2005) found these factors to have a positive effect on organizational performance. Such a contradictory finding can be explained by considering the research results the literature has reported. For example, O'Regan *et al*. (2005) found that SMEs do not use innovation culture in a strategic and structured manner. The literature therefore supports this study's finding that SMEs in the manufacturing sector have a negative perception of the relationship between innovation culture and SME performance. Gwynne (1999) supported this view by arguing that SMEs are driven by a fascination with new products and do not plan for the implementation of an innovation culture (Fiegenbaum and Kamani, 1991; Gwynne, 1999).

I would not expect large organizations' results to mirror such findings, as they are generally challenged with respect to the way they should embed innovation into their cultures by establishing smaller, more specialized divisions (Acs *et al*., 1997; Chandler, 2000; Damanpour, 1992). The implications of this discussion for SMEs are

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that both their performance and their management of the transition from entrepreneurial to managed innovation are likely to improve as they increasingly formalize and recognize that strategy and innovation culture are inseparable throughout the innovation process (Schumpeter, cited in Narayanan, 2001: 86).

This study found an insignificant negative correlation between technological capabilities and SME performance. Large organizations' results should mirror this finding. A possible explanation for this is that SMEs view technological capability as an enabler rather than a driver of their performance. A consideration of the implementation of the business process reengineering (BPR) concept in large organizations can explain it further (Bessant and Tidd, 2007; Davenport, 1993). BPR requires a radical departure from existing business paradigms and is especially dependent upon the successful implementation of information technology (Bessant and Tidd, 2007). When BPR programs fail, such failure tends to be due to an inability to align these programs with the firm's strategic objectives (Cole, 1994), and Holland and Kumar (1995) reported failure rates as high as 80 percent. The implication of this discussion is that SMEs and large firms should not view innovation from an exclusively technological perspective, but from a strategic and market-driven perspective instead (Bessant and Tidd, 2007).

CONCLUSION AND IMPLICATIONS

With respect to the first research question, this study concludes that the key drivers of innovation in manufacturing SMEs are innovation strategy and formal structure. The implication is that manufacturing SMEs are likely to improve their performance as they increasingly mirror large manufacturing firms with respect to strategy and formal structure. This finding is consistent with Damanpour (1992), who concluded that large firms are more innovative than SMEs in the manufacturing sector. With respect to the second research question, this study concludes that SMEs do not appear to use innovation culture in a strategic and structured manner. This is inconsistent with the literature, which suggests that innovation culture is a significant predictor of SME performance (O'Regan *et al*., 2005). The implication is that manufacturing SMEs' performance is likely to improve as they increasingly recognize that innovation culture and strategy are closely aligned throughout the innovation process (Narayanan, 2001). This study has some limitations. It gathered quantitative data from one respondent each within individual SMEs, and therefore presents an opportunity for future research in the manufacturing sector involving multiple respondents from SMEs and large organizations.

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APPENDIX

Table A1. Confirmatory factor analysis: independent variables

Construct or variable	Description of construct or variable	Factor loading	Reliability
F1:	**Innovation strategy**		
F1-1	The organization's vision or mission includes a reference to innovation	0.577	
F1-2	Innovation strategy has helped the organization to achieve its strategic goals	0.524	
F1-3	Increasing our production volume is an important measure of our process innovation	0.597	
F1-4	Improving administrative routines is seen as part of our innovation strategy	0.693	
F1-5	Internal cooperation is an important part of innovation strategy implementation	0.749	
F1-6	Customer satisfaction is part of our innovation strategy	0.751	
F1-7	Improving product or service quality is one of our key objectives of innovation strategy	0.780	
F1-8	Formulating innovation strategy increases employee skills	0.808	
F1-9	Improving employee commitment, morale, or both is part of our innovation strategy monitoring	0.859	
			$\alpha = 0.87$
F2:	**Formal structure**		
F2-1	Managers formally allocate resources to the use of cross-functional teams	0.537	
F2-2	Employees formally monitor developments in new technologies	0.584	
F2-3	Employees document and use failures as opportunities to learn	0.596	
F2-4	Managers provide systems to facilitate formal communication	0.604	
F2-5	Action plans or timetables and procedures are used to monitor progress	0.609	
F2-6	The senior manager encourages all employees to challenge the status quo	0.672	
F2-7	Our flat structure facilitates searching for and incorporating diverse points of view	0.687	
			$\alpha = 0.82$
F3:	**Customer and supplier relationships**		
F3-1	The firm's reputation is important to its competitive advantage	0.714	
F3-2	Customers have the same or similar technologies to the organization's	0.764	
F3-3	Customer satisfaction is important to the firm's competitive advantage	0.792	
F3-4	Product or service supply is important to the firm's competitive advantage	0.820	
F3-5	Suppliers have the same or similar technologies to the organization's	0.857	
			$\alpha = 0.71$
F4:	**Innovation culture**		
F4-1	Our culture rewards behaviors that relate to creativity and innovation	0.522	
F4-2	Our organization's culture encourages informal meetings and interactions	0.573	
F4-3	Our culture encourages employees to monitor their own performance	0.577	

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Table A1 (*Continued*)

Construct or variable	Description of construct or variable	Factor loading	Reliability
F4-4	Employees take risks by continuously experimenting with new ways of doing things	0.636	
F4-5	Our culture encourages employees to share knowledge	0.640	
F4-6	Our culture focuses on teamwork long term performance	0.710	
			$\alpha = 0.70$
F5:	**Technological capabilities**		
F5-1	Competitors have the same or similar technologies to the organization's	0.450	
F5-2	Managers allocate resources to sharing technology	0.596	
F5-3	Considers the use of technology as a driver of business growth	0.556	
F5-4	Technological objectives guide the evaluation of new ideas	0.652	
F5-5	Employees search for information and new ideas and technologies	0.715	
F5-6	Employees work toward specific technological goals or objectives	0.751	
			$\alpha = 0.72$

Table A2. Confirmatory factor analysis: dependent variables

Variables	Dependent construct	Factor loading	Reliability
	SME performance		
F6-1	Number of product configurations	0.545	
F6-2	Success of new products launched	0.565	
F6-3	Accelerated speed to market	0.653	
F6-4	Reduction in waste	0.653	
F6-5	Increased market opportunities	0.683	
F6-6	Increased delivery-in-full-on-time (DIFOT)	0.687	
F6-7	Improved product innovations	0.705	
F6-8	Improved work methods and processes	0.708	
F6-9	Increased quality	0.788	$\alpha = 0.84$

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