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Innovation in SMEs: the impact of strategic orientation and environmental perceptions

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Abstract

Purpose – To investigate the role and impact of strategic orientation and environmental perceptions on innovation and supporting mechanisms such as process technologies and management practices, in SMEs.

Design/methodology/approach – A quantitative approach based on a random sampling methodology of 1,000 SMEs. Construct validity was tested in the qualitative phase of the research.

Findings – SMEs can be categorised as either prospectors or defenders. This polarisation was confirmed in this study. For example, prospectors are more likely to engage in new product development, whereas defenders are five times more likely to modify an existing product than introduce a newly patented product. Prospector-type firms tend to deploy more new process technologies and leading management practices compared with defender type firms, particularly in a turbulent operating environment. Defenders recognise the need to "catch up" and indicate that they intend to introduce process technologies over the next two years. Firms tend to place a greater emphasis on innovation in turbulent operating environments.

Research limitations/implications – The study was restricted to two different sector types: engineering and electronics. Future studies should examine other sectors and their sub sectors, possibly augmented by qualitative in-depth case studies or an ethnographic approach.

Practical implications – The practical implications of the study are outlined in the paper. Chief executives are encouraged to align their strategic orientation with their innovation strategy. In addition, defender type firms should consider the greater use of process technologies and management practices.

Originality/value – This paper contributes to the integration of strategic orientation and innovation.

Keywords Innovation, Small to medium-sized enterprises, Strategic management

Paper type Research paper

Introduction

Today's business environment is probably the most dynamic that any business has faced. Practically anything that can happen to business is happening to some firm or other, as most seek to minimise the fall out from price wars, continuous cost efficiency drives and at the same time maximise new market opportunities (Amit and Zott, 2001). Prahalad and Ramaswamy (2003) contend that as:

> The convergence of multiple discreet technologies and major changes in the competitive landscape are transforming the market place, the potential for innovation is greater than ever.

By implication, failure to innovate is likely to result in reduced competitiveness. Others concur by stressing the importance of innovation as one of the primary means by

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which a firm can achieve sustainable growth (Senge and Carstedt, 2001; McEvily *et al.*, 2004), as well as address the key issues facing firms in today's competitive environment: greater cost efficiency and the provision of new products to meet customer's demands. The role of innovation and its importance as a driver of competitiveness, profitability and productivity is well documented in the literature (Porter, 1998).

The key issue facing many small- to medium-sized enterprises (SMEs) relates to how they can foster effective innovation using organisational supporting mechanisms (McEvily *et al.*, 2004). It is therefore no surprise that considerable research has been undertaken on the role and importance of innovation. However, the pattern of previous studies indicates a strong focus on the impact of research and development, almost to the exclusion of aspects such as innovation and its' various supporting mechanisms.

Innovation and supporting mechanisms

Innovation is defined by Linder *et al.* (2003) as "implementing new ideas that create value". This generic description refers to the various forms that innovation can take such as product development, the deployment of new process technologies or innovative management practices (Zott, 2003; Glynn, 1996). From a practitioner perspective, this means the adoption of new products and/or processes to increase competitiveness and overall profitability, based on customer needs and requirements (Zahra *et al.*, 1999; Mone *et al.*, 1998). Effective innovation therefore means that SMEs need to maximise the creative resources that they possess (Nonaka and Takeuchi, 1995). The importance of innovation as a driver of performance and competitive advantage is well covered in the literature (McEvily *et al.*, 2004; Shoham and Fieganbaum, 2002; Roberts, 1999; Hitt *et al.*, 1996; Banbury and Mitchell, 1995). Kanter (1999) encapsulates the benefits of innovation by stating that "winning in business today demands innovation". However, existing studies on innovation focus largely on drivers of product development such as creativity (Amabile *et al.*, 1996), resource availability (Dougherty and Hardy, 1996), mergers, acquisitions, divestitures, downsizing, and cost reduction (Hitt *et al.*, 1996), as well as firm size (Acs and Audretsch, 1988). More recently, attention has focused on the need to meet customer demands in shorter product cycles using flexible manufacturing systems (Zenger and Hesterly, 1997).

