Successful Patterns of Internal SME Characteristics Leading to High Overall Innovation Performance

Annemien Pullen, Petra de Weerd-Nederhof, Aard Groen, Michael Song and Olaf Fisscher

Small and medium-sized enterprises (SMEs) struggle with the paradox of developing new products and technologies on the one hand and minimizing costs on the other. These SMEs must be innovative to survive and grow. However, compared to large firms, SMEs have several problems in their innovation process, which negatively influence their overall innovation performance. This research explores successful patterns of internal SME characteristics that lead to high overall innovation performance. Cluster analyses were conducted to find patterns in the internal characteristics of SMEs with high overall innovation performance. We find that companies that focus on incremental innovation and that achieve high overall innovation performance indeed share a pattern in their internal organization, when controlling for innovation type. The paper adds to the current body of knowledge by comparing high- and low-performing companies based on competence differences. Because real-life organizations consist of multiple organizational characteristics, we also contribute to management practice by simultaneously addressing multiple organizational characteristics for the successful organization of innovation.

Introduction

For small and medium-sized enterprises (SMEs), new product development (NPD) is of high importance if they want to survive and grow. However, while SMEs need to innovate, they must also minimize costs (Hanna & Walsh, 2002). Compared to large firms, SMEs have a number of typical problems with regard to their innovation process. They have greater financial constraints, they have more manpower bottlenecks in terms of too few or inadequately qualified personnel, and they often do not have other products (cash cows) to compensate for a lack of sales and profits (Nooteboom, 1994; Kaufmann & Tödtling, 2002). On the other hand, SMEs also have some advantages with regard to innovation. SMEs are usually less bureaucratic and generally have greater incentives to be successful than large firms (Nooteboom, 1994; Michael & Palandjian, 2004). The problems that SMEs face in their innovation processes lead to low innovation performance. However, high innovation performance is an important denominator of competitive advantage for SMEs (O’Regan, Ghobadian & Sims, 2006). Therefore SMEs must find a way to achieve high innovation performance. One way to do this is by arranging their internal organization in such a way that a fit between the internal organization and the environment of the SME is created (DeWeerd-Nederhof, 1998; DeWeerd-Nederhof et al, 2007). However, the exact architecture of such an internal organization remains rather vague.

In researching the relationship between innovation performance and the organizational characteristics, many authors focus on one or two organizational characteristics (Meyer, Tsui & Hinings, 1993). For example, Miles and Snow (1978) focus on business strategy types, and Clark and Wheelwright (1992) focus on team structures. This narrow focus unfortunately leads to a form of reductionism (Drazin & Van de Ven, 1985). This form of reductionism can be overcome by simultaneously addressing the multiple internal
characteristics of (holistic) organizations (Miller & Friesen, 1984; Meyer, Tsui & Hinings, 1993). Only by simultaneously addressing the multiple internal characteristics of (holistic) organizations can relationships between performance and these organizational characteristics be fully understood (Drazin & Van de Ven, 1985). Therefore, in this study we address multiple internal characteristics simultaneously.

The level of resources and the mix of organizational characteristics (the pattern) is different for radical and incremental innovation (Wheelwright & Clark, 1992). Therefore, in this research we distinguish between radical and incremental innovation and focus on patterns of internal characteristics.

Parry et al. (2009) examine the impact on perceived cycle time of six variables that reflect a business unit’s NPD strategy, NPD environment, product strategy and NPD processes on a dataset of 164 US companies. They consider the pattern of relationships among these six factors. In particular, they define theoretical and empirical ideal profiles and examine the impact of deviations from these profiles on perceived cycle time (Parry et al., 2009). We build on the research of Parry et al. (2009) and include eight additional countries in the analyses. Furthermore, we compare the differences in innovation performance across companies.

The main objective of this paper is to search for successful patterns of internal characteristics of the SME to explain differences in overall innovation performance. Our contribution lies in the comparison we make between high- and low-performing companies based on competence differences. Because real-life organizations consist of multiple organizational characteristics, we also contribute to management practice by simultaneously addressing multiple organizational characteristics for the successful organization of innovation.

The next section consists of a literature review on internal SME characteristics that culminates in a number of testable hypotheses. The third section describes the methodology and the dataset that is used to test the hypotheses. After presenting the results in the fourth section, we provide a discussion and then end the paper with conclusions and suggestions for further research.

**Theoretical Framework**

In this section we describe the definition of innovation that is used as well as the internal SME characteristics that are the independent variables of this research. At the end of this section, we present the research hypotheses.

**Innovation Performance**

Wheelwright and Clark (1992) use three categories of commercial development projects: derivative (incremental), breakthrough (radical) and platform projects. Studies have confirmed that radical and incremental innovation projects do indeed need different strategies and structures (Ettilie, Bridges & O’Keefe, 1984); different technology adoption models (Dewar & Dutton, 1986); and different environmental, organizational and process factors (Koberg, Detienne & Heppard, 2003). Therefore, in this research we distinguish between radical and incremental innovation.

