

Strategic Study

Determinants of the innovative ability of SMEs

Literature review

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Preface

In the nineties, innovation has become a critical success factor for many small and medium-sized enterprises. In many markets it is necessary to have a regular stream of successful innovations to be able to achieve goals like profit, return and growth.

Many entrepreneurs will be interested as to how they can improve their innovative ability. This study shows a literature review of the determinants of the innovative ability of SMEs. When studying innovation one will discover two research traditions: both general and business economists investigate this subject. We pretend to give an exhaustive overview of the determinants mentioned in these traditions. In addition, we have attempted to integrate both traditions by drawing up a conceptual model that can be tested in future research.

We would like to thank our review panel consisting of Dr. P.R. Beije, Dr. A.J. Cozijnsen, Dr. Y.M. Prince and Prof. Dr. A.R. Thurik. We greatly appreciated their comments on the previous versions of this report and learned a lot from them. We would also like to thank Bas Schrover, who worked for six months at EIM as a trainee, for making a valuable contribution to this study.

Jeroen de Jong
Erik Brouwer

Executive summary

Research question

For an SME it seems necessary to have a regular stream of innovations to achieve business goals like profit and return. In this study the research question was formulated as follows:

What factors determine the innovative ability of SMEs?

Definitions

An innovation is the development and successful implementation of a new or improved product, service, technology, work process or market condition, aimed at gaining a competitive advantage. Innovative ability is a necessary condition for an organisation to maintain a permanent flow of innovations. It is the ability of the entrepreneur and his employees to generate ideas and develop and successfully implement these ideas into new or improved products, services, technologies, work processes or market conditions.

Methodology

Our research consisted of an extensive literature review on determinants of innovative ability in two trends of literature in innovation research: the organisational and the general economic tradition. In a focus group with Dutch innovation experts we integrated the determinants found into one conceptual model. This broad focus gives our study an added value compared to previous studies, because to date there has been no research which attempted to integrate both traditions of innovation research.

Limitations

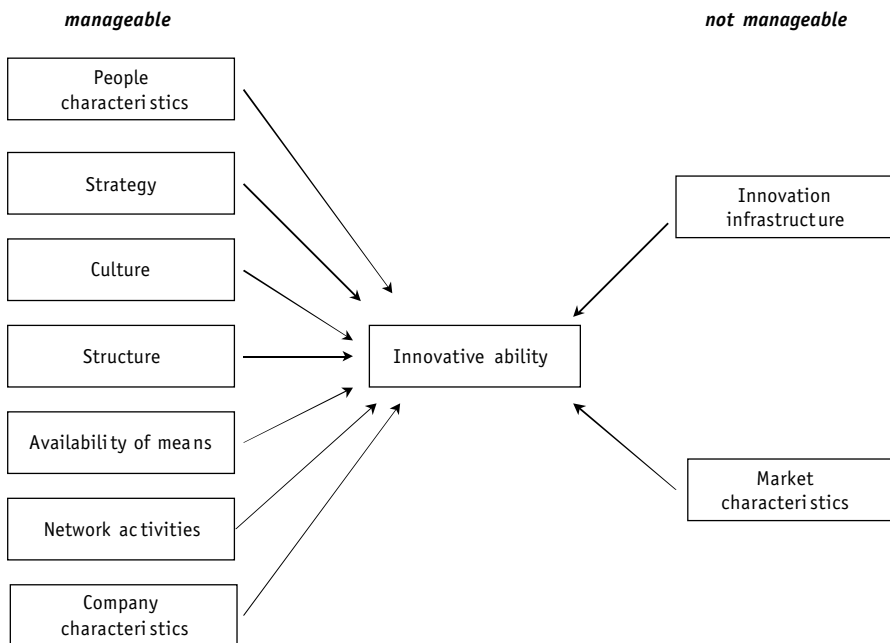
- We limited ourselves to literature research and drawing up a conceptual model. We did not perform an empirical test on the significance of this model.
- The innovation process consists of various stages. In this study we limited ourselves to determinants of *idea generation*. In fact, this limitation means that we have focused only on the first part of our definition of innovative ability: the ability of the entrepreneur and his employees to generate ideas. We did not pay explicit attention to the factors that determine the successful implementation of the ideas generated.

- We focused on the determinants of product innovations, but did not pay explicit attention to the determinants of other types of innovation (like process innovations).

Conceptual model

Our research yielded a list of determinants that we have integrated into a conceptual model. This model consists of 9 categories. We make a distinction between determinants that are manageable and those that are not manageable for the entrepreneur (figure 1):

figure 1 conceptual model for explaining the innovative ability of an SME



Source: EIM, 1999.

From our literature research we conclude that an SME will generate more ideas for new or improved products when it has several of the following characteristics:

- *People characteristics*: willingness of the employees to take risks, the entrepreneur's commitment to innovation, internal entrepreneurial activities, the presence of internal capabilities and skills
- *Strategy*: the presence of innovation in the mission statement, innovation objectives in the strategy
- *Culture*: loose control, people orientation, openness, result orientation, professionalism, spread of information

- *Structure*: de-standardisation, vertical integration, multi-functional teams, co-operation between departments, challenging task assignment and expansion, job rotation, autonomy, a reward structure that stimulates innovation
- *Availability of means*: freedom to experiment, financial resources, education and training, use of creative techniques
- *Network activities*: external orientation, customer orientation, co-operation with other companies, buying technological knowledge and information
- *Company characteristics*: high technological competence, high diversification plan, high range of activities along the production line, export activities, location of the company in urban areas, high complexity of product design, low lead time in the introduction of the novelty.

We have also found some environmental characteristics that stimulate the innovative ability of an SME:

- *Innovation infrastructure*: high level of general technological activity and basic knowledge, the existence of patents, the existence of tax reductions, the existence of R&D subsidies
- *Market characteristics*: open economy, a mid-degree of competition, high intensity of non-price competition, low intensity of price competition, short length of the product life cycle, high degree of demand-pull, low price elasticity, heterogeneous demand, high uncertainty of demand.

Suggestions for further research

- Empirical test. Our model should be tested as to the suitability of its categories and the significance of its presumed causal effects. To be able to make a statement about which determinants must be dealt with first when trying to improve the innovative ability of an SME, an empirical test is necessary.
- Measuring innovative ability. Before the conceptual model can be tested one must tackle the problem of how to measure the concept of innovative ability. Future research should give a clear answer to this.
- Determinants of successful implementation. In this study we limited ourselves to factors relevant to the generation of innovative ideas. We did not pay explicit attention to the factors that determine the successful implementation of the generated ideas. In future research it is worthwhile to investigate to what extent the determinants of innovative ability overlap and differ between the various stages of the innovation process.

- Determinants of other types of innovations. In this study we focused on the determinants of product innovations, but we did not pay explicit attention to the determinants of other types of innovation (like process innovations). In future research one could investigate to what extent the determinants of innovative ability overlap and differ between different kinds of innovations.

1 Introduction

1.1 Motivation and research question

Motivation

Many companies work in an environment of changing consumer preferences, increasing competition and changes in technology. To be able to achieve business goals like profit, return and growth in this environment, it is necessary to have a regular stream of successful innovations. Buijs (1988) states that innovations are a necessary condition for an organisation to stay in the market. The strategic position of a company is dependent on the ability to offer high-quality products and services that fit the needs of the market. A permanent stream of innovations is, therefore, of significant importance.

Various researchers show that SMEs with much innovative success perform better than SMEs with less innovative success (Geroski, 1995; Banbury and Mitchell, 1995; Soni, Lilien and Wilson, 1993). For instance, Soni, Lilien and Wilson (1993) examined the relationship between the number of innovations and company performance. They concluded that there is a strong positive relationship between the number of innovations and company performance and that innovative ability is very important for the continuity of a company.

Research question

As stated, a permanent stream of innovations is important for any organisation, so many SMEs will be interested to know how they could improve their innovative ability. The objective of this strategic exploration is to discover what factors determine the innovative ability of SMEs. The research question is formulated as follows:

| |
|--|
| What factors determine the innovative ability of SMEs? |
|--|

This report shows the results of extensive research which aimed to identify as many determinants of the innovative ability of SMEs as possible. Before we start the discussion of the determinants found, we shall:

- define the most important concepts in this study (section 1.2)
- discuss the assumptions and limitations (1.3)
- discuss the traditions of innovation research (1.4)
- present an overview of the determinants found, summarised in a conceptual model (1.5).

1.2 Definitions

Innovation

Literature provides many definitions of innovation, such as:

- ‘Introduction of something new; technological, industrial renewal’ (van Dale, 1992)
- ‘The adaptation and anticipation of an organisation to changes in the environment’ (Buijs, 1987)
- ‘The development and successful introduction of new or improved products, services, work processes; innovation also involves organisational changes, new markets and improved leadership styles’ (Timmerman, 1985)
- ‘Every renewal that is designed and implemented to strengthen the position of an organisation with regard to its competitors and that in the long run results in a competitive advantage’ (Vracking and Cozijnsen, 1992).

Innovation roughly means renewal. It is traditionally seen as the development of new products. From this technological viewpoint we find various narrow definitions of innovation, like van Dale (1992). However, in this study we do not interpret innovation as just technological renewal. According to Cozijnsen and Vracking (1992) an innovation can be linked to six objects: product development, new markets, technology, (work) process development, organisational development and the environment. We choose a broader definition of innovation, derived from the Timmerman (1985) and Vracking and Cozijnsen’s (1992) definitions:

An innovation is the development and successful implementation of a new or improved product, service, technology, work process or market condition, directed towards gaining a competitive advantage.

Schumpeter (1926) made a distinction between the concepts of invention and innovation. An invention is an idea or model for a new or improved product, process or technology. An innovation is a new or improved product, process or technology, which is commercially successful on the market. So, commercial success is a necessary condition for an invention to become an innovation.

Innovative ability

To be able to realise a permanent flow of innovations, a company must have enough innovative ability. Innovative ability is an abstract concept that is not directly measurable. Brown and Eisenhardt (1995)

state that the employees of a company are at the heart of the innovation process. The employees are the people who come up with vague ideas, concepts, and specifications, and turn these into successful innovations. Gosselink (1996) notes that the heart of innovative ability is rooted in the knowledge, motivation and skills of the employees who are involved in the innovation process. By this he means those employees who generate innovative ideas and advocate their ideas themselves in order to enable them to develop into commercial successes. Therefore, the innovative behaviour of employees has our central attention in this study.

Taking this into account, together with the definition of innovation previously mentioned, we choose the following definition of innovative ability:

Innovative ability is a necessary condition for an organisation to have a permanent flow of innovations. It is the ability of the entrepreneur and his employees to generate ideas and develop and successfully implement these ideas into new or improved products, services, technologies, work processes or market conditions.