However, despite the numerous articles and theoretical discussions, there is no conclusive theoretical perspective on innovation (Drazin and Schoomhoven, 1996; Tushman and O'Reilly, 1997). Following a review of previous research on innovation, Shoham and Fieganbaum (2002) suggest the need for additional theoretical integration to link organizational context with innovation – an issue addressed by this study.

Aims of the research

While the literature outlines a number of barriers to innovation (Tidd *et al.*, 2001), there is a dearth of research on what encourages and drives product development, management practices and process technologies deployment from a strategic orientation perspective. In this paper, we examine the impact of strategic orientation and managers' perception of the operating environment on innovation in SMEs. We have focused on SMEs as their importance is well documented in terms of innovation (SGS Consulting, 2002). The sample of SMEs was selected using the European

Commission size criterion of firms employing up to 250 staff (see O'Regan, 2004). In addition, it is important to understand that SMEs are not smaller versions of larger firms. Their needs and often their decision-making processes differ significantly from those of larger firms (Shrader *et al.*, 1989).

The paper aims to refocus attention towards strategic orientation and its influence on product and process innovation. We were unable to find empirical research examining the association between strategic orientation and deployment of leading management practices or new process technologies. Accordingly, this study fills an important gap in the literature. In addition, we contend that innovation type decisions are influenced to a significant extent by the firms' perception of its operating environment. This paper is structured as follows: first, strategic orientation is outlined followed by a brief description of the operating environment. Second, the methodology outlines the conduct of the research. Third, the analysis is depicted and interpreted. Finally, the paper presents conclusions and recommendations for the future.

Strategic orientation

All firms, even in the same industry grouping, do not respond to the operating environment in the same way. For example, some firms may "anchor their reactions primarily to the behaviour of other firms that are strategically similar to them" (Garcia-Pont and Nohria, 2002). Others may adopt a more independent stance comprising various approaches such as a stronger emphasis on innovation. The responses to the operating environment can be categorised according to the strategic orientation of each firm.

Strategic orientation is defined by Manu and Sriram (1996, p. 79) as:

> How an organization uses strategy to adapt and/or change aspects of its environment for a more favourable alignment.

It is a primary means of understanding actions that firms take to achieve enhanced profitability, financial performance or competitive advantage. Hambrick (1983 p. 5) states that strategic orientation has a high degree of consistency, as it is "a pattern in a stream of decisions (past or intended) that guides the organization's ongoing alignment with its environment and shapes internal policies and procedures". In addition, it helps to:

> Bring order to the complex set of interrelated phenomena by identifying recurring patterns of decisions which then provide a comprehensive, yet parsimonious, orientation to the study of strategy (Slater and Olson, 2000).

To date, research has focused on the examination and validation of two principal typologies, Porter's generic strategies and the Miles and Snow's strategic orientation typology (Porter, 1980; Miles and Snow, 1978). Both typologies have distinct features (Segev, 1989). Kald *et al.* (2000, p. 207) suggests that the Miles and Snow's typology is primarily focused on strategic orientation whereas Porter's generic strategies are focused on strategic positioning.

We examined both typologies from an innovation perspective. For example, innovation is one of the principal drivers of the prospector orientation in the Miles and Snow typology as well as the basis of the differentiation focus in Porter's model of competitive advantage. We choose the Miles and Snow typology as it focuses on the "dynamic process of adjusting to environmental change and uncertainty" (Miles and

Snow, 1978, p. 3), and effectively takes into consideration the trade-off between external and internal strategic factors (McKee *et al.*, 1989). The literature suggests that the use of Porter's (1980) model of competitive strategy is not appropriate in the case of SMEs, as the element of choice is often restricted to a focus strategy (Rugman and Verbeke, 1987). On the other hand, the literature is highly supportive of the use of the Miles and Snow typology in SMEs (Olson and Currie, 1992; Rugman and Verbeke, 1987).

The next section will consider the Miles and Snow typology in greater detail.