When we use the term innovation, we refer to the innovation concepts formulated by Afuah (1998) and Garcia and Calantone (2002). They state that, in the field of high technology, innovation is invention + commercialization (Afuah, 1998; Garcia & Calantone, 2002).

The performance that is achieved at the end of the NPD process is the innovation performance at the firm level. It can be defined as the sum of the successes of a firm’s innovations (Salomo, Strecker & Talke, 2007). Innovation performance can be measured using three items: the existence of a strong emphasis on research and development (R&D), the introduction of many new products/services over time, and significant changes in products/services (Miller & Friesen, 1982). An alternate way to measure innovation performance is presented by Cooper and Kleinschmidt (1995). They present a number of measures for innovation performance at the firm level: success rate, sales percentage, profitability relative to spending, technical success rating, sales impact, profit impact, success in meeting sales objectives, success in meeting profit objectives, profitability relative to competitors, and overall success. Of these performance measurements, the sales percentage (represented by new or modified products) most clearly indicates whether a company is successful in NPD at the firm level (Cooper & Kleinschmidt, 1995). We adopt this operationalization of innovation performance in this research.

**Internal SME Characteristics**

Internal characteristics of an organization are important denominators for the innovation performance of that organization. The combination of these characteristics is of particular interest as organizations consist of multiple variables that are represented in their coherence and the way they influence each other. Ernst (2002), Cooper, Edgett and Kleinschmidt (2004a, 2004b, 2004c), and Kahn, Barczak and Moss (2006) compare the internal characteris-
tics of best- and worst-performing companies in NPD. As a result they all present a framework of success factors for NPD. The categorization of internal characteristics that the authors use in their frameworks differs, but the success factors are to a great extent similar. Table 1 shows these frameworks as they are represented by the original authors. For the sake of comparison we only adjusted the sequence in which the main concepts in the frameworks were represented. As the frameworks all underline the importance of strategy, process (including market research), and organization (including what Cooper, Edgett and Kleinschmidt (2004a, 2004b, 2004c) and Kahn, Barczak and Moss (2006) categorize as people), we used these variables in this research to analyse the internal characteristics of the SME that influence innovation performance.

To search for successful patterns of internal SME characteristics to explain differences in innovation performance, we used the conceptual model shown in Figure 1. This figure represents the relation between the independent variables (the internal SME characteristics) and the dependent variable (overall innovation performance). The internal SME characteristics are further specified as strategy, process and organization based on the frameworks shown in Table 1. These concepts are further explained in the following subsections. Each independent variable (internal characteristic) is described by (1) defining the variable, (2) explaining the relation between the variable and innovation performance, and (3) further specifying the relation between the variable and the different innovation types. In this way we structurally build the hypotheses.

**Strategy**

This section defines the variables that together make up the strategy construct and links them to innovation performance. These variables are business strategy and dominance.

Business strategy represents defining and planning a focus for the NPD efforts of a small business unit, division, product line or individual project (Kahn, Barczak & Moss, 2006). It is an agglomeration of decisions through which a strategic business unit aligns its mana-

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**Table 1. Comparison of Frameworks of Internal NPD Success Factors**

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td><strong>Strategy</strong></td>
<td><strong>Strategy</strong></td>
<td><strong>Strategy</strong></td>
</tr>
<tr>
<td>Clear objectives</td>
<td>Clear goals</td>
<td>Strategic plan</td>
</tr>
<tr>
<td>Long-term goals</td>
<td>Portfolio management</td>
<td>Long-term goals</td>
</tr>
<tr>
<td>Overall strategy</td>
<td>Resource availability</td>
<td>Resource availability</td>
</tr>
<tr>
<td></td>
<td>Effective allocation</td>
<td>Portfolio management</td>
</tr>
<tr>
<td><strong>Process</strong></td>
<td><strong>Process</strong></td>
<td><strong>Process</strong></td>
</tr>
<tr>
<td>Quality of planning</td>
<td>Formalization</td>
<td>Formalization</td>
</tr>
<tr>
<td>Continuous commercial assessment</td>
<td>Quality of execution</td>
<td>Strict rules and procedures</td>
</tr>
<tr>
<td>Quality of market research</td>
<td>Market research</td>
<td>Market research</td>
</tr>
<tr>
<td></td>
<td>Clear product definition</td>
<td>Clear product definition</td>
</tr>
<tr>
<td><strong>Culture</strong></td>
<td><strong>People</strong></td>
<td><strong>People</strong></td>
</tr>
<tr>
<td>Free time and skunk works</td>
<td>Culture and climate</td>
<td>Cross-functional teams</td>
</tr>
<tr>
<td>Resource availability</td>
<td>Top management support</td>
<td>Team structure</td>
</tr>
<tr>
<td><strong>Organization</strong></td>
<td><strong>Organization</strong></td>
<td><strong>Organization</strong></td>
</tr>
<tr>
<td>Cross-functional teams</td>
<td>Team structure</td>
<td>NPD training</td>
</tr>
<tr>
<td>Team structure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Role of senior management</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Senior management support</td>
<td></td>
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</tr>
</tbody>
</table>
gerial processes (including its capabilities) with its environment (Miles et al., 1978).