1.3 Limitations

In recent decades much research has been done to discover how the innovative ability of an SME can be improved. The related question is: which activities and factors show a positive correlation with successful innovation? The relevant literature is found to lack a clear conclusion about the factors that have this positive relationship. Wolfe (1994) mentions various causes of confusion:

1. The way in which studies measure innovation varies widely, or is hardly touched upon. The different measures used for successful innovation do not make it any easier to generalise the results of the various studies.
2. Most studies concentrate on only a part of the innovation process. It is frequently not very clear to what part of the process the study is limited.
3. The studies lack clear indications of the types of innovations investigated. It seems likely that a simple process innovation is based on other success factors than a complex organisational innovation.

Below, we give an answer to these causes of confusion. This effectively implies a number of limitations for this study.

Ad 1 Measuring innovation

In literature, many measures for innovative success are employed when conducting empirical tests on the significance of the determinants of innovative ability. However, this study focuses only on the literature on innovative ability. We shall not conduct an empirical test on the significance of the determinants found, so the problem of measuring the concept of innovation does not apply here.

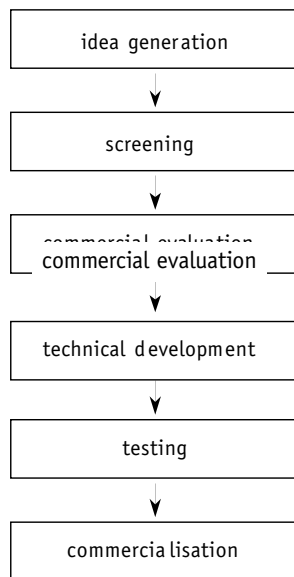
Ad 2 The innovation process

Innovations are developed and implemented in processes, which consist of various stages. It is frequently not very clear to what part of the process a study is limited. Moreover, there are several models of the innovation process. Buijs (1987) mentions some of these models.

Model for new product development

Many researchers use an ‘activities model’ to describe the innovation process. An activities model describes the steps that one should take to develop an innovation. The most famous example is the model for new product development from Booz, Allen and Hamilton (1968), which is shown in figure 2.

figure 2 model for new product development



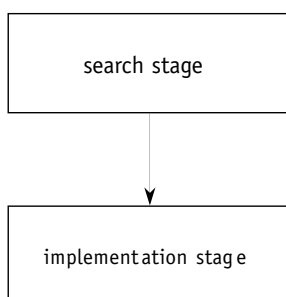
Source: Booz, Allen and Hamilton (1968).

The process starts with the generation of a new idea. The employees of an SME are usually the most important source of these ideas, which could be rejected in each of the remaining stages. First, there is a rough selection of the generated ideas by looking at the market potential and production possibilities. In the commercial evaluation stage, the idea is thoroughly analysed in terms of marketing, competitors and costs. Then the company develops a prototype of the new product, so at this stage the idea is transformed into a tangible product. After that, the most expensive stages of the development process start. During the test, the prototype is used by potential customers. The company uses their findings to develop the prototype into a final product. Then, eventually, the product is commercialised in the market.

Two-stage model

Buijs (1987) employs a simpler version of the activities model. He divides the innovation process into two stages (figure 3):

figure 3 the innovation process



Source: Buijs (1987).

In the search stage, the organisation recognises a need for innovation, generates ideas, screens these ideas, and determines the objectives for further development. Next, in the implementation stage the innovation is developed, tested and introduced on the market.

In order to be a successful innovator, it is very important for an SME to have a continuous flow of ideas. Commandeur et al. (1993) mention that most pitfalls in the innovation process are found in the search stage. Besides, according to Kotler (1996) only one out of 60 ideas is eventually developed into a successful innovation. *Therefore, in this study we shall focus on the search phase of the innovation process.* We shall describe the factors that cause or stimulate the entrepreneurs and the employees of an organisation to generate new ideas.

Ad 3 The type of innovation

Of course, innovation is not exclusively related to the development of new products. As already explained, Cozijnsen and Vrakking (1992) mention six objects to which an innovation can be related:

- product development
- new markets
- technology
- (work) process development
- organisational development
- the environment.

The determinants between these innovation types can differ as well. It is likely that a complex organisational innovation is based on more success factors than a product innovation. In this study, *we shall focus on the determinants of product innovations*, because Gupta (1994) and Craig and Hart (1992) mention that the importance of new products for SMEs is considerable and still growing.

1.4 Traditions of innovation research

According to Adler (1989), the innovation research splits into two broad areas of inquiry. These areas are the general economic tradition and the organisational tradition; these will be discussed below.

General economic tradition

The general economic tradition examines differences in the patterns of innovation across countries and industrial sectors, the evolution of particular technologies over time, and intra-sectoral differences in the propensity of companies to innovate. The level of analysis is at the macro- or meso level. Researchers applying this method often use hard, numeric indicators to measure the amount of innovation by a company, such as the amount of R&D expenditure, possession of an ISO certificate, the percentage of turnover of new products and the number of patents and licenses. Prince (1997), Kleinknecht (1995), Nieuwenhuijsen and van Leeuwen (1998), and Brouwer and Kleinknecht (1995) are examples of studies in which such indicators were applied. Prince (1997) and van der Valk (1998) provide an overview of some general economic indicators for measuring innovation.

Organisational tradition

The *organisational tradition* focuses at a micro-level regarding how specific innovations are developed, and the innovative ability of a company can be improved. In this tradition, an innovation is not necessarily related to the products and technologies, but also to work

processes, the organisation, the market, the entrepreneur and so on. In comparison with the general economic tradition, the organisational approach has a broader definition of innovation. The organisational approach also examines other factors as determinants of innovation, like working in multi-functional teams, the customer orientation of employees and reward criteria for the employees. Because these factors are not directly measurable, organisational researchers frequently use psychological methods (e.g. Likert scales) to measure innovative ability and its determinants.

In table 1 we show the most important characteristics of the two traditions.

table 1 characteristics of two traditions for innovation research

| characteristic | general economic | organisational |
|--------------------------|---------------------------------|----------------------------|
| objective level | describe and explain innovation | explain innovation |
| definition of innovation | macro/meso | micro |
| method of measurement | narrow | broad |
| | hard, numeric scales | soft, psychological scales |

It should be noted that in reality the difference between the traditions is not as distinct as table 1 suggests. Recently, general economists employ a broader definition of innovation. Prince (1997) describes the extent of innovation in sectors of the Dutch manufacturing industry in this way. She emphasises that innovation is more than R&D and product development.

In this study we shall focus on *both the general economic and the organisational tradition*, because we wish to explain the innovative ability of an SME as well as possible, so a broad overview of the literature is necessary. Actually, the added value of this study is achieved through this broad focus, because as yet there has been no research which attempted to integrate both traditions.

1.5 Methodology and model

Methodology

Summarising, in this study we focus on the determinants of the innovative ability of an SME, i.e. factors which influence the amount of ideas for new or improved products, generated by the entrepreneur and his employees. Our research consisted of two activities:

- literature review. We have answered our research question by a

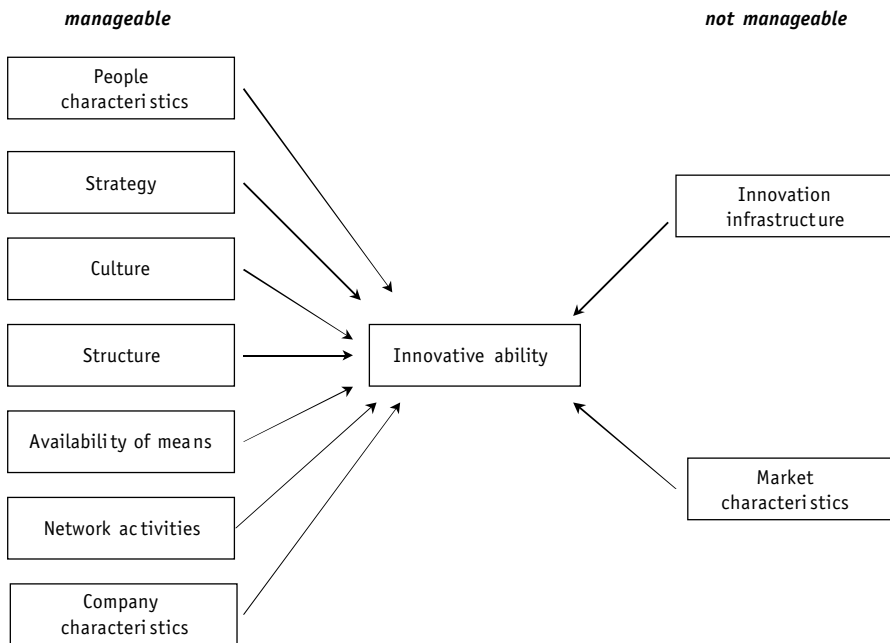
detailed examination of the literature on innovative ability. To obtain a broad overview, we have focused on both organisational and general economic literature. In addition, we have emphasised both Dutch and international literature sources.

- focus group. Our research was reviewed by a panel, consisting of Dutch experts on the subject of innovation and SME research (appendix I names the members of this panel). In a focus group with these experts we integrated the organisational and general economic determinants found into a conceptual model which is discussed below.

Model

In the literature, about fifty organisational and general economic factors are mentioned that influence innovative ability. To obtain an overview, a conceptual model was needed. For this purpose we distinguished nine categories that determine the innovative ability of an SME. In the model we make a distinction between determinants that are manageable and not manageable (figure 4).

figure 4 conceptual model for explaining the innovative ability of an SME



Source: EIM, 1999.

This model will serve as a guide for our discussion of the determinants found in chapters 2 to 10. In chapter 11 we shall summarise our findings and make some suggestions for future research. Before we start the discussion we must notice three things. First, we emphasise that our model consists of both organisational and general economic determinants. To be able to locate their origin, appendix II states in which trend of literature we found any determinant that is discussed in the following chapters (organisational vs. general economic tradition). Second, some determinants overlap to some extent. For example, it will often be the case that a company with a structure that is optimal for innovation will also have a culture strongly supportive for innovative ability, and vice versa. Third, we note that in the general economic tradition many researchers use the R&D expenditure as an indicator for the innovative ability. Consequently, some of the determinants discussed are factors which cause the amount of R&D expenditure to be increased.

2 People characteristics

In this chapter, and up to and including chapter 11, we shall discuss the nine categories that determine the innovative ability of SMEs. We start with people characteristics. As mentioned before, the entrepreneur and the employees of an SME are at the heart of the innovation process. Below, we discuss the influence on the innovative ability of:

- the willingness to take risks (2.1)
- the entrepreneur's commitment (2.2)
- internal entrepreneurial activities (2.3)
- the presence of internal capabilities, skills and competencies (2.4).