The Miles and Snow typology

The Miles and Snow typology focuses on the direction and influence given by managing directors and the top management team to the firm's overall vision and direction. It suggests that three fundamental issues need to be addressed by decision-makers in any firm; managing the firm's share of the market (the entrepreneurial problem), deploying solutions (the engineering problem) and finally, structuring the firm to manage the processes outlined (the administrative problem). Miles and Snow's contention is that a pattern of the responses to these issues indicating the orientation of the firm can be detected. Four types of organisation were identified based on their approach to the changing operating environment – prospectors, analysers, defenders, and reactors (see Table I). Miles and Snow contend that every organisation has a dominant trait resulting from the influence of its key decision makers and their perceived view of the operating environment. The choice of whether to be proactive or reactive will, to a large extent, follow from this view.

Each of the strategic orientation types represents different approaches and perceptions of the operating environment. For example, prospectors welcome and

Strategic orientation	Main focus	Traits
Prospector	Entrepreneurial, Innovation and new opportunities orientated	External orientation, environment scanning, Maximise new opportunities. Innovation to meet market needs Flexibility and freedom from constraining company rules and regulations Welcomes change and sees the environment as "uncertain"
Defender	Defending existing market Targets a narrow market segment (may be a niche market) Uses variety of means to defend existing market	Narrow range of products/services Internal orientation, efficiency of existing operations Uses well established ideas/methods and avoids unnecessary risk Centralised control and a functional structure are common
Analyser	Hybrid of prospector and defender types	Operates well in both stable and dynamic markets. Uses efficiency and increased production in stable markets and innovates in dynamic markets
Reactor	Reacts to change	Short-term planning, reacts to others actions

Table I.
A summary of the Miles and Snow strategic orientation categories

thrive in innovative, dynamic environments, maximising new opportunities (Hambrick, 1983). Prospectors are likely to be first to the market place and seek to exploit this advantage. They have a tolerance of risk and an acceptance of change, empowerment and flexibility.

Defenders have a singular orientation as their managers "devote primary attention to improving the efficiency of their existing operations" (Miles and Snow, 1978). The focus of "defenders" is described as producing and distributing goods or services as efficiently as possible (Miles and Snow, 1978) and at the same time, preserving a stable market niche. While they are happy to achieve change, they feel more comfortable with existing strategies (McDaniel and Kolari, 1987). In practice, defenders are likely to adopt a cost leadership approach and focus on efficiency and continuous improvement. This is likely to necessitate a high level of control. Defenders are likely to be heavily bureaucratic and unlikely to adopt a dynamic approach to change.

Analyser type firms comprise a mixture of both the prospector and defender traits. They operate in stable markets, routinely and efficiently. In unstable markets they monitor competitors for new ideas and try out the more promising ones. In other words, Miles and Snow's key supposition is that a firm's product and markets lead to choices of how to compete (competitive advantage), to grow, and attain functional support. Essentially, "analysers" focus on efficiency and increased production when the market is stable and on innovation when the market is dynamic or uncertain (Slater and Narver, 1993).

Reactors are firms that adopt a *laissez-faire* approach to their operating environment and are largely unprepared for any changes arising. The main strategic goal of this category is "survival". Miles and Snow refer to the actions of "reactors" as being inconsistent, arising from a lack of clear goals and direction. Consequently, reactors are unlikely to be proactive and more likely to delay responding to the external environment until it is absolutely necessary. Conant *et al.* (1990) state that "reactors" respond to the challenges of the market in an erratic manner. Others go further than this and state that reactors "do not present any consistent pattern of response behaviour to environmental conditions" (Matsuno and Mentzer, 2000). Indeed, Miles and Snow (1978, p. 12) refer to reactors as firms whose "management fails to align strategy, structure, and context in a consistent fashion". Essentially this is a management approach of "last resort" and could be categorized as "continuous fire fighting".

Miles and Snow contend that the prospector, defender and analyser styles are capable of leading to competitive advantage within the industry. However, they caution that the reactor style is often a manifestation of a poorly aligned strategic orientation and structure, and is therefore unlikely to lead to competitive advantage. The literature base suggests that the continuum ranges from prospector to defender (Doty and Glick, 1994), with no longer any place for reactors (Ketchen *et al.*, 1993; Zahra and Pearce, 1990). Accordingly, the following hypotheses were formulated:

H1a. SMEs with a prospector strategic orientation will exhibit a higher degree of product innovation than firms with a defender strategic orientation.