Having a clear strategy in NPD is vital as ‘undertaking product innovation without a strategy is like running a war without a military strategy’ (Cooper, 2000, p. 38). In relation to innovation performance, business strategy is found to be one of the most important drivers of innovation performance (Cooper, 1984; Cooper & Kleinschmidt, 1995). The best performers tend to have clearly identified strategies in place to guide their NPD efforts (Cooper, Edgett & Kleinschmidt, 2004b).

Miles and Snow (1978) developed a business strategy typology which consists of three strategic types of organizations: defenders, analysers and prospectors. There is a fourth strategic type (the so-called reactor), but this form is a strategic failure, in that inconsistencies exist among its strategy, technology, structure and process (Miles et al., 1978). Even though some researchers argue that the validity of the Miles–Snow typology is unconfirmed and that the typology itself is too narrow and limited (Zahra & Pearce, 1990), the typology is well known and often used. Combining the Miles–Snow typology with other internal characteristics (as we did in this research) overcomes the issue of the typology being too limited. Ettlie, Bridges and O’Keefe (1984) link innovation type and business strategy. They find that a more traditional strategy tends to promote incremental innovation, while a more aggressive technology strategy promotes radical innovation. In the Miles–Snow typology this implies that an analyser strategy is most suitable for incremental innovation. The analyser strategy tries to improve its efficiency by improving or enhancing its products. In contrast, for radical innovation, the prospector strategy is most suitable, as the prospector strategy is most strongly focused on market opportunities and emerging trends. Table 2 shows the definitions of both the analyser and prospector strategies. The defender and reactor strategy are omitted, as in theory these two types are linked neither to successful incremental innovation nor to successful radical innovation.

SMEs with high dominance rarely have to change their practices to keep up with the market and competitors and can control and

![Figure 1. Conceptual Framework](image)

**Table 2. Definitions of Strategy Types**

<table>
<thead>
<tr>
<th>Strategy Type</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prospector</td>
<td>We continuously search for market opportunities and regularly experiment with potential responses to emerging environmental trends. Therefore, we often are the creators of change and uncertainty to which our competitors must respond.</td>
</tr>
<tr>
<td>Analyser</td>
<td>We attempt to maintain a stable, limited line of products or services, operating routinely and efficiently through the use of formalized structures and processes. At the same time, we monitor a carefully selected set of promising new product and market developments in different industries.</td>
</tr>
</tbody>
</table>
manipulate their environment (Bantel, 1998). Dess and Beard (1984) characterize the environment in terms of instability (or dynamism) and munificence. Instability is the rate of environmental change and the unpredictability of environmental change. Munificence is the extent to which the environment can support sustained growth (Dess & Beard, 1984).

In relation to innovation performance, having a certain amount of dominance (power or authority) is important for an SME to be able to execute the necessary actions to achieve the goals that are set in the strategy (Simon, 1976). We assume that companies that focus on radical innovation are ahead of their competitors and the market. The technologies that are used are so fundamentally new that they can control their environment with it and have high dominance. On the other hand, companies that focus on incremental innovation have to enhance their products to keep up with the market.

In summary, we hypothesize that, for successful incremental innovation, SMEs should combine an analyser business strategy with a low level of dominance. For successful radical innovation we argue that SMEs should follow a prospector business strategy, combined with high levels of dominance.

Process

The variables that together make up the process construct are formalization and marketing–R&D integration. This section describes these variables and links them to innovation performance.

Formalization of the NPD process is defined as ‘a system of rules covering the rights and duties of positional incumbents; a system of procedures for dealing with work situations’ (Walsh & Dewar, 1987, p. 217). The Product Development and Management Association best practices studies find that 60 per cent of successful organizations use a formal process (Griffin, 1997). Ernst (2002) summarizes these findings. He states that ‘the existence of a formal NPD process, which is comprehensive and characterized by professionalism throughout the process, especially in terms of evaluation and selection of new ideas and development and market introduction, has a positive effect on the success of new products’ (Ernst, 2002, p. 9). In addition, in their three-part series, Cooper, Edgett and Kleinschmidt (2004a, 2004b, 2004c) find similar results. They indicate that putting a formal NPD process in place is clearly a strong practice among better performers. Also the framework of Kahn, Barczak and Moss (2006) shows that the best-performing companies (they call it level four companies) use a formal process.

Ettlie, Bridges and O’Keefe (1984) distinguish between innovation types. They find that high levels of formalization are positively related to the development of incremental new products, while low levels of formalization are needed for successful radical product development.