2.1 Willingness to take risks

Description

A company's willingness to take risks could mean several things. In our opinion, it means that the entrepreneur and the employees accept ambiguities and uncertainties. People feel at ease in uncertain situations and there are higher tolerance levels for mistakes.

Relationship with innovative ability

Cooper (1993) stresses that the importance of a company's willingness to take risks affects innovative ability. The only way to avoid mistakes is by not taking any risks at all. However, this will be the deathblow to any form of creativity. The traditional mentality of avoiding mistakes and structuring and correcting deviations from rules and procedures is important for a stable process, but clearly not for a company's capacity for innovation. The conception of innovative ideas will not benefit from standardisation and stability.

Rothwell (1992) also mentions the willingness to take risks as a major component of an innovative organisational culture. Innovation is a high-risk activity. The only assurance a company has is that there will be failures. Furthermore, Rothwell stresses the entrepreneur's willingness to take risks. When one innovation project fails, the entrepreneur should suppress any tendency to abandon other innovative efforts. On the contrary, he should endeavour to analyse and learn from the mistakes.

Finally, Gaspersz (1998) mentions 'tolerance for failures' as a crucial factor in the capacity for innovation. Employees should feel free to propose and further develop their ideas, however impractical they may seem at first sight. When ideas fail this should not be seen as

failures but as a postponement of success and a learning curve. In this regard, Kanter (1984) points out the importance of job security in a company. When employees are dismissed immediately following a failed innovation, the organisation's willingness to take risks will diminish drastically.

2.2 The entrepreneur's commitment

Description

An entrepreneur who is committed to innovation encourages creative behaviour, not only by emphasising the importance of innovation in words, but also by setting examples through his own actions. As a rule, the entrepreneur has considerable influence on the innovative ability of an SME. First of all, there is management responsibility for formulating the mission and the strategy. In chapter 3, it becomes clear that he should incorporate the notion of innovation as a means of promoting the innovative ability. However, the influence of the entrepreneur on the capacity for innovation extends further. Hofstede (1991) says that management is among the most important factors affecting business culture. Therefore, the entrepreneur can encourage a business culture suitable for innovation.

Relationship with innovative ability

Gosselink (1996), McGourthy *et al.* (1996) and Rothwell (1992) conclude that the entrepreneur's commitment to innovation is essential for a company's innovative ability. Gosselink (1996) argues that the entrepreneur should pay particular attention to individual innovative efforts. Ultimately, the employees in an organisation are the ones who generate new ideas and carry them out.

To generate new ideas it is important that the employees display creative behaviour. According to McGourthy *et al.* (1996), it is important that the entrepreneur constantly encourages such creative behaviour. Suppose for example that a manager incorporates innovation objectives in the company's strategy, but then does not have the time or patience during daily activities to listen to ideas from employees and does not make funds available for working out these ideas. Eventually, idea generation in that company will be minimal.

Rothwell (1992) says that the transparent commitment of the entrepreneur is an essential condition to initiate innovation and to retain it in the long term. He points out that each employee must understand the importance of innovation. It is the manager's task to bring

this about, first by clarifying its strategic importance and then by showing a commitment to innovation in his or her actions.

Besides the manager's commitment, another factor is the confidence that a manager radiates in respect of innovation. Zien and Buckler (1997) discuss this confidence as a determinant of the innovative ability. The struggle for innovation means that employees should show risk-taking behaviour and not be afraid to make mistakes. That also means that there will be a constant state of uncertainty, since existing products and processes will disappear or be adapted. Such uncertainty could have a paralysing effect on employees, providing an obstacle to innovative action. Management fulfils a key role in doing away with uncertainty, not only by showing high-level commitment to innovation, but also by having a high degree of confidence in the employees, not blaming them for every mistake or wrong decision.

Van de Ven (1986) refers to the role played by the entrepreneur in creating a culture designed to encourage innovation. An innovative organisation demands a special kind of supportive leadership. The entrepreneur, according to van de Ven (1986), should focus on a culture in which innovation can flourish. Showing confidence in the employees plays a major role. If the entrepreneur neglects this, then it is possible that several values and norms will come into being that are counter-productive to company objectives, including innovation.

2.3 Internal entrepreneurial activities

Description

Entrepreneurial activities are carried for one's own account and risk. By internal entrepreneurial activities we mean situations in which the employees develop activities on their own initiatives, can develop opinions about which markets are interesting, what customers in the various markets need and can indicate the direction their company should take. Dealing with uncertainties and risks, being commercially minded and market-orientated are also characteristics of internal entrepreneurial activities. And, certainly not least important, entrepreneurial activities also involve the ability within a company to fight for a promising idea and 'to win the battle'.

Relationship with innovative ability

Gosselink (1996) calls the presence of internal entrepreneurial activities in an SME a condition for innovative ability. Actually, this determinant serves as a summary of many other determinants dis-

cussed in this study, such as autonomy, the willingness of all employees to take risks, acceptance of uncertainty, customer orientation and the freedom to experiment. According to Gosselink, entrepreneurial activities should be present in each job and department of an organisation. Each employee should have the freedom to experiment and to test new ideas as to their commercial value and feasibility in practice. Such internal entrepreneurial activities will produce ideas at every level; ideas which could affect an organisation's development in a number of ways.

In this regard, Shane (1994) mentions the presence of 'innovation champions', which enlarge a company's innovative ability. An 'innovation champion' is someone who takes a personal risk to ensure the success of an idea, to overcome obstacles and opposition relating to that idea. Shane (1994) mentions four characteristics of 'innovation champions' that favourably affect the innovative ability. Again, our conclusion is that this determinant summarises several previously discussed determinants of the capacity for innovation:

- Innovation champions dare to deviate from existing norms, rules and procedures. This enlarges creativity and problem-solving potential.
- Innovation champions seek out and gather support for innovations within their organisations. They do so by promoting co-operation among various employees. This usually takes place informally, providing a stimulus to idea generation.
- Innovation champions use a loose-control mechanism to guide their activities. This promotes the creative use of organisational resources by employees.
- Innovation champions use decision-making methods that apply equally to all employees. As a result, anyone is free to propose his or her opinions and ideas.

Shane (1994) also states that innovation champions could be brought to the forefront due to imperfections within existing organisations. To start with, there are the existing norms, rules and procedures. If these are solely geared towards maximum efficiency of the organisation's activities, they often result in maintaining the status quo. This is devastating for successful innovation. One example is the procedure for allocating funds and other resources to an innovation project. If this takes place in accordance with the rules, it may take too long, thus endangering the innovation project. Another example is the hierarchy within an organisation, which could prevent interdepartmental communication, even though it is essential for the formation of ideas. At such times, according to Shane (1994), there is a big

chance that an innovation champion will emerge, who will break through the existing rules and procedures.

2.4 The presence of internal capabilities, skills and competencies

Description

In this context, internal capabilities, skills and competencies refer to having flexible, inventive employees with the right education in the right places. Their capabilities, skills and competencies play an important role to generate ideas for companies.

Relationship with innovative ability

Having flexible employees is important, because in a bureaucratic and rigid company many steps have to be taken before a new idea is accepted. Furthermore, the gaps between inventors and management in an inflexible company are wide, which could cause the excitement of creating new ideas to be negligible. In this situation, the incentive to generate ideas is missing (Acs and Audretsch, 1989).

Employees' skills and competencies help companies to be innovative. According to Beije (1989) and Leiponen (1999) it is not only an advantage to generate new ideas, but the company will also be an attractive partner in collaborative arrangements and can benefit fully from transfer technology, and the 'absorptive capacity' will be high.

3 Strategy

The company's mission statement (3.1) and strategy (3.2) provide guidelines for the activities that a company will develop in the future. Therefore, this subject is relevant to our discussion of the determinants of innovative ability.

3.1 Innovation in the mission statement

Description

The mission is often seen as the starting point of a company's strategic management. According to Bunt *et al.* (1994), the mission states the what and why of a company's reason for being. A mission statement must provide answers to fundamental questions such as 'why do we exist?' and 'what do we want to achieve?' The difference between a mission and traditional business goals lies in the fact that a mission lacks quantitative and time-related elements. A mission statement allows for the expression of emotions and underlying values. Many smaller companies do not devote any explicit attention to their missions, but they can usually define their reasons for being in the market place and what they wish to achieve in general terms.

Relationship with innovative ability

Bart (1996) mentions that a mission statement plays a significant role in influencing and encouraging employee behaviour within an organisation. He concludes that a company's innovative ability expands when the mission statement incorporates the notion of innovation and when the company communicates this mission statement to its employees in a clear and forceful way. He recommends first defining the desired (innovative) behaviour and then incorporating it into the mission statement.

According to Prakken (1994), the presence of innovation as part of 'company doctrine' increases the organisation's innovative ability. Prakken (1994) uses the term 'company doctrine' in a survey of innovative behaviour of employees in Japanese companies. It is usual in these companies to continually persuade employees that their innovative performance should go far beyond the level of new products. Prakken explains the innovative behaviour of many employees in Japanese companies by the presence of such company doctrines.

Finally, Buijs (1988) and Sneeep (1994) state that having a clear business vision is a condition for successful product innovation. A busi-

ness vision provides a direction and a destination. The similarities with the mission are clear: a business vision also provides guidance for a company's innovative efforts.

3.2 Innovation objectives in the strategy

Description

A strategy provides direction for a company in its environment and, according to Bunt *et al.* (1994), serves as a guideline for the allocation of resources and efforts. In various areas an organisation makes strategic choices, for example concerning growth, supply of products, market segments, technologies used and distribution. The relation to the mission is that strategy is a more specific elaboration of a mission. Despite the fact that a strategy is more specific than a mission, strategic decisions are fundamental choices with long-term effects. Although many smaller companies pay little attention to strategy explicitly, the entrepreneur is often able to indicate the activities he wishes to develop in the long term, including his (financial) objectives.

Relationship with innovative ability

Rothwell (1992) argues in favour of explicitly incorporating innovation objectives in a company's strategy. Strategic attention for innovation is important to keep the organisation from viewing innovation as an ad-hoc process. Companies with no innovation strategy tend to innovate only in response to the innovation of their competitors or to meet market demands or because new opportunities present themselves accidentally. On the other hand, organisations with clear innovation strategies constantly point out to their employees the importance of a continuous process of renewal. This ongoing focus on renewal ensures that employees more readily come forward with ideas for new or improved products.

Tushman and O'Reilly (1997) are also of the opinion that innovation objectives play a significant role in increasing the innovative ability. When innovation is incorporated in the strategy, the employees become aware of its strategic importance and it mobilises them to make active contributions which result in an increase of innovation capacity. In this connection, Gosselink (1996) mentions that innovation strategy, regardless of whether it is explicitly formulated, is a major directional and motivating instrument for developing innovative decisiveness. The entrepreneur also uses it to communicate his own innovation commitment to his employees. An indication of the inno-

vation strategy of a company can be derived from the presence of innovation in the mission, objectives for innovation, programmes for innovation, and budgets.