H1b. SMEs with a prospector strategic orientation will exhibit higher deployment levels of new process technologies than firms with a defender strategic orientation.

H1c. SMEs with a prospector strategic orientation are likely to deploy leading management practices, more intensively than firms with a defender strategic orientation.

Operating environment

The degree and complexity of the current changing environment is driving firms, both large and small, to seek new ways of conducting business to create wealth (Stopford, 2001). However, managers are likely to perceive the importance of their firm's operating environment differently (Mezias and Starbuck, 2003). This means that opportunities and threats will be addressed in different ways (Bertrand and Schoar, 2003; Jackson and Dutton, 1988; Lang *et al.*, 1997). For example, firms operating in a dynamic or turbulent environment will be more aware of the need to be externally orientated, innovative and proactive (Crant, 2000; Naman and Slevin, 1993; Dess *et al.*, 1997; Markides, 1998). In this study we use the following factors to define a turbulent operating environment: short product cycle, rapid technological change and intense rivalry.

Previous empirical studies provide evidence that environmental turbulence (Naman and Slevin, 1993) and environmental complexity (Zahra, 1991) are both positively related to innovative, risk-taking and proactive behaviour by firms. It follows from this that manager's emphases on process technologies and management practices may be affected by how they see their operating environment. Accordingly, the following hypotheses were generated:

H2a. A turbulent operating environment will affect the likelihood of product innovation in prospector SMEs more than in defender SMEs.

H2b. A turbulent operating environment will affect the likelihood of adoption of new process technologies more in prospector SMEs than in defender SMEs.

H2c. A turbulent operating environment will affect the likelihood of adoption of leading management practices in prospector SMEs more than in defender SMEs.

Methodology

The sample consisted of 1,000 small- and medium-sized UK electronics and engineering firms. The reason for this choice was threefold. First, the contrasting product life cycles of the sectors. Engineering organisations, by and large, operate in a mature market, whereas electronic firms operate in a market characterised by short product life cycles. Electronics is one of the sectors identified by Linder *et al.* (2003) in which "innovation is competitively important". Second, the relative economic importance of the two sectors. Third, the presence of a large number of small- and medium-sized firms within the two sectors. Small- and medium-sized firms were defined as having fewer than 250 employees. As there are nearly 15,000 electronic/engineering SMEs in the UK (Department of Trade and Industry, 1996), it was decided to use a random sampling methodology using a directory available from a reputable commercial firm. Manufacturing firms were chosen as the levels of fixed commitment and capital are higher compared to service firms (Swartz and Iacobucci, 2000).

Based on an analysis of the Miles and Snow classification, each respondent was asked to indicate the best "fit" Miles and Snow type classification that was most appropriate to their firm. Rather than list the Miles and Snow categories we asked firms to indicate one of the following statements that best described their firm:

- "Competing on the basis of price, quality, delivery or service, and operating efficiency based on a strong emphasis on maintaining existing markets" (Defender type).
- "Focusing on efficient and increased production following a full analysis of directional strategy and how to compete" (Analyser).
- "Continually seeking opportunities and using flexibility to adapt and respond rapidly and creatively to the changing external environment" (Prospector).
- "Reacting to a market place based on observing the experiences of others and a preference for the short-term" (Reactor).

This approach enabled firms to give an objective response and avoided any unnecessary bias, where firms might try to indicate a preferable response category. This technique is widely used in management studies (Snow and Hrebiniak, 1980; Davig, 1986) and particularly in studies on the Miles and Snow typology (Conant *et al.*, 1990; Shortell and Zajac, 1990; James and Hatten, 1995; Rajagopalan, 1996). We were careful to indicate that the classifications were outlined in a random manner and were not ranked or intended to reflect a preferable behavioural type. Accordingly, the Miles and Snow typology types bracketed above, were not displayed in the questionnaire.