Marketing–R&D integration is defined as the degree to which there is communication, collaboration and a cooperative relationship between marketing and R&D (Leenders & Wierenga, 2002). It involves a cross-functional process in which the functional areas of marketing on the one hand and R&D on the other hand are cooperating.

‘Interfunctional coordination and collaboration between R&D and marketing is crucial to the success of the new product development process’ (Song, Neeley & Zhao, 1996, p. 552). Leenders and Wierenga (2002) elaborate on this by saying that NPD involves a cross-functional process in which different functional areas have to cooperate to be successful. For the success of a new product, it is especially important that market information reach the NPD function along the entire NPD process (Mumford, 2000; Ernst, 2002). Cooper, Edgett and Kleinschmidt (2004c) turn this the other way around by stating that a lack of solid market and customer information is a major cause of new product failure.

In this research it is assumed that the more radical the innovation, the less important market information is, because radical innovation deals with the emergence of a new dominant paradigm instead of dealing with complementary assets (Cesaroni, Di Minin & Piccaluga, 2005). Thus, we argue that SMEs that aim for high incremental innovation performance should have high levels of formalization and marketing–R&D integration. In contrast, we argue that, for successful radical innovation, SMEs should combine low levels of both formalization and marketing–R&D integration.

Organization

The variables climate, culture and team structure together form the organization construct. The definition of these variables and their relation to innovation performance are described in this section.

The climate that Cooper, Edgett and Kleinschmidt (2004a) refer to is the organizational climate as defined by the attitude of the individuals concerning the organization – its degree of trust, conflict, morale, rewards equity, leader credibility, resistance to change.
and scapegoating as seen by the individuals (Burton, Lauridsen & Obel, 2004). It is regarded as an attribute of the organization, a conglomerate of attitudes, feelings and behaviours that characterizes life in the organization (Ekvall, 1996). More precisely, climate is shared perceptions, both formal and informal, of organizational policies, practices and procedures (Reichers & Schneider, 1990). In an entrepreneurial climate, employees have (1) the possibility to use a set portion of their workday for independent work developing their own ideas (free time) and (2) support for work on unofficial projects (skunk works) (Cooper and Kleinschmidt, 1995; Ernst, 2002).

In relation to innovation performance, climate is an enabler of creative processes that lead to new ideas in organizations. It is an intervening variable which affects the results of the operations of the organization (Eisenhardt, 1989; Ekvall, 1996). Organizational climate interacts with the organizational context to influence innovation performance (Nyström, Ramamurthy & Wilson, 2002). One of the resources that should be available in order to improve innovation performance is idea time and freedom for employees (Mumford, 2000). These are the key elements of an entrepreneurial climate (Cooper & Kleinschmidt, 1995; Cooper, Edgett & Kleinschmidt, 2004a). An entrepreneurial climate translates into ideation, free time, skunk works and available resources (bootstrapping) (Cooper & Kleinschmidt, 1995).

In all NPD, regardless of innovation type, the presence of an ‘entrepreneurial climate’ is needed (Cooper & Kleinschmidt, 1995; Cooper, Edgett & Kleinschmidt, 2004a) in order to achieve high innovation performance.

Organizational culture is defined as the shared beliefs and values held by an organization’s members (Smart & St. John, 1996). Or, according to Burton, Lauridsen and Obel (2004, p. 70), ‘culture is a pattern of knowledge, belief, and behavior that includes social forms’. Culture is a common set of shared meanings or understandings about the group/organization and its problems, goals and practices (Reichers & Schneider, 1990).

In relation to innovation performance, organizational culture is regarded as the context in which innovation takes place (Prajogo & Sohal, 2001). The more innovative this context, the higher the innovation performance. According to Prajogo and Sohal (2001) this implies that the propensity for innovation is inherent in the members of the organization. Cameron and Ettington (1988) defined four types of culture divided on a two-dimensional scale. On the horizontal axis the scale ranges from an internal, short-term orientation to an external, long-term orientation. On the vertical axis the scale ranges from flexibility and spontaneity to stability, control and predictability. Cameron and Ettington distinguish between the clan culture (internal orientation and flexibility), the adhocracy culture (external orientation and flexibility), the hierarchy culture (internal orientation and stability), and the market culture (external orientation and stability). Smart and St. John (1996) use the four culture types of Cameron and Ettington (1988) and link them to organizational performance. They find that different culture types are related to higher levels of performance on different effectiveness dimensions. When looking at the four different types of culture and taking the different innovation types into account, it is expected that radical innovation projects require an adhocracy culture. These projects are external and long-term oriented and focused on flexibility and spontaneity. Incremental innovation projects are more short-term oriented and focused on stability, control and predictability. Therefore, it is expected that companies with a focus on incremental innovation use a hierarchy culture to achieve high innovation performance. Based on Cameron and Ettington’s model, only the adhocracy and hierarchy cultures are considered in this research.