The innovation strategy can be made operational in various ways. Zien and Buckler (1997) point out that each employee in a company is a source of ideas. It is therefore important to make product innovation the responsibility of the entire organisation, not just the R&D department. This could be translated into innovation objectives for each individual. De la Fuente (1998) mentions the example of a Dutch consultancy company where each employee has an annual objective of presenting several ideas to the entrepreneur for improving the product range, working processes, etc.

4 Culture

Hofstede (1991) defines a business culture as *the collective mental programming of the members of an organisation*. Business culture is at the heart of an organisation's informal structure. A strong culture means a system of informal rules that spells out how people are to behave. By knowing what is expected of them, employees will waste little time deciding how to act in a given situation. This means that through culture, employees can be motivated and directed towards creative behaviour without strong pecuniary incentives (or disincentives) and the exercise of authority.

Below, we discuss six culture-related determinants of innovative ability:

- loose control (4.1)
- people orientation (4.2)
- openness (4.3)
- result orientation (4.4)
- professionalism (4.5)
- spread of information (4.6).

4.1 Loose control

Description

Sanders and Neuijen (1992) review the distinction between business cultures with loose and tight control. In companies with loose control we find relatively little structure or rules. Relatively few employees in such companies worry about cost control. Further, meeting times in such companies are not strictly adhered to. There are many jokes about the company and the work done. Conversations among the employees often concern matters unrelated to work. On the contrary, in companies with tight control we find a strong degree of discipline. In such cultures, employees are very aware of costs, there is strict adherence to meeting times and conversations usually relate to the company and the work itself.

Relationship with innovative ability

Sanders and Neuijen (1992) recommend a culture characterised by loose control to promote the innovative ability. Innovative companies generally have many non-standardised activities. Loose control is best suitable for managing such activities. Since the entrepreneur does not know which activities will result in successful innovations, they cannot provide tight control over them. On the contrary, tight

control would result in a situation in which only existing rules and procedures would be observed. Employees would generate fewer ideas and there would be a slow-down of innovative activities.

There appear to be several negative effects of slack controls; for example, not paying attention to costs at all could threaten the continuity of a company. However, according to Sanders and Neuijen (1992) loose and tight controls should be seen as two extremes. In reality these extremes will rarely occur.

White (1996) also mentions loose control as a determinant of the innovative ability. According to White, the technical employees of an organisation are behind most product innovations. In larger companies, technical employees are part of the R&D department. In SMEs, we often find only a few technically trained employees. Loose controls are necessary to increase the number of product innovations by these employees. Compared to other employees, technicians have a different way of thinking, working and communicating. White mentions that they have strong inner motivations to make technological advances. With loose control, they have more creative freedom and a greater opportunity to develop their inner drives in the form of new or improved technologies. This will have an effect on new product success as well.

4.2 People orientation

Description

Sanders and Neuijen (1992) discuss the distinction between people-orientated and work-orientated business cultures. In people-orientated cultures people feel that allowance is being made for personal problems and that the company takes responsibility for the well-being of its employees and their families. Those who work in people-orientated cultures have a greater voice in the organisation. In taking decisions, the entrepreneur regularly consults his employees. On the contrary, in a work-orientated culture people feel pressured to get their work done and the company worries only about the work performed by the employees. In this culture, individual persons take the decisions.

Relationship with innovative ability

Sanders and Neuijen (1992) recommend a people-orientated culture to enlarge the innovative ability. This type of culture gives employees a greater voice in decision-making, increasing their commitment

to the work, so that they will feel more free to present ideas for new or improved products. On the other hand, in work-orientated cultures employees will focus mainly on doing their existing work and will not take many initiatives for change.

In this regard, Zien and Buckler (1997) state that there should be a culture in which the employee is the central figure. According to Zien and Buckler, work-orientated cultures are not innovative because they are characterised by fixed procedures, tasks and processes. The result is an 'oversimplified working environment'. In such environments there is no challenge to show creativity and innovation. On the contrary, in people-orientated cultures, these qualities, which are essential to an organisation's capacity for innovation, are stimulated. Finally, Shane (1994) states that a people-orientated culture is a condition for successful innovation. In his view, every employee can make a valuable contribution to the realisation of innovations. The capacity for innovation increases when all employees offer ideas and are able to implement these ideas. This is contrary to the classical view of innovation, in which the R&D department is the only one allowed to carry out innovative actions. We must note that, especially in SMEs, R&D departments are lacking and ideas are yielded by (all) employees. In Shane's view, a culture must be designed in which each employee is involved in the innovation process. The entrepreneur should treat all staff contributions equally, irrespective of an employee's position or job title. This could be done, for example, by introducing 'management by consensus'.

4.3 Openness

Description

Sanders and Neuijen (1992) mention the distinction between open and closed business cultures. In a company with an open culture, new employees and outsiders feel quickly at home. Nearly every new employee will fit in such an organisation. New employees need only limited time to settle into their jobs. The opposite holds true for closed cultures, in which the employees do not have a very close relation with the entrepreneur and colleagues. In such organisations, newcomers need more time to adjust. It should be noted that open and closed cultures are two extremes that seldom occur. In reality, mixed forms are quite common.

Relationship with innovative ability

Sanders and Neuijen (1992) believe that an open organisation culture contributes to an organisation's innovative ability. Open cultures

provide better support for an exchange of ideas. Mutual trust and respect are common here, and since the employees feel at home more quickly in open cultures, the sooner they will come up with new ideas for (product) innovations.

Gaspersz (1998) notes that organisations that succeed in creating innovative climates, virtually without exception, have open cultures. By an open culture, Gaspersz means organisations open to new ideas and changes suggested by employees, along with maintaining intensive contacts with groups that offer new points of view. This results in a rich breeding ground for product innovations. The intensive contacts can involve both the external environment (customers, suppliers and scientists) and the internal working environment (the employees).

4.4 Result orientation

Description

Sanders and Neuijen (1992) discuss the distinction between result-orientated and process-orientated business cultures. A result-orientated culture emphasises the results of the work process. How these results are realised is of less importance. Result-orientated cultures have few rules and procedures for carrying out the work and solving problems. There are many people at work who feel at ease in unknown, high-risk situations. The opposite of this is a process-orientated culture in which the emphasis follows the rules and procedures for doing the work. In general, employees avoid risk taking.

Relationship with innovative ability

Sanders and Neuijen (1992) consider the result orientation of a company as an important determinant of the innovative ability. In order to be innovative, it is important that the employee feels at ease in unknown, high-risk situations. According to Amabile (1998), a result-orientated culture strongly contributes to the capacity for innovation of SMEs. Result-orientated companies give their employees greater freedom of action. Everything is focused on the final results. The employees are free to do their work as they see it. When people are able to decide about their own work processes, this acts as an incentive to creativity by advancing their intrinsic motivation and giving people a greater sense of participation. Moreover, they can tackle problems in ways that take full advantage of their own expertise.

Amabile (1998) does not think it desirable that employees set their own work objectives as well. If the entrepreneur sets clear, well-specified objectives, this will often help to further creativity. Also, the entrepreneur should not change the objectives too frequently. There is nothing so destructive to creativity as poorly defined or frequently changed objectives. Although the employees are free to do their jobs, they have no sense of direction. The entrepreneur should tell his staff which mountain they have to climb, but leave them free to climb it the way they want.

4.5 Professionalism

Description

Sanders and Neuijen (1992) discuss the difference between a professional and an organisational culture. In a professional culture the employees focus mainly on their job. When an employee in a professional culture is asked what kind of work he does, he will answer with: 'I work as an accountant/ software developer/dentist', or something like that. People in a professional culture generally think that they are hired for a job because of their skills. Besides, people in a professional culture often have a high education level and are very much involved in the company's future.

The opposite is the organisational culture in which the employee focuses mainly on the company instead of his job. When an employee in an organisational culture is asked what kind of work he does, he will answer with: 'I work at company X'. People in an organisational culture generally think that they are hired for a job because of their personality, social class and background. Besides, people in an organisational culture are less educated and do not think about the future very much.

Relationship with innovative ability

Neuijen (1992) mentions that a professional culture has a more positive effect on the innovative ability than an organisational culture. In a professional culture the employees are more involved with their job and will be more open to information from outside the company. In addition, they have had a lot of training and education and frequently think about the company's future. These are all factors that will improve idea generation in the company.

Finally, Neuijen (1992) mentions that in a professional culture there is generally more high-tech technology present. Organisational cul-

tures tend to have more traditional technologies. In our opinion, it is not hard to imagine that a high-tech environment is a better basis for product innovations.

4.6 Spread of information

Description

There are various ways for companies to spread information among their employees. Burns and Stalker (1961) state that the organisation can be organised as a network. This enables employees to communicate with anyone who could offer help in solving problems. Depending on the exact location of the information, communication takes place both vertically and horizontally. This communication is often informal in nature.

Relationship with innovative ability

Oden (1997) says that the spreading of the available information within an organisation is relevant for successful innovation. The availability of a large diversity of information for the employees affects the idea-generating ability of a company. In this context, Damanpour (1991) points to the positive effect of internal communication on innovative ability. Good internal communications facilitates the dissemination of ideas within a company, contributing to a culture in which ideas are more likely to be translated into action.

There are various ways of promoting the dissemination of information in a company. Tidd *et al.* (1997) suggest the following:

- The use of multimedia and ICT. The effective use of databases, information systems and e-mail will substantially promote the dissemination of information among employees within an organisation.
- The presence of 'technological gatekeepers'. Technological gatekeepers are staff members who gather information from various sources and circulate it to people who can make the best use of it. Since the success of innovation is strongly dependent on the availability of information and a good communication structure, technological gatekeepers are very important. These are people who, in practice, are often very comfortable with the informal structure of organisations.
- The effective resolution of conflicts. Nothing is as destructive for good communications than conflicts among employees.
- Having employees co-operate in multi-functional teams. A separate section of this report is devoted to the way in which this increases an organisation's innovative ability.

- Job rotation. Having employees regularly rotate jobs gives them a broad perspective of the organisation's problems, creating a continual flow of innovative ideas. There is also a separate section dealing with this subject.

5 Structure

Mintzberg (1979) defines the organisational structure as: the formal system of work relationships that both divides the different work tasks (differentiation) and provides co-ordination between these tasks (integration). There are various structural characteristics that have a stimulating effect on the innovative ability:

- de-standardisation (5.1)
- vertical integration (5.2)
- multi-functional teams (5.3)
- co-operation between departments (5.4)
- task assignment and expansion (5.5)
- job rotation (5.6)
- autonomy (5.7)
- reward structure (5.8).