We used managerial perceptions as they shape to a significant degree the strategic orientation of the firm. This is consistent with the work of Chattopadhyay *et al.* (1999) and Spanos and Lioukas (2001). Gioia and Chittipeddi (1991, p. 434) stated:

> The CEO is portrayed as someone who has primary responsibility for setting strategic directions and pans for the organisation, as well as responsibility for guiding actions that will realise those plans.

In a review of the literature, Westphal and Frederickson (2001) found that top management has a significant impact on strategic orientation. The literature accepts the validity of CEO or general managers, self-tying of organisations strategic configurations (Hillman and Keim, 2001; Geletkanycz and Black, 2001).

The validity of the constructs used and their relevance was tested through the qualitative phase of the research. This involved in-depth interviews with six managing directors of SMEs and discussions with employer representative bodies such as the Chamber of Commerce and the Confederation of British Industry. Furthermore, the survey instrument was tested and modified through the pilot phase of the fieldwork.

The procedures used to analyse the responses included the determination of the reliability of the instrument. Internal consistency was established using Cronbach's alpha and factor analysis. Cronbach's alpha was used to test the scale reliability. Factor analysis was used to reveal the underlying themes and also as a means of data reduction. The validity of the constructs used and their relevance was tested in the qualitative phase of the research and the pilot testing of the survey instrument. Cronbach's alpha was used to test the scale reliability. Factor analysis was used to reveal the underlying themes and also as a means of data reduction. The relationship between strategic orientation, operating environment and the emphases on

management practices and process technologies was examined using descriptive statistics.

Analysis

Factors such as change in address, size and sector incompatibility reduced the effective size of the sample to 702 SMEs. A total of 194 valid responses were received – a response rate of 27 per cent. The analysis indicates that 47.4 per cent of the respondent firms perceive themselves as "prospectors" and 44.8 per cent perceive themselves as "defenders". Both styles accordingly account for over 92 per cent of all firms in this sample. This is consistent with expectations of the planning styles for prospectors and defenders put forth by Miles and Snow (1978). A total of 6 per cent of firms described themselves as analysers and only 2 per cent as reactors. The number of reactor type firms is too small for meaningful analysis. The emphasis by analysers on process technologies and management practices is depicted in Tables I and II for information purposes. However, we decided to omit both analysers and reactors from any further analysis.

A chi square test indicates that there is no association between strategic orientation and industrial sector ($\chi 2 = 4.73$, df $= 1$, $p = 0.49157$) in this sample. Accordingly, the analysis does not differentiate between engineering and electronics firms.

Strategic orientation and innovation

The results of the analysis depicting the relationship between strategic orientation and innovation are depicted in Table II.

The analysis indicates that prospector type firms are more likely to engage in product innovation compared with defender type firms. This is not unexpected. Defender type firms are five times more likely to modify existing products than introduce patented products. This reflects the nature of defender type firms and confirms their propensity to "defend" existing markets. Accordingly, *H1a* is accepted.

The emphases on process technologies by both prospector and defender type firms are depicted in Table III.

Table III indicates that a higher number of prospector type firms use computer controlled multipurpose machine centres compared with defender type firms. The difference are significant at $p < 0.01$. Prospectors have a higher use of robots in manufacturing, automated inspection and greater use of systems such as MRP and MRP11. Interestingly, prospectors also have a significantly greater use of digitalised interchange with both customers and suppliers. This suggests that prospectors strongly emphasise external orientation and are keen to access new opportunities. This is consistent with the dominant traits of prospector-type firms, where innovation is

Table II.
Percentage of firms engaged in product innovation according to strategic orientation over the last three years

	Prospector $n = 92$	Defender $n = 87$	Analyser $n = 9$
Modified existing products	72.8	54.9	66.6
Added a new product	76.3	42.8	77.8
New product in a new field of technology	44.7	17.7	11.1
Introduced a patented product	27.0	11.5	11.1