Culture should not be confused with climate. Culture refers to the deep structure of organizations, which is rooted in the values, beliefs and assumptions held by organizational members. In contrast, climate portrays organizational environments as being rooted in the organization’s value system, but tends to present these social environments in relatively static terms. Climate is often considered to be relatively temporary, whereas culture is more stable over time (Denison, 1996). Culture exists at a higher level of abstraction than climate, and climate is a manifestation of culture. Organizational culture deals with beliefs, perceptions and behaviour, whereas organizational climate has been built up from measures or qualitative assessments of individual perception (Pettigrew, 1990).

The team structure we refer to in this research is the structure of cross-functional product development teams. Cross-functional teams are project teams that consist of different capabilities and disciplines. These cross-functional teams are important for NPD as effective product and process development requires the integration of specialized capabilities (Clark & Wheelwright, 1992). The rapid change and diffusion of technology and burgeoning global competition have intensified the need for complex and highly novel product innovations. In this context, the use of cross-functional teams has become very important.
Firms interested in improving both proficiency in their development process and the survival rate of new products should promote cross-functional integration (Thieme, Song & Shin, 2003). This is also in line with the research of Sosa, Eppinger and Rowles (2004), who state that complex product development requires structuring the organization into groups of cross-functional design teams to design systems and components, and with the research of Cooper, Edgett and Kleinschmidt (2004a), who have identified the presence of cross-functional teams as a common factor in organizations they rated as best performers.

Clark and Wheelwright (1992) have identified a number of structures for cross-functional project teams: (1) functional team structure, (2) lightweight team structure, (3) heavyweight team structure, and (4) autonomous team structure. Which project structure is most suitable depends on the environment, organization size and innovation type.

In their research Ettlie, Bridges and O’Keefe (1984) find structural differences for incremental and radical innovation. They find that incremental innovation depends more on traditional structures and radical innovation depends more on informal structures. In addition, Clark and Wheelwright (1992) write that, when companies push to develop new products quickly, without distraction from other tasks (but without losing sight of organizational procedures), a lightweight team structure is most suitable. Furthermore, they find that radical innovation projects require team members to have freedom to generate ideas that are different from current practices, as is possible in the autonomous team structure. In line with the research of Clark and Wheelwright (1992) and Ettlie, Bridges and O’Keefe (1984), we hypothesize that the lightweight team structure can be found in incremental innovation and the autonomous team structure in radical innovation.

We therefore hypothesize that successful incremental innovation requires a combination of an entrepreneurial climate, a hierarchy culture and a lightweight team structure. In addition we hypothesize that SMEs should combine an entrepreneurial climate with an adhocracy culture and autonomous team structure to achieve high radical innovation performance.

Successful Patterns

From the literature discussed above we selected the theories we believe are the most determinative in their field. With the help of these selected references, we constructed two internal patterns that lead to high innovation performance. Both the selected references and the patterns are shown in Table 3. This table shows the variables described in the previous section and their link with innovation performance. Organizational pattern 1 includes the values of the variables that theory suggests

<table>
<thead>
<tr>
<th>Selected references</th>
<th>Theoretical organizational pattern 1</th>
<th>Theoretical organizational pattern 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy</td>
<td>Miles and Snow (1978)</td>
<td>Prospector</td>
</tr>
<tr>
<td>Dominance</td>
<td>Bantel (1998)</td>
<td>High level</td>
</tr>
<tr>
<td>Formalization</td>
<td>Griffin and Page (1996)</td>
<td>No formalized processes</td>
</tr>
<tr>
<td>Marketing-R&amp;D</td>
<td>Leenders and Wierenga (2002)</td>
<td>Low level</td>
</tr>
<tr>
<td>integration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climate</td>
<td>Ekvall (1996) and Cooper and</td>
<td>Entrepreneurial</td>
</tr>
<tr>
<td></td>
<td>Kleinschmidt (1995)</td>
<td></td>
</tr>
<tr>
<td>Culture</td>
<td>Cameron and Ettington (1988)</td>
<td>Adhocracy</td>
</tr>
<tr>
<td>Team structure</td>
<td>Clark and Wheelwright (1992)</td>
<td>Autonomous</td>
</tr>
</tbody>
</table>
lead to high overall innovation performance when the focus is on radical innovation. Organizational pattern 2 shows the values of the variables for the organization of incremental innovation. It is important to keep in mind that, for this research, the combination of these variables is important. We look at patterns of internal characteristics in relation to innovation performance and not at the individual organizational characteristics in relation to innovation performance.

The hypotheses that are tested in this research are:

H1a: For SMEs with a focus on incremental innovation, innovation performance will be high when their internal organization is in line with pattern 2.

H1b: For SMEs with a focus on radical innovation, innovation performance will be high when their internal organization is in line with pattern 1.