5.1 De-standardisation

Description

Some companies create numerous rules and procedures to standardise work processes and reduce uncertainty in the business operations as much as possible. In this study, de-standardisation is taken as the degree to which an organisation's work processes are established in rules and procedures. The most extreme form of de-standardisation is the total absence of rules and procedures, while the most extreme form of standardisation results in establishing all company work processes in detail.

Relationship with innovative ability

Various authors point out the link between de-standardisation and a company's innovative ability. Burns and Stalker (1961) assume that there is a negative relationship between the presence of substantial formal rules and the number of successful product innovations. Formal rules and procedures impede a company's flexibility. The innovation process, according to Burns and Stalker (1961), does not benefit from this. On the contrary, they argue for a co-ordinating mechanism based on informal contacts among employees.

Damanpour (1991) mentions the relationship between standardisation and innovation success. He concludes that the relation between de-standardisation and innovative ability depends on the phase of the innovation process. There are indications that during the search phase of the innovative process there is a negative relationship

between de-standardisation and the innovation process. Employees' creativity and flexibility, which are very important during the search phase, will be impeded by rules and procedures. However, during the implementation phase, there seems to be no link between de-standardisation and innovation success. His explanation is that the implementation of the innovation process can be managed very strictly.

Shane (1994) also concludes that an organisation's capacity for innovation derives no benefit from a multitude of rules and procedures. Rules and procedures, for example, determine who reports to whom, through which channels information should be disseminated and who will supervise and assess the work of individual employees. Such rules ensure that the activities of an organisation are co-ordinated in an efficient manner. However, innovation is per definition an uncertain process. When the employees of an SME simply follow existing rules and procedures, it will be difficult for the organisation to adjust to changes in its environment.

5.2 Vertical integration

Description

In this study we define vertical integration as the presence of few hierarchical levels. The number of management layers is limited, leaving short lines of communication between employees and the entrepreneur.

Relationship with innovative ability

Various authors argue that vertical integration advances a company's capacity for innovation. Damanpour (1991) mentions that in such companies more ideas are produced than in companies with many management layers. In hierarchical structures, it is more difficult to exchange innovative ideas. This tends to discourage employees from coming up with ideas for new products or services. In this context, Feringa, Piest and Ritsema (1990) point out that it is important that employees have direct lines of communication with the entrepreneur so they can get rapid feedback on their ideas and clearly see how such ideas progress.

Cobbenhagen *et al.* (1994) conclude that innovative SMEs generally have vertically integrated structures. They point out that horizontal work flows are at the centre of such structures. Work is organised in teams that are responsible for projects from start to finish and in

which various jobs or disciplines are represented. Oden (1997) says that, in vertically integrated organisations, instead of satisfying managers (vertical relationship), employees concentrate on satisfying the needs of their internal and external customers (horizontal relationship), which in turn improves the innovative ability.

It should be noted that horizontal integration is not particularly relevant in very small companies. These companies already operate implicitly as vertically integrated organisations. The medium-sized companies in particular can benefit from vertical integration.

5.3 Multi-functional teams

Description

To improve the innovative ability of a company, interdisciplinary activities are of extreme importance. Interdisciplinary activities mean that people with different backgrounds (functions, education) work together. An interdisciplinary approach results in being confronted with a variety of information, which becomes available from the various backgrounds. This causes the employees of the company to look at problems from different perspectives and generate new ideas (of course, ideas for new products will be among them).

For SMEs, there are several ways to improve the amount interdisciplinary activities in their work processes. In this section we shall discuss the possibility of multi-functional teams. We define a multi-functional team as a group of persons with different functional backgrounds (work, education, experience, etc.) who carry out a particular job.

Relationship with innovative ability

Brown and Eisenhardt (1995) conclude that working in multi-functional teams generally improves the innovative ability of a company. The interdisciplinary backgrounds of the team members means that people can look at problems from different perspectives. This improves their ability to generate ideas for product innovations. In this context, Cozijnsen (1996) mentions the multi-functional team as a characteristic of the innovative organisation structure. In this structure the work is executed in projects, during which multi-functional teams are responsible for carrying out the project.

Amabile (1998) states that a team ideally consists of employees who each contributes his/her own point of view and experience. In a team with different backgrounds the ideas of the team members will

be combined in a very useful way. As the opposite of a multi-functional team, Amabile (1998) mentions the homogenous team. In practice, the building of a homogenous team can be very attractive, because homogenous teams do not have many conflicts and tend to achieve quick solutions. In this kind of teams, the members usually state that they like each other. However, homogenous teams are not suitable for improving the innovative ability, because each team member makes a similar contribution. Below, we shall discuss the best way to form a multi-functional team.

Brown and Eisenhardt (1995) state that it is important that the team members have some experience together and already know each other. When a team is completely new there is a risk that the way in which the team members share information and co-operate is not effective. In this case, the most important advantage of a multi-functional team (the confrontation of information from different backgrounds) is lost.

On the other hand, there is a risk that team members who have already co-operated for a long time will be 'internally orientated'. In this case, the communication with the company is neglected and a separate team culture arises. In this context, Buijs (1987) mentions that teams should have a new, changing composition from time to time.

Tidd *et al.* (1997) point out that successful product innovation mainly depends on the ability of a company to combine different perspectives into new ideas. Their research shows that, compared to individuals, teams are better suited to realise this. Tidd *et al.* (1997) mention a number of success factors:

- The team objectives, tasks and responsibilities are clearly defined
- Effective team leadership
- Effective handling of conflicts
- High quality of communication with the rest of the organisation
- Presence of all necessary team roles.

When discussing the presence of team roles Tidd *et al.* (1997) mention the following. The employees of a company can be classified according to the roles that they play in a team. For instance, there are persons who can generate lots of ideas, persons who can take decisions and persons who can negotiate in case of conflicts. In order to be successful, Tidd *et al.* (1997) recommend that all these team roles are represented.

Buijs (1983) mentions the importance of different team roles as well.

He concludes that each employee has a specific set of capabilities and will therefore fulfil a specific role in a team. One person is of particular importance for the search phase of the innovation process. Buijs (1983) calls this person the 'dreamer'. A dreamer is an employee who has a very concrete level of thought. In addition, a dreamer has wide interests and is full of emotions. His most important strength is his fantasy and imagination. Therefore, a dreamer is able to look at problems from many different points of view and can generate a lot of ideas for new products and product improvements. However, the most important weakness of a dreamer is his indecisiveness, because he keeps thinking of new ideas all the time.

In very small companies, the possibility of multi-functional teams is less relevant. In a small company, the number of employees is often too small to put different teams together. However, it is a fact that SMEs can improve their innovation success by means of interdisciplinary activities, for instance via co-operation with other companies. This determinant will be discussed in section 7.3.

5.4 Co-operation between departments

Description

In this section we shall discuss the possibility of co-operation between the departments of an organisation to improve the innovative ability. In advance, we must state that this co-operation is not relevant for very small businesses, since these companies normally do not have any departments. It will be particularly the medium-sized enterprises (> 50 employees) who can use co-operation between departments to improve their innovation success.

Relationship with innovative ability

Kanter (1984) mentions the importance of many horizontal contacts between departments. This will result in an increase in the variety of the information that becomes available during work. With this information the employees and the entrepreneur can look at problems more thoroughly and generate more creative ideas and solutions. In our opinion, this will have an effect on the number of ideas generated for new products, and improvements in existing products, as well.

Dhondt *et al.* (1996) recommend intensive co-operation of research and development and sales and production departments. If the R&D department co-operates with the sales department, they can take into

account customer needs and preferences when developing new products. If the R&D department co-operates with the production department, they can take into account the costs and internal changes that an innovation will cause.

Zien and Buckler (1997) stress the need for co-operation between the marketing and the R&D department as well. They conclude that innovative companies have very strong and direct relationships between these departments. Both departments work on the same projects and have both formal and informal relationships. It appeared that in innovative companies, the communication between both departments worked out 'automatically' and had an informal nature.

There is always a danger that the department which initiates the innovation will dominate the innovation process. Rothwell (1992) concludes that in successful innovative companies the start for new product development is made by several departments together. He states that it is of minor importance which department starts the innovation, but that it is very important that all departments co-operate and share information.

Dougherty (1992) discusses a number of ways of how an entrepreneur can improve the co-operation between departments. For an extended discussion of these issues we refer to Dougherty (1992):

- Organising workshops together. This gives the employees insight in the work process in other departments and contributes to the mutual understanding.
- Training. In order to co-operate well, every employee can be trained in skills like meeting behaviour, listening comprehension, chairmanship and taking group decisions.
- Meeting customers together. If an employee from the production department joins a sales representative, he will obtain a good overview of the ultimate results of his own work. In addition, employees from different departments will work towards a combined objective.

For an extended discussion of these issues we refer to Dougherty (1992).

5.5 Task assignment and expansion

Description

When assigning tasks, it is important that the entrepreneur chooses the right people to do a job. The decisive factor here is the challenge

presented by the work. The challenge should not be such that people become bored, nor be so great that they lose control or feel threatened. A task should require all the skills and talents of the employee concerned, but not the skills and talents that such an employee lacks.

Relationship with innovative ability

Amabile (1998) indicates the importance of good employee task assignment as a means of improving the innovative ability. When employees face challenges in doing their work they will display more innovative behaviour. To bring about proper links between people and tasks, the entrepreneur must gain extensive information about the skills and talents of his employees. In reality, entrepreneurs do not often try to obtain such information, so that ideal links between people and tasks are lacking. This results in suppressing employee creativity.

Kanter (1984) mentions the possibility of task expansion as a means of promoting innovative ability. Employees face maximum challenges when tasks are broadly formulated and overlap with tasks of other employees. This increases co-operation among the employees. In this context, Dougherty (1992) states that in innovative companies tasks should be more broadly formulated than in traditional companies. In traditional companies, work is subdivided into small pieces. Employees feel responsible only for their own contributions. On the other hand, when task descriptions are broad and the activities overlap with other employees, the employees then feel more involved in the company as a whole and will be quicker to come up with innovative ideas.

Finally, Maira and Thomas (1999) argue in favour of having 'excess' employee capabilities. Maira and Thomas (1999) mean that employees should have an opportunity to develop or pursue new skills, if the working environment makes such demands. Otherwise, a company could not produce the desired product innovations and adaptations. Imagine, for example, that a marketing employee is confronted with the demand for a product variant which must meet very strict milieu requirements in a new export market. The product variant does not yet exist. If the marketing employee has detailed knowledge of potential production techniques, such knowledge would be useful in assessing the feasibility of the new product.

5.6 Job rotation

Description

In this study, we define job rotation as frequently exchanging tasks and jobs among employees. Job rotation (as with task expansion) is a method for broadening the employee's point of view.