	Prospector $n = 92$		Defender $n = 87$		Analyser $n = 9$	
	In use now	Intend to use	In use now	Intend to use	In use now	Intend to use
Computer aided design and drafting	67.4	1.2	60.7	9.8	77.8	–
Computer numerically controlled machines	39.5	2.3	46.4	7.1	33.3	44.4
Computerised multi-purpose machine centres	19.3*	5.8	8.0*	5.4	11.1	11.1
Robots (manufacturing)	9.3*	7.0	5.4*	5.4	22.2	–
Robots (assembly)	7.0*	7.0	2.7*	2.7	11.1	–
Flexibility manufacturing systems	14.0	14.0	9.0	15.3	11.1	–
MRP	23.8*	15.5	14.2*	2.8	11.1	–
MRP11	14.8**	15.5	10.7**	3.9	11.1	–
Automated inspection	11.5*	10.3	5.4*	6.3	11.1	–
Digital interchange with suppliers	40.2*	23.0	23.4	28.8	11.1	–
Digital interchange with customers	26.4*	32.2	22.3	25.9	11.1	22.2
Automated stock control	19.5	26.4	23.2	19.6	11.1	44.4
Flexible assembly systems	19.5	16.1	22.3	15.2	22.2	–

Notes: *$p < 0.01$; **$p < 0.05$

Table III.
Percentage of firms emphasising process technologies

emphasised. The use of process technologies by defender type firms is also consistent with the main traits of defender firms. For example, they are more focused on efficiency measures using established mechanisms rather than focus on new processes. Accordingly, *H1b* is accepted.

Table IV depicts the degree of emphasis given by prospector and defender firms to management practices.

The analysis indicates that prospector type firms emphasise all management practices to a greater extent compared with defender type firms, with the exception of "planned preventative maintenance". Arguably, this is an internal controlling mechanism consistent with defender type activities. The differences between prospector and defender firms are statistically significant at $p < 0.01$. For example, the differences in the use of kaizan, spc, total quality management, quality function deployment, failure modes and effect analysis and kanban are all statistically significant. This is consistent with the literature that refers to the main focus of prospectors as being on effectiveness rather than efficiency focussed. Accordingly, *H1c* is accepted.

The attributes of the operating environment were factor analysed. The attributes loaded onto two factors: turbulent environment and stable environment. The analysis is depicted in Table V.

The analysis depicted in Table V indicates that prospector type firms are engaged in product innovation to a greater extent in both types of environment compared with defender firms. Interestingly, a higher percentage of both prospector and defender type firms modify existing products, add new products or introduce patented products in a turbulent environment compared with firms in a stable environment. While we expected that this might be the case, we did not anticipate that the difference would be

	Prospector $n = 92$		Defender $n = 87$	
	In use now	Intend to use	In use now	Intend to use
Kaizan	17.6*	3.3	7.2*	1.8
SPC	19.8*	4.4	11.7*	3.6
TQM	24.4*	18.9	14.3*	14.3
Quality function deployment	25.8*	10.1	13.5*	8.1
Health and safety progress	64.8	14.3	54.0	20.4
Quality policy deployment	46.2	11.0	42.9	12.5
ISO9000	57.1	27.5	56.4	20.4
Suggestion scheme	47.3	9.9	38.9	14.2
Systematic employee training	68.1	14.3	61.6	14.3
Planned preventative maintenance	43.3	11.1	46.4	15.2
Benchmarking	28.6	23.1	27.0	22.5
Concurrent engineering	20.7	13.2	16.5	10.8
Problem-solving tools	24.2	13.2	20.5	17.0
Just-in-time	36.3	9.9	31.3	9.8
Failure modes analysis	25.3*	4.4	14.3*	8.0
Poka Yoke	5.6	9.0	5.3	3.7
Kanban	22.2*	2.2	13.5*	3.6
Problem-solving techniques	36.3	18.7	28.8	15.3

Note: *$p < 0.001$

Table IV.
Percentage of firms emphasising management practices

	Prospector		Defender	
	Turbulent $n = 49$	Stable $n = 43$	Turbulent $n = 53$	Stable $n = 34$
Modify existing products	74.5*	57.0	42.7	30.2
Added a new product	75.0*	59.2	36.0	31.3
New product in a new field of technology	45.5*	33.7	15.7	11.3
Introduced a patented product	26.7*	15.9	13.7	8.1

Note: *$p < 0.001$

Table V.
Percentage of prospector and defender firms engaged in product innovation in turbulent and stable environments

as large as depicted above, with all of the differences statistically significant. Accordingly, *H2a* is accepted.