High innovation performance, as included in the hypotheses, means that the achieved innovation performance is higher than the average innovation performance of the subset of companies.

Methodology

The research described in this paper is survey research. Data collection is carried out with the specific aim of testing the adequacy of the concepts developed in relation to the phenomenon, of hypothesized linkages among the concepts, and of the validity boundary of the models (Forza, 2002). The research is part of the international research project ‘Patterns in New Product Development’ which aims to develop new knowledge in the field of NPD.

Sampling Process

Europe and Australia

In Europe and Australia, companies were selected based on sector (first two digits of SIC codes). Table 4 shows the different datasets that were used to select companies and the responses in each country. Publicly available information, mainly web-based, was then used to determine the possible suitability of these companies. Firms were contacted by telephone to ensure their suitability in terms of numbers of staff engaged in NPD, which needed to be at least five full-time employees (FTEs); 1,480 companies were found that met this criterion. Of these, 423 companies indicated their willingness to participate in this study and a questionnaire was sent to them. The contact person was asked to distribute the questionnaire to a manager who has been involved in developing new products in their organization or who has knowledge of overall new product programmes in their organization. Follow-up phone calls and e-mails were used to increase the response rate.

United States

Sampling in the United States consisted of 500 randomly selected firms from all non-service firms listed in the World Business Directory. A pre-survey letter requesting pre-approval for participation was sent to all 500 firms. A total

Table 4. Sampling Data from Europe and Australia

<table>
<thead>
<tr>
<th>Country</th>
<th>Sampling frame</th>
<th>First selection</th>
<th>Suitable</th>
<th>Willing to participate</th>
<th>No. of firms participating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>EPO</td>
<td>67</td>
<td>46</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>Denmark</td>
<td>Nnerhervv</td>
<td>145</td>
<td>145</td>
<td>36</td>
<td>31</td>
</tr>
<tr>
<td>Finland</td>
<td>Voitto</td>
<td>60</td>
<td>60</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td>Netherlands</td>
<td>EPO</td>
<td>178</td>
<td>119</td>
<td>34</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>FME</td>
<td>2,500</td>
<td>200</td>
<td>29</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>Chamber of Commerce</td>
<td>200</td>
<td>121</td>
<td>21</td>
<td>13</td>
</tr>
<tr>
<td>Norway</td>
<td>Diagnose</td>
<td>551</td>
<td>154</td>
<td>125</td>
<td>8</td>
</tr>
<tr>
<td>Portugal</td>
<td>Convenience sample</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spain</td>
<td>DUNS</td>
<td>109</td>
<td>35</td>
<td>31</td>
<td>19</td>
</tr>
<tr>
<td>Turkey</td>
<td></td>
<td>600</td>
<td>600</td>
<td>110</td>
<td>52</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>4,410</td>
<td>1,480</td>
<td>423</td>
<td>187</td>
</tr>
</tbody>
</table>
of 186 firms agreed to participate and provided a contact person, while 36 companies declined to participate, 42 letters were returned due to invalid contact person or address, and 236 companies did not respond. The questionnaire was sent to 422 firms (the 186 firms that agreed to participate and the 236 non-responding firms from the pre-survey). Just as in the other countries, the contact person was asked to distribute the questionnaire to a manager who has been involved in developing new products in their organization or who has knowledge of overall new product programmes in their organization. To increase the response rate, four follow-up mailings were sent to the companies.

Data Description

Europe and Australia

Of the 423 European and Australian companies that received questionnaires, 187 returned completed questionnaires, resulting in a response rate of 44.21 per cent. The European dataset includes 130 SMEs from eight different European countries. The range of the number of FTEs in the companies is shown in Table 5 and is based on the categorization on European Standards (Commission of the European Communities, 2003).

United States

Of the 422 US companies that received questionnaires, 164 returned usable questionnaires. For the United States, the response rate was 38.86 per cent. The US dataset includes 69 SMEs. The range of the number of FTEs in these companies is shown in Table 5.

Measurements

Overall innovation performance was measured as a scale variable using the sales percentage performance measurement of Cooper and Kleinschmidt (1995). They find that, out of 10 performance measurements, this measurement most clearly indicates whether a company is successful in NPD at the firm level (Cooper & Kleinschmidt, 1995).

Measurements for Strategy

To measure the nominal variable business strategy, the business strategy types of Miles and Snow (1978) were used. Companies were asked to indicate whether they consider themselves to be analysers, prospectors, defenders or reactors. In addition to the business strategy types, the level of dominance of the SME in its environment was measured as in Bantel (1998) and then translated into a nominal variable. SMEs were asked to what extent they must change their practices to keep up with the market and competitors and to what extent they can control and manipulate their environment to their own advantage.