Relationship with innovative ability

According to Prakken (1994), job rotation makes the departments and employees in an organisation familiar with each others work. The employees will find it easier to place problems in a wider context. Job rotation gives employees more empathy with their colleagues' work. Work experience in different job areas enhances creative potential since the broad experience gained by employees will more quickly enable them to suggest ideas for improving existing products.

Maira and Thomas (1999) state that when employees come into contact with other job areas through job rotation, they can gain new ideas and insights for new or improved products and services. They conclude that innovative companies favour the horizontal mobility of their employees more than do traditional companies. They do this by moving their employees back and forth among different jobs, enabling them to gain a variety of experience and to become more flexible.

Van de Ven (1986) considers job rotation as a means of increasing awareness of the total organisation's objectives. After all, job rotation provides greater variation in the work and increases employee commitment to the job and the company. In this way, employees can look beyond their own limited areas of responsibility and view their activities in a wider context.

5.7 Autonomy

Description

Autonomy refers to SME employees who do their work freely and independently and who therefore decide their own approach to doing the work. The responsibilities in an autonomous organisation are at a low hierarchical level. The management tasks are decentralised as much as possible.

Relationship with innovative ability

According to Prakken (1994), autonomy contributes to innovation capacity because autonomous employees have extensive competencies, increasing their job involvement. This promotes the creativity and generation of new ideas. Dougherty and Hardy (1996) also argue in favour of substantial autonomy for employees. According to them, centralised structures and processes are geared towards maintaining the status quo. This is in opposition to innovation, because it creates a hostile climate in respect of creativity. In this context, Dougherty and Hardy present a warning. At a given moment, an entrepreneur must assess the ideas of autonomous employees. They conclude that innovations sometimes fail because the 'gap' is too great. This could happen because the employee has lost sight of the strategy, or support for innovation has dissipated for some other reason. Dougherty and Hardy argue that autonomy should not mean that employees totally lose contact with their colleagues.

Oden (1997) discusses 'decentralised decision-making' that promotes the innovative ability of companies. He uses the term 'empowerment' to describe employees that have a high degree of influence in the course of events and can take their own decisions. The participation of employees in the decision making process is a major characteristic of empowerment. Bowen and Lawler (1992) state that employees who participate in the decision making process are an important source of ideas. Because of their influence on decision making, they will generate and propose ideas more often.

Oden (1997) points out the fact that decentralised decision-making places the creativity and knowledge of all employees at the service of the organisation. Autonomous employees will take extensive initiatives (including ideas for new products or improvement of existing ones), but also share knowledge with their colleagues. The ultimate aim of all this is self-management. This means that employees assume responsibilities and monitor the progress of their own work. In such an ideal situation, management's only role is that of a teacher and facilitator.

In this regard, Damanpour (1991) points out that centralisation has a negative effect on an organisation's innovative ability. His research shows that this connection actually exists. Concentrating decision-making in a central body prevents innovative solutions to problems. The delegation of decision-making power is crucial for innovation. Finally, we refer to Kanter (1984), Vrakking and Cozijnsen (1992),

Gosselink and Timmers (1989) and Snee (1994) for a further discussion on the benefits of autonomy for innovative ability.

Van de Ven (1986) concludes that the capacity for innovation is best served when work takes place in autonomous task forces. Kuipers and van Amersfoort (1990) define an autonomous task force as 'a group of people, permanently employed and an unchanging composition of members who can perform many tasks, which is responsible for carrying out, regulating, assessing, analysing and improving clearly finished tasks, for which the necessary resources are made available'. Kuipers and van Amersfoort consider autonomous task forces as the building blocks of an innovative organisation. According to them, the autonomous task force has sufficient freedom of action to resolve problems independently. This increases employee commitment to the job and, consequently, the generation of ideas.

5.8 Reward structure

Description

Many entrepreneurs employ a reward system that aims to improve the effectiveness and efficiency of the existing work processes. Some examples of the reward criteria in these systems are: the number of years of service (it is assumed that an employee with more experience performs more effectively/efficiently), the realisation of some pre-defined targets (as a standard for effectiveness) or the elimination of mistakes (as a standard for efficiency). With such a reward system, improvement means 'doing a job better'.

However, such a reward system is not very suitable for an innovative organisation. The main objection is that a traditional reward system implies upholding the company rules and procedures. In an innovative organisation there must be possibilities for constant change. Therefore, a reward structure which motivates employees to innovative behaviour is required. The employees must be challenged to be creative and criticise the existing rules and procedures.

Relationship with innovative ability

McGourthy *et al.* (1996) mention that the reward system can play a significant role in stimulating the company's innovative behaviour. They discuss four examples. The reward system can be made dependent on:

- team performances. This certainly stimulates the co-operation in teams, and this co-operation stimulates the creativity of the employees.

- the innovative efforts of employees. For instance, the reward could be based on the number of generated ideas or the amount of financial resources an employee asks for to work out an idea.
- the innovation results. For instance, the reward could be based on the number of patents or the cash flow from new products.
- the company's results. The advantage is that employees are stimulated to co-operate with their colleagues and with other departments. This certainly improves creativity, because the employees will obtain a broader view of the company's problems and learn how to deal with problems from various perspectives.

In this context, Ayas (1996) notes that the reward system in an innovative organisation should not focus on individual performance. Instead, team performances should be the guideline for the reward system. In order to improve their innovative ability, people should co-operate and share their information. The importance of this co-operation and sharing will be emphasised and encouraged if the reward system is based on team performance. To be able to reward team performances, these performances must be made measurable. Ayas (1996) therefore argues for a reward system that is based on innovative efforts or results.

Amabile (1998) says that the reward system in an innovative organisation must emphasise the intrinsic motivation of the employees. Amabile (1998) distinguishes two kinds of motivation:

- external motivation
- intrinsic motivation.

External motivation stems from sources outside an employee. An externally motivated employee is 'forced' to do a job, with the objective to gain something (like money or a promotion) or to prevent something (for instance, being sacked). Money is the most frequently used external motivator. However, for innovation purposes it is important to recognise that money does not result in enthusiasm for a job. In the long run, a financial reward will not cause an employee to be happy in his job if he did not like it from the start. On the other hand, intrinsic motivation is characterised by enthusiasm and interest. It is an 'internal force' which drives an employee to do a job. This kind of motivation stems from inside of a person. When people are intrinsically motivated, they will enjoy performing their job because they are challenged by it.

Amabile (1998) concludes that employees will generate more ideas and behave more innovatively when they are intrinsically motivated.

So, according to Amabile (1998), the possibilities to improve the innovative ability by means of the financial reward system are limited. The innovative ability can be improved much more by intrinsic motivators. To realise this, it is important that the entrepreneur allocates the workload corresponding to the skills, talents and needs of his employees. Furthermore, the attitude of the entrepreneur is another important intrinsic motivator (by complimenting innovative efforts).

6 Availability of means

The availability of means seems to be a necessary condition for innovation success. Most product innovations require time, money and knowledge. Creativity is also essential to produce ideas to start the innovation process. We shall discuss the influence of the following on the innovative ability:

- the freedom to experiment (6.1)
- financial resources (6.2)
- education and training (6.3)
- use of creative techniques (6.4).

6.1 Freedom to experiment

Description

Companies with great freedom to experiment give their employees the time to try out their ideas (for example, to test new packaging, etc.), and management takes the results of such experiments seriously. Tidd *et al.* (1997) explain the need for experiments from environmental variables. They argue that the turbulent internal and external working environments in which many companies operate today make constant change necessary. In such environments, an increasing number of companies encounter the process of change. As a result, their willingness to change through experiments will increase.

Relationship with innovative ability

Buijs (1988) mentions that the freedom to experiment is essential for the innovative ability, since many successful innovations are discovered when people start to question a use or habit, or try to do their work in a different way. Consequently, ideas for new products could result. The freedom to experiment therefore contributes to idea generation.

Zien and Buckler (1997) argue that being able to experiment in each job is important. Their research shows that precisely innovative organisations offer many opportunities for product experiments. They do this by making time and money available and by the entrepreneur taking the findings of the experiments seriously. Experiments carried out by individuals increase the chances of developing successful new products. A well-known example here is the US company 3M, whose 'post it' notes were the result of the initiative of one employee. The very fact that such experiments by employees are taken seriously, promotes a climate in which there is a great willingness to experi-

ment and generate new ideas.

Finally, Nagel (1992) and Cooper (1993) mention the ‘possibility to experiment’ as a determinant of innovation success. Many ideas for successful product innovations are discovered accidentally in the implementation phase of other product innovations. For instance, when 3M was developing a new type of glue, they discovered the famous ‘post it’ notes by accident.

So, if the entrepreneur wants to organise the innovation process as efficiently as possible, he reduces the possibility of accidental discoveries. On the contrary, it is important that the entrepreneur encourages initiative, creativity and experiments. Gaspersz (1998) discusses some possibilities to improve the freedom to experiment:

- A low workload. With a high workload, employees can not take any distance from their daily work and routines. It is important that the employee has the opportunity to walk around or read professional literature. For instance, employees do not have to account for 15 percent of their time.
- Rooms for silence and meditation. This helps the employees to take some distance from their daily work.
- Tools that encourage creativity, like software for brainstorming.

6.2 Financial resources

Description

In order to be innovative, an entrepreneur must be prepared to make investments. Although some product innovations occur quite spontaneously, most product innovations are rather expensive, and the return on the investments is not clear in advance. So to be innovative an SME requires money.

In this context, the creditworthiness of the company on the capital market is relevant as well. The capital market can be defined as the market on which long-term financial contracts between different partners are made. To some extent, companies will be dependent on the availability of money and their borrowing capacity on this capital market to finance their investments.

Relationship with innovative ability

Gosselink (1996) mentions the presence of financial resources as a determinant of the innovative ability. When an entrepreneur or employee is aware of the fact that there are no resources available to

work out ideas, then he or she will not be very motivated to generate ideas at all. Nagel (1992) thinks of financial resources as a condition for innovation success. When a company has enough financial resources available to produce and distribute new products, this has a positive influence on the innovative ability for products.

Felder *et al.* (1996) discuss the influence of creditworthiness on the ability to borrow money on the capital market to finance innovative activities. Less creditworthy companies are less likely to perform R&D and so the generation of new ideas is frustrated. Their findings confirm this hypothesis: companies with a low credit rating are less likely to perform R&D than companies having high credit ratings.