We next examined the degree of emphasis on both process technologies and management practices by both prospectors and defenders in turbulent and stable operating environments. The analysis is depicted in Tables VI and VII.

Table VI provides a deeper understanding of the relationship between process technologies and strategic orientation in both types of environments. The analysis shows that a higher percentage of prospector type firms emphasise all the process technologies in a turbulent environment compared with a stable environment. The differences in respect of the majority of the process technologies listed are statistically significant.

Defenders on the other hand have a lower level of emphasis on process technologies. Indeed, the perception of the environment appears to make little difference as none of the differences in emphasis between defender type firms in a turbulent environment

	Prospectors		Defenders	
	Turbulent $n = 49$	Stable $n = 43$	Turbulent $n = 53$	Stable $n = 34$
Computer-aided design and drafting	68.2*	50.1	42.7	36.9
Computer numerically controlled machines	58.6*	45.0	34.8	30.4
Computerised multi-purpose machine centres	25.5*	17.2*	13.6	7.5
Robots (manufacturing)	11.4**	7.0*	7.8	6.8
Robots (assembly)	16.8**	7.5*	3.9	3.4
Flexibility manufacturing systems	18.6	15.0*	9.8	6.9
MRP	28.6*	15.2*	12.2	10.7
MRP11	17.1	13.5	11.3	5.7
Automated inspection	14.1	12.5	8.9	6.8
Digital interchange with suppliers	40.0*	30.0*	25.5	22.4
Digital interchange with customers	29.2*	16.0	25.5	22.0
Automated stock control	22.2	15.0	27.5	20.3
Flexible assembly systems	22.2	12.5	27.5	16.9

Notes: *$p < 0.01$; **$p < 0.05$

Table VI.
Percentage of prospector and defender firms engaged in process technologies in turbulent and stable environments

	Prospector		Defender	
	Turbulent $n = 49$	Stable $n = 43$	Turbulent $n = 53$	Stable $n = 34$
Kaizan	19.6*	11.6	9.8	6.9
SPC	26.1*	14.0	11.8	8.6
TQM	26.7*	16.3	15.4	13.8
Quality function deployment	36.4*	14.0	9.6	8.8
Health and safety progress	65.2	62.8	53.8	57.6
Quality policy deployment	45.7	43.1	44.2	41.9
ISO9000	58.7	57.6	49.6	48.8
Suggestion scheme	39.1	31.2	36.5	30.6
Systematic training of employees	65.2	62.8	59.6	52.1
Planned preventative maintenance	41.3	34.2	34.0	32.6
Benchmarking	26.1	25.6	28.8*	17.2
Concurrent engineering	15.2	13.3	26.8	11.5
Problem solving tools	26.1	25.6	23.1*	17.2
Just-in-time	41.9	30.4	30.2	28.1
Failure modes and effect analysis	32.6*	18.6	15.4	12.1
Poka Yoke – full proof processes	8.4	7.1	12.0	6.9
Kanban	26.1*	17.9	15.7	10.3
Problem solving techniques	37.9	37.2	31.4	25.9

Note: *$p < 0.01$

Table VII.
Percentage of prospector and defender firms emphasising management practices in turbulent and stable environments

compared with a stable environment, are statistically significant. However, it should be pointed out that a higher percentage of firms emphasise process technologies in a turbulent environment compared with those in a stable environment. The main differences between defenders and prospectors in both environment types can be encapsulated as efficiency-orientated in prospectors as a conduit towards competitive advantage. Defenders do not have any statistically significant differences in their

activities between turbulent or stable environments. Accordingly, *H2b* is accepted. The degree of emphasis on management practices is depicted in Table VII.

The analysis of Table VII indicates that prospectors emphasise management practices to a greater extent in both types of environment compared with defender type firms.