Measurements for Process

The level of formalization was measured on a nominal scale by presenting multiple descriptions of development processes of a business unit. The respondents were asked to indicate which development process most closely

Table 5. Full-Time Equivalent (FTE) Categorization per Country

<table>
<thead>
<tr>
<th>Country</th>
<th>2–9 FTE</th>
<th>10–49 FTE</th>
<th>50–250 FTE</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Denmark</td>
<td>2</td>
<td>9</td>
<td>9</td>
<td>20</td>
</tr>
<tr>
<td>Finland</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Netherlands</td>
<td>1</td>
<td>14</td>
<td>18</td>
<td>33</td>
</tr>
<tr>
<td>Norway</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Portugal</td>
<td>0</td>
<td>1</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>Spain</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>14</td>
</tr>
<tr>
<td>Turkey</td>
<td>11</td>
<td>17</td>
<td>14</td>
<td>42</td>
</tr>
<tr>
<td>US</td>
<td>0</td>
<td>28</td>
<td>41</td>
<td>69</td>
</tr>
<tr>
<td>Total</td>
<td>18</td>
<td>77</td>
<td>104</td>
<td>199</td>
</tr>
</tbody>
</table>
describes the development process that is used in their business unit. To analyse marketing–R&D integration, the respondents were asked to indicate on 7-point Likert scales to what extent both departments share information, to what extent conflicts between both departments are constructive, and to what extent both departments are more like teammates than competitors.

**Measurements for Organization**

The presence of an entrepreneurial climate (nominal variable) was measured by asking the respondents to indicate on a 7-point Likert scale to what extent employees have the freedom to define their own work and to what extent there is time for people to develop unplanned new ideas. To measure the nominal variable business culture, the business culture types of Cameron and Ettington (1988) were used. Respondents were asked to indicate whether they have a clan, adhocracy, hierarchy or market business culture. To measure the nominal variable team structure, the team structure types of Clark and Wheelwright (1992) were used. In the survey, respondents were asked to indicate whether they use a functional, lightweight, heavyweight or autonomous team structure.

**Data Analysis Techniques**

Prior to the data analysis, we split the dataset in two subsets: one with SMEs that focus on incremental innovation and one with SMEs that focus on radical innovation. Each of these subsets was analysed separately.

To test the hypotheses, simultaneous analysis of multiple variables is needed. We chose to conduct cluster analyses in both subsets as this enables a holistic view and analyses of the data. In cluster analysis a sample of entities is classified into a smaller number of mutually exclusive subgroups based on the similarities between subgroups (Forza, 2002). From the various types of cluster analyses that are available, the two-step cluster analysis was selected because only in this type of cluster analyses can both continuous and categorical variables be processed at the same time (Norusis, 2009). The independent variables were business strategy, dominance, formalization, marketing–R&D integration, (entrepreneurial) climate, business culture and team structure, while the dependent variable was innovation performance. To examine whether innovation performance of the identified clusters differs significantly, analysis of variance (ANOVA) tests were conducted.

**Results**

From the dataset, 100 companies have a focus on incremental innovation projects. A two-step cluster analysis was conducted on these companies in order to test hypothesis 1a.

First, we find that companies in our dataset that focus on incremental innovation indeed share a pattern in their internal organization. In our dataset we can distinguish between two groups, also called clusters as they are the outcome of the cluster analysis (see Table 6).

Cluster 1 includes 56 companies, which is 62.9 per cent of the incremental dataset. Cluster 2 includes 33 companies (37.1 per cent). The mean innovation performance of both clusters is shown in Table 7. The innovation performance of both clusters is significantly different ($p < 0.05$) as shown by the ANOVA results displayed in Table 8. The innovation performance of cluster 1 is significantly higher than that of cluster 2. The innovation performance of cluster 1 is also higher than the average innovation performance of the incremental dataset.

Second, as a result of the cluster analysis, we find the organizational pattern that is dominant in the cluster. Companies that focus on incremental innovation and that achieve high innovation performance have an organizational configuration that combines an analyser or
prospector business strategy with an adhoc–racy business culture. Furthermore, they have a high level of marketing–R&D integration. Half of the companies have high dominance in their environment, and the other half have low dominance. Most of the time they do not use formalized processes. The team structure they use is the functional team structure. In 52 out of 56 companies in this cluster, an entrepreneurial climate is present. Based on theory we expected that the organizational pattern that leads to high innovation performance would include an analyser strategy, with a low level of dominance, a high level of marketing–R&D integration, a hierarchy culture, a lightweight team structure and an entrepreneurial climate. Table 9 shows that there are differences between theory and practice in the areas of business strategy, formalization, business culture and team structure. We will discuss these differences in the next section.

In addition, our results indicate the differences between the organizational pattern that leads to high innovation performance and the less successful organizational pattern in terms of innovation performance. The differences can be found in the areas of business strategy, dominance, marketing–R&D integration and (entrepreneurial) climate. Cluster 1 is dominated by analyser and prospector business strategies. The other cluster is dominated solely by an analyser business strategy. The companies in cluster 2 mainly have low dominance in their environment and low marketing–R&D integration, instead of high scores for both variables as in cluster 1. Finally, 30 out of the 33 companies in cluster 2 do not have an entrepreneurial climate.