According to Nijssen (1992) the amount of financial resources required strongly depends on the innovation strategy of the company. The amount of resources is a result of the strategic intention that the company expresses. Nijssen (1992) concludes that a company can make a choice out of four roles where the issue of innovation is concerned:

- **Prospector.** These companies are continuously looking for new chances in the market place. They show a very active attitude toward new product development. In many markets, prospectors are the cause of changes.
- **Defender.** Defenders spend less time looking for possibilities to develop new products. The focus of their activities is mainly on improving their productivity and efficiency. Defenders are usually dedicated to serving a niche market.
- **Analyser.** The strategy of these companies is somewhere between the prospector and the defender. An analyser has some characteristics of both types. In a stable market, the analyser will behave like a defender (focusing on productivity and efficiency). In a dynamic market, the analyser will behave like a prospector and be more innovative (focusing on change and new products).
- **Reactor.** Reactors are companies without a consistent strategy. They just react to changes in their environment when they are forced to do so.

When a company wants to be a prospector, it can realise its favourite role only when there are enough financial resources available. Compared with a defender, a prospector must have more resources to support the innovation process. This also applies to the financial means for the entrepreneur and the employees to experiment, which is a determinant of creative behaviour.

Amabile (1998) gives an important guideline for the required amount of financial resources. According to Amabile (1998), in practice it

appears that creativity is not stimulated by allocating more resources to the employees than is strictly necessary. However, when the entrepreneur does not allocate enough resources, this is definitely devastating for the creativity of his employees. Amabile (1998) warns that most entrepreneurs do not realise this. They make a mistake by saving on the financial resources to work out ideas. In fact, the employees could start using their creativity to find financial resources somewhere else, instead of generating ideas to help the company.

Damanpour's (1991) findings are contradictory to Amabile's (1998) guideline. According to Damanpour (1991), a margin ('slack') in the financial resources does cause an improvement of the innovative ability. By maintaining some slack in the resources an organisation can afford mistakes, and develop new products that do not have a direct commercial value. This will increase the number of ideas generated by the company's employees.

Dougherty and Hardy (1996) recommend the introduction of 'pockets of seed money' in a company. 'Pockets of seed money' are budgets which are distributed among the employees of the company. Every employee is allowed to allocate his budget to work out promising ideas. The result is that every idea gets several chances to prove itself. The main difference from 'slack' is that 'pockets of seed money' do not imply extra financial burdens on the regular work. They are meant as 'external' capital to stimulate the generation and implementation of innovative ideas.

6.3 Education and training

Description

Tidd *et al.* (1997) stress the importance of education and training as ways of promoting the capacity for innovation. Their research shows that there is a connection between investments in the education and training of employees and the number of successful innovations. Their explanation is that a company's capacity to produce new products depends to a large extent on the knowledge and capabilities of those who provide ideas and develop innovations.

Relationship with innovative ability

Education and training can advance the capacity for innovation in various ways, according to Tidd *et al.* (1997). Firstly, training programmes can be directed towards enlarging the body of knowledge.

This directly increases the creative capacities of employees. A larger body of knowledge, combined with new experience, can ensure that people could find solutions for previously unsolved problems.

Secondly, training can serve as a motivating factor. In general, employees appreciate being given an opportunity to gain new knowledge and experience. They feel appreciated because attention is being paid to them. They will more readily think about problems facing their organisations and suggest potential solutions (ideas). It is important here that employees do not feel obliged to attend training courses on subjects that do not interest them.

Finally, Cozijnsen (1996) adds that training could focus on doing away with resistance to innovative processes. Innovative processes are, by definition, processes of change which will encounter natural resistance. It appears that a major component of such resistance lies in the fact that employees do not know which skills they will require in the new situation. Identifying and acquiring such skills at an early stage would overcome a substantial amount of resistance.

6.4 Use of creative techniques

Description

Creativity is the first step along the road to successful innovation. Feringa, Priest and Ritsema (1990) define creativity in two ways. Firstly, creativity is the capacity to abandon programmed ways of thinking. This frees the way for new approaches. Secondly, creativity is the capacity to re-combine knowledge and experience in a new way, which could then provide unexpected solutions to previously unsolved problems. This will generate ideas for new or improved products as well.

There are many techniques designed to advance human creativity in a direct manner. Buijs (1987) mentions no less than 50 creative techniques. Prakken (1994) makes a distinction between creative techniques at individual or group levels. In several cases, use of these techniques requires specialist knowledge and experience. To promote the capacity for innovation, it is not necessary for the entrepreneur to have a thorough command of these techniques, but the entrepreneur must be aware of the pitfalls in using such techniques, so they can be deployed in a responsible manner.

Relationship with innovative ability

Creative techniques contribute directly to the capacity of employees to generate solutions and ideas. This will generate ideas for new or improved products as well. Buijs (1987) and Prakken (1994) suggest that the use of creative techniques can enlarge the innovative ability of SMEs considerably. However, Mahajan and Wind (1992) conclude that the use of creative techniques is still very restricted in the U.S.

Buijs (1987) mentions three general rules for using group creative techniques. The first rule concerns the attitude that one should take towards other participants. This involves that, instead of assuming the normal critical attitude ('we've already tried that' or 'that doesn't work in our experience'), employees should take a 'what's good about it' attitude. Thinking along with other people's ideas often produces the best results. The second rule is that one often has to come up with several ideas before one really good one emerges. A creative discussion therefore entails thinking in alternatives. Thirdly, one should not become too involved in the subject matter. Regularly distancing oneself from a subject provides a good opportunity for opening up new points of view.

Further, Buijs (1987) describes the three most important creative techniques at group level:

1. brainstorming
2. morphology
3. synectics.

1. Brainstorming

During brainstorming sessions participants use each other's spontaneous reactions to previously expressed ideas. Buijs (1987) calls such spontaneous reactions 'associative links'. Examples of associative links are: nail, drawing pin, band-aid, painting, Rembrandt, the Nachtwacht, the Rijksmuseum, Amsterdam, a night on the town. Everyone builds associative links in their own way. When different people react to each other's ideas, it can result in very different associations and the birth of new ideas.

During brainstorming sessions it is not allowed to react critically to other people's ideas or comments. Each idea has something positive, which then becomes the basis for elaboration. Following the session one can, of course, belittle an idea. Creating a loose, free, enthusiastic atmosphere is therefore very important for brainstorming sessions. Laughter, encouragement and positive assessment seem to have a positive effect on the results.

2. *Morphology*

Morphology is the systematic approach to the creation of ideas. First, the problem is subdivided into several subsidiary questions. The subsidiary questions are resolved first and then combined in one or more total solutions. Quantity is achieved because each subsidiary problem can be resolved in a different way. For the total solution, this produces a multitude of combinations. In this way, solutions can be found that no one had thought of before.

3. *Synectics*

Synectics involves trying to arrive at new insights by distancing oneself from the subject matter. First, plenty of time is allowed for the participants to get used to the problem. Then, one tries to estrange the participants from the subject by confronting them with totally different thoughts, for example, by selecting a word arbitrarily, following which the participants endeavour to associate the word with the original problem. The confrontation again produces new ideas. We refer the reader to Buijs (1987) for several examples.

7 Network activities

In chapter 5 we discussed the fact that interdisciplinary activities are important to improve innovative ability. Interdisciplinary activities mean that people with different backgrounds work together. An SME could realise this by employing network activities. Below, we discuss the effects of four kinds of network activities:

- external orientation (7.1)
- customer orientation (7.2)
- co-operation with other companies (7.3)
- transfer of technology and information (7.4).

7.1 External orientation

Description

Companies that have a strong external orientation have frequent, intensive contacts with their environment. Such companies identify opportunities and threats from their working environments and use them to create or improve products.

In this regard, knowledge is said to have spill-overs: companies can poorly appropriate all returns from R&D and innovations and it can hardly be protected from competitors. Spill-overs can be either:

- international. International spill-overs are more likely the more open an economy is.
- national. National spill-overs can either come from intra- or from inter-industry trade.
- internal to the company. Spill-overs internal to the company arise from different divisions co-operating together. This subject was discussed in chapter 5.

Relationship with innovative ability

The spill-overs of knowledge creation from companies enhance the opportunities for product innovations at other companies. This occurs because companies learn from the knowledge entrenched in goods, activities or organisations (Favre *et al.*, 1999). When an SME is open to these signals, this increases the innovative ability.

Vrakking and Cozijnsen (1992) point out the importance of a company's external orientation in increasing the number of successful product innovations. This external orientation is characterised by strong scientific interest, active gathering of information and a high frequency of contacts with suppliers. According to Cooper and

Kleinschmidt (1995), the extent to which a company is knowledgeable of its environment is a critical success factor in the success of product innovations. Developing and implementing external orientation in each job constitutes a major step in creating and maintaining an innovative organisation. Finally, Nagel (1992) and Snee (1994) mention an external network (consisting of relations with universities, competitors and advisers) that increases the innovative ability.

Rothwell (1992) recommends the creation of special jobs to increase the external orientation of SMEs. For example, he calls for the appointment of a 'technological gatekeeper'. This is a person who collects technical information by visiting conferences, lectures and maintaining various contacts. The purpose of this is to give the organisation an antenna to the outside world. In this way, an organisation can identify and take advantage of significant technological innovations.

Heydebreck (1997) mentions a number of external parties. He discusses the way in which they can help an SME to generate product ideas:

1. suppliers
2. competitors
3. other external parties.

1. *Suppliers*

For new product development, it is important for an SME to share information with its suppliers. A supplier used to be the performer of the customer's needs, but nowadays there is a shift to 'co-makership'. Suppliers are becoming partners who bring in knowledge about technology, design and production. This new knowledge can help an SME to generate ideas for new products.

2. *Competitors*

It is important that an SME gains information about its competitors' plans and activities concerning product innovation. By taking this information into account an SME can improve its own innovation success (for instance, by imitating their competitors' innovations). Furthermore, once an SME knows what its competitors are doing to stimulate the innovative behaviour of their employees, the SME can adjust its own organisation in the same direction. A possible source of this information is new employees recruited from the competitor.

3. *Other parties*

Finally, Heydebreck (1997) mentions the government, political parties, unions, universities, research institutes and consultants as infor-

mation sources. The information can improve insight of the external environment. An SME can meet these parties via co-operation, ad hoc meetings, visiting fairs, etc. The subject of co-operation with other companies is discussed in one of the following sections.

Finally, customer relations are part of a company's external orientation as well. This subject is discussed in the next section.

7.2 Customer orientation

Description

An SME with strong external orientation will also maintain intensive contacts with its customers. Such companies pick up information about customers' experience with their products, using this to improve their products and services.

Relationship with innovative ability

When an SME is sensitive to signals from its clients the company will expand its innovative ability. Ottum and Moore (1997) conclude that companies using customer information have more successful product innovations. The customer information seems to be a valuable source for ideas. In this regard, Vrakking and Cozijnsen (1992) mention the importance for companies of a high contact frequency with their customers. Twiss (1992) mentions that innovative success strongly depends on meeting customers needs. Therefore, it is of significant importance that the company uses their customers' opinions in every stage of the product development process.