Prospectors have statistically significant differences between the following functions in turbulent and stable environments:

- kaizan;
- total quality management;
- quality function deployment;
- failure modes and effect analysis; and
- kanban.

Clearly, prospectors feel the need to focus on greater quality in a turbulent environment as a means of differentiation and achieving some competitive advantage. On the other hand, while a slightly higher percentage of defenders emphasise all management practices in a turbulent environment, only benchmarking and problem-solving tools in a turbulent environment compared with a stable environment are statistically significant. Accordingly, *H2c* is accepted.

Discussion and managerial implications

The analysis of this study indicates that prospector type firms are more likely to engage in new product development compared with defenders. Arguably, this represents a strong external orientation as an approach to meeting existing and potential customer demands and requirements. On the other hand, defenders are five times more likely to modify an existing product than introduce a new one. This indicates that they are more likely to engage in short-term activities to defend their existing markets rather than focus on new customers. The strong external focus of prospector firms is also evident from their use of process technologies to access and maximise new opportunities; and from their use of management practices to increase their overall effectiveness.

Prospector type firms seem to have a greater awareness of, and willingness to adapt to their operating environment. For example, prospectors engage in innovation in both turbulent and stable operating environments to a far greater extent than defender firms. While defenders tend to engage in innovation to a higher extent during turbulent environments, their involvement is much less than that of prospectors in a stable operating environment. This indicates that prospectors are continually looking for new opportunities and is consistent with the overall criteria used to describe prospector type firms, whereas defenders appear to innovate only when they are pressurised to do so.

The study presents a number of findings that are of practical use to manufacturing firms. First, strategic orientation (prospector or defender types) is a good predictor of innovation, and should be considered during the strategy formulation and deployment stages. Second, the use of management practices and process technologies by prospector firms are actively used to innovate and compete in the operating environment. This is arguably instrumental in widening the gap further between prospector and defender type firms.

The results confirm that defender type firms realise that they need to take actions to protect their markets as evidenced by the significant number of defenders indicating their intention to deploy more process technologies and management practices over the next two years. Third, the findings indicate that prospector firms place a greater emphasis on both process technologies and management practices in a turbulent environment compared with a stable environment. The difference in emphasis between both environment types was much higher than we expected. On the other hand, the difference in emphasis by defender type firms does not differ significantly between turbulent and stable environments. Arguably, the greater emphasis placed on process technologies and management practices by prospector type firms influences the success of their overall innovation activities.

However, the study also found that the use of process technologies is becoming more prevalent as indicated by the intention of defenders firms to introduce problem solving techniques, benchmarking and IS09000 over the next two years. This appears to be more an *ad hoc* approach rather than one based on a strategic orientation approach. For example, this approach does not enable firms to engage in continuous innovation, an activity that many experts see as vital to enable competitive advantage to be retained (Chesbrough, 2003; Prahalad and Ramaswamy, 2003). This also means that while firms may be competitive in the short-term, they are likely to face disappointment in the medium- to longer-term. Accordingly, defender type firms should give consideration to placing a greater emphasis on the supporting mechanisms for innovation: process technologies and management practices.

Finally, the analysis suggests a polarisation of strategic orientation by firms in the two sectors examined. As firms represented in the study have been established for over five years, it is clear that the two main categorisations are prospectors and defenders. This implies that the reactor-type and to a lesser extent, analyser-type, are no longer appropriate categorisations for firms similar to those examined in this sample.

Limitations

However, a caveat must be added on the limitations of the study. First, the study focuses on only two sector types: mature products and stable technology, products with short life cycles and changing technology respectively. Clearly the conclusions apply primarily to these sectors. Each sector was assumed to be internally homogeneous with no differences between sub-sectors. This assumption should be tested in future studies. Second, the main emphasis of this study relates to the two main strategic orientation types; prospector and defender. Any future research should consider a more in-depth approach. It would have been beneficial to augment the quantitative data with qualitative in depth case studies or an ethnographic approach. Further testing should be carried out to confirm the finding's relevance to business practice, and its effective operationalisation.

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