Discussion

In this study we show that SMEs that achieve high innovation performance and focus on incremental innovation projects share a configuration in their internal organization. The configuration that was found to lead to high innovation performance in practice gives an indication of the internal organization that might be recommended for incrementally focused SMEs. In this configuration, an analyser or prospector business strategy is combined with an adhocracy business culture, a high level of marketing–R&D integration, no
formalized processes, a functional team structure and an entrepreneurial climate.

The results indicate that the main differences between theory and practice can be found in the variables business strategy, formalization, business culture and team structure. Even though theory suggested that the best-performing (incrementally focused) companies use formalized processes, this is not the case in practice. This might be explained by the fact that in incremental innovation the amount of risk and uncertainty is lower. Companies know what they are doing; it becomes more a matter of routine. Either the analyser or prospector strategy is used instead of just the analyser strategy. The strong presence of the prospector strategy can be explained by the size of the companies in the dataset. SMEs that want to achieve high innovation performance cannot afford to be expectant or passive with regard to market opportunities. Put more strongly, a company has to be the creator of change in its market. With regard to team structure for incremental innovation, a project steering committee is possibly too heavy for the type of work to be done and the size of the company. In incremental innovation the development process is well known and each functional department knows its role. Therefore the functional team structure is more applicable. Instead of the hierarchy culture, an adhocracy business culture is present because the adhocracy culture better fits the prospector strategy than the hierarchy culture does. The hierarchy culture is internally focused and aims for stability and control. This does not fit the prospector strategy. In contrast, in the adhocracy culture, the orientation is external and on the long term. It has an innovation-oriented and entrepreneurial focus, which fits the prospector strategy.

The literature from which the theoretical organizational pattern and the hypotheses were constructed focus mainly on one variable. In this research, we focused on multiple variables at the same time, because in practice companies combine multiple organizational characteristics that are interrelated. This explains the differences between the theory and our results.

Conclusions and Further Research

This research adds to the current body of knowledge in that it compares high- and low-performing SMEs based on competence differences. It also presents companies with a clear indication of how to configure their internal organization to achieve high innovation performance for incremental innovation. By taking a holistic view, the disadvantages of reductionism have been overcome.

In line with theory, we indeed found a clear pattern in the internal organization of incrementally focused SMEs that achieve high innovation performance. However, the internal pattern we found differs from the pattern that was suggested by theory. This can be explained by (1) the fact that most theory is focused on large firms whereas our research focuses on SMEs and (2) the fact that most theory focuses on one variable and thus implies that these theories are not applicable in practice.

Furthermore we find that incrementally focused SMEs that achieve high innovation performance combine an analyser or prospector business strategy with an adhocracy business culture. They also have a high level of marketing–R&D integration. Most of the time they do not use formalized processes. They use a functional team structure in an entrepreneurial climate.

We have overcome some reductionism, because we used the interaction approach in clustering the companies. Using the systems approach to explore the interrelations between the variables in further research would be another step forward in overcoming reductionism.

For further research it might also be interesting to conduct cross-country and cross-industry analyses. The Patterns in NPD database is a very rich database with data from a variety of countries and sectors, but for our research the sample size was too small to control for both countries and industries. Further research into the internal configuration used by successful radically focused companies is also of interest to establish whether a distinction between innovation types really matters and is necessary (as suggested in theory). Because we collected data at one point in time, and as NPD is dynamic and changes over time, longitudinal analysis of research results might be worthwhile as well. This research focused on the internal configuration of SMEs, but as SMEs often collaborate in NPD with external partners, the external configuration also influences the overall innovation performance. By taking the external characteristics of the SME into account, the relation between the overall innovation performance and organizational characteristics (internal and external) would become even clearer.

Note

1. According to European standards, SMEs are defined as companies that have 250 or fewer full-time employees (Commission of the European Communities, 2003).
References


Cornell University and an MBA and PhD from the University of Virginia. Dr Song was ranked as The No. 1 Innovation Management Scholar by the *Journal of Product Innovation Management* in 2007, one of the top 20 technology management scholars by *R&D Management* in 2006, one of the most prolific researchers in technology innovation management field by the International Association of Technology Management in 2004 and in 2009, and among the ‘most-cited scientists in economics and business’ over a ten-year period by Essential Science Indicators. He received the 2005 Excellence in Research Award from the American Marketing Association. Dr Song is associate editor of six academic journals and serves on the editorial board of several top academic journals. Dr Song has published over 90 articles in academic journals including *Management Science, Strategic Management Journal, Academy of Management Journal, Journal of Marketing Research, Marketing Science, Journal of Marketing, Journal of the Academy of Marketing Science, Journal of International Business Studies, Journal of Operations Management, Journal of Product Innovation Management*, among others.

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