Heydebreck (1997) discusses the customer's role in improving the innovation success as well. SMEs should think of the customer as an important business partner, because every product innovation must satisfy his needs. Therefore, it is necessary that the customer is participating in the innovation process. The customer is a very valuable partner for any organisation, because he has experience with the company's current products and possibly has experience with the competitors' products as well. The customer is aware of the product's weaknesses and could supply information about how the competitors have solved these problems. His ideas are usually more valuable than the results of a brainstorm session with the internal marketing department, because the customer has real needs and is prepared to spend money to satisfy them.

Finally, Sanders and Neuijen (1992) mention the distinction between pragmatic and normative business cultures. A pragmatic culture is heavily customer-orientated. The emphasis is on satisfying the customers' needs. In a pragmatic culture, results are more important than following the right procedures. On the other hand, in a normative culture there is great emphasis on compliance with, and proper application of, procedures. Although Sanders and Neuijen do not say anything about the innovative ability, it seems obvious that a pragmatic business culture is the best way to promote this. After all, this culture is more open to the customers' needs.

Literature contains several suggestions as to how SMEs can enlarge customer orientation. According to Brandt (1982), companies can expand various activities to inventory their customers' needs along with accompanying trends. This takes place by entering into formal and informal relationships. Brandt (1982) emphasises that the presence of informal contacts and relations with customers is a valuable source of information.

Tidd *et al.* (1997) list several simple measures that organisations could take to improve/extend customer orientation:

- Having employees visit customers and suppliers. It is important for companies that their people visit customers and suppliers, because they can gain insight into product use and new ideas. In their research, Christiansen (1996) and Dhondt *et al.* (1996) reach identical conclusions. They even advocate that the production employees of a company should visit customers.
- Closely involving customers in the innovation process by means of market research, product assessments, visiting shops or observing the customer when using the product. Regular feedback to customers will increase the number of ideas for product improvement.
- Introducing internal client contacts. This means that employees regard their colleagues as customers, to whom they must 'sell' their work. So there will not be any distinction between external and internal clients.

7.3 Co-operation with other companies

Description

Another way to improve the amount of interdisciplinary activities is via co-operation with other companies. Most literature on this subject is about technological co-operation with other companies.

Hulshoff and Snel (1998) define technological co-operation as developing a new product or work process together, or exchanging knowledge. Both can be realised with various participants, like competitors, customers, universities and research institutes.

Relationship with innovative ability

Gosselink (1996) mentions technological co-operation with parties from the external environment as a determinant of innovative ability. Each participant brings in his own knowledge and skills. Again, this will cause an increase in the variety of the information that becomes available during work. With this information the participants can look at problems more thoroughly and will generate more creative ideas and solutions. This will have an effect on the number of ideas generated for new products, or improvements to existing products.

Hulshoff and Snel (1998) mention that gaining increased knowledge is one of the most important motives for co-operation between companies. In their opinion, new ideas can easily emerge from this knowledge. For instance, if the customers join the co-operation, the company will gain valuable information about their customers' needs. If the competitors join the co-operation, the company can gain an accurate impression of the market by gathering the market knowledge from both parties.

In literature a number of conditions for successful co-operation are mentioned. We restrict ourselves to a short overview. For a detailed description we refer to Hulshoff and Snel (1998):

- There must be a clear strategy and objectives from the start.
- The partners must agree about each one's contribution to the co-operation. It should be clear for what each partner can be held responsible. This is even more important when the participants have unequal sizes.
- The co-operation should originate from a customer's unsatisfied requirement.
- The initial expenses should never be underestimated.
- The participants must realise that financial benefits will normally come in the long run.
- Acceptance of cultural differences between partners is crucial.

7.4 Transfer of technology and information

Description

Companies can acquire new product ideas from technological knowledge or information outside the company. Here, we are looking at the transfer of technology and information in exchange for money. This subject must be differentiated from the source mentioned above, namely external knowledge from contacts with other parties (external orientation).

Relationship with innovative ability

It can be expected that the transfer of technological knowledge and information improve the opportunity to innovate, because of the increased knowledge companies obtain. Recently, national and European authorities have given strong emphasis to this manner of innovation policy. Therefore, it will be interesting to see the results some empirical studies regarding technology transfer will produce.

From Brouwer's (1997) study it appears that expenditure on product innovation increases when a company acquires external knowledge. Brouwer states that a part of this increase in total innovation expenditure is explained by the cost of acquiring external technological knowledge.

8 Company characteristics

The innovative ability of an SME can be influenced by some of its own enterprise characteristics as well. We should mention that company characteristics are not as manageable for the entrepreneur as the determinants that we discussed in the previous chapters. We discuss the following:

- technological competence (8.1)
- company size (8.2)
- high diversification scheme (8.3)
- high range of activities along the production line (8.4)
- export activities (8.5)
- location of the company in urban areas (8.6)
- high complexity of product design (8.7)
- low lead time in the introduction of the novelty (8.8).

8.1 Technological competence

Description

Nagel (1993) defines technology as a company's specific knowledge, skills and affinity with its products and work processes. The technology present in a company is often a prerequisite for being able to produce innovations. Gosselink (1996) asserts that the term technology includes the technological know-how present in the company. It is important that the organisation remains committed to the development of the technology. The timely implementation of new technologies in order not to fall behind in relation to the competition, is an essential area of attention for technological management.

Relationship with innovative ability

Cooper and Kleinschmidt (1995) consider the available technology a critical success factor for the success or failure of product innovations. In the first place, without any up to date technology it is difficult to develop a new product that satisfies the needs of a modern customer. For instance, nowadays the use of computer technology in modern cars is indispensable. When a company does not have any modern technology, in many cases it will be impossible to generate useful ideas for new products that can actually be produced. Therefore, technical competence is also relevant for the search phase of the innovation process; a lack of technical competence will frustrate idea generation.

Gosselink (1996) states that technology also consists of technological know-how, which is present in a company to keep pace with technical developments. It is an essential concern for the entrepreneur to introduce new technical developments in time. Otherwise, the company will find itself falling behind its competitors. In this context, Nagel (1992) states that it is hard to give a general guideline as to how an entrepreneur should act when faced with a new technology. In a market with free competition a company will be faced with new technologies every few years. According to Nagel (1992), changing too early can be just as disastrous as changing too late. It appears rare for one company to be the market leader in a number of consecutive technologies.

8.2 Company size

Description

In this respect, company size is determined by the number of employees a company has. Below, we shall discuss whether a small company size is better suited for idea generation than a medium size.

Relationship with innovative ability

In theory the influence of the company size on the generation of ideas is ambiguous. On the one hand larger companies are reasoned to have more innovative ability because there are many employees, which increases the possibilities of interdisciplinary activities (Brouwer, 1997) and because the risk for the company as a whole is less (Vossen and Nooteboom, 1996).

On the other hand, smaller companies tend to be more flexible than larger companies. This encourages the generation of ideas as well. Scherer (1988) has summarised the advantages small companies may have in contributing innovations compared to larger-sized companies:

- Smaller companies are less bureaucratic, so daring ventures are not blocked by a highly structured organisation.
- Company size can change the trade-off between product and process innovations. In larger companies profits from product innovations will decrease compared to process innovations.
- It is easier to get smaller organisations excited about an innovation than larger ones because the links between challenges, employees and potential rewards are closer.

Brouwer (1997) found that the elasticity of company size related to a company's innovative ability is less than one. Furthermore, company size has a negative influence on percentage shares in total sales of products new to the company and sector. In general this means that smaller companies are less likely to be innovative, but those smaller companies which innovate, innovate more intensively than larger companies which innovate. These findings are consistent with the estimates by Vossen and Nootboom (1996) and Felder *et al.* (1996).

8.3 High diversification scheme

Description

The diversification scheme of a company is the scope to which a company's line of business extends. A high diversification scheme refers to a wide range of business activities.

Relationship with innovative ability

It could be argued that companies having high diversification schemes are more likely to be innovative for various reasons. First, these companies are more likely to have several divisions. In addition, these companies are more likely to have a greater variety of information available, which stimulates the idea generation. Lunn (1987) found a significant positive impact of a higher degree of diversification on the number product innovations. According to Felder *et al.* (1996) however, there is no significant impact on the R&D intensity. So the increase in innovative products through a higher degree of diversification is not due to a higher intensity of R&D. Presumably, the increased probability of product innovations comes from the presence of the large amount of information available.

8.4 High range of activities along the production line

Description

An SME performing many activities along the production line itself, i.e. not making extensive use of suppliers of raw materials or intermediate goods, can have more innovative ability than an SME that does not.

Relationship with innovative ability

Companies performing many activities along the production line can be expected to be more innovative. The reasoning behind this is that

companies which perform more activities internally have more opportunities for interdisciplinary activities and can therefore generate more ideas as well. In a case-study for Spanish firms Martinez-Ros and Labeaga (1998) found that these companies are indeed more innovative (have more product innovations).

8.5 Export activities

Description

Export activities are activities which involve trade across borders, i.e. trade with foreign companies.

Relationship with innovative ability

One can expect exporting companies to perform more R&D than companies operating solely on the national markets, because those who export are likely to gather more information, and therefore be more creative. Felder *et al.* (1996) did indeed find a significant relation between exporting companies and innovation intensities. Moreover, the same is true for companies which have the intention to enter the foreign markets.

Lotti and Santarelli (1999), however, point out that the causality could also be the other way around. As an outcome of innovative activities companies are more likely to export. The incentive to export is greater for companies with more innovation success since they have more intangible resources to sustain growth (Martinez-Ros and Labeaga, 1998). So the causality between the two activities is not clear.

8.6 Location of the company in urban areas

Description

In an urban area the information density, positive externalities from knowledge centres (for instance universities) and other innovative companies are more agglomerated than in rural areas.

Relationship with innovative ability

It can be argued that the location of a company has a positive influence on the innovative ability of a company. Companies in urban areas can benefit from the information density, which has a positive effect on the number of ideas generated. Brouwer (1997) found that companies in more urban regions have a significantly higher proba-

bility of selling products ‘new to the industry’ than companies in rural areas of the Netherlands. The regional effects are confined to ‘true’ innovations, i.e. products new to the sector, but does not hold for ‘new to the company’ innovations. Nonetheless such regional effects are remarkable, since The Netherlands is a small country with a well-developed transport- and communication infrastructure.

8.7 High complexity of product design

Description

A highly complex product design is a way to protect a company’s knowledge. If a product design is highly complex it is more difficult for competitors to copy the product.

Relationship with innovative ability

It is clear that if the product design is highly complicated it is more easy to keep the design secret and to reap more benefits from an idea. This determinant encourages companies to innovate highly complex products, because these are more easy to keep inside the company. These companies tend to have more innovation success, which encourages even more idea generation. According to the empirical research done by Arvantitis and Hollenstein (1994) the complexity of a design is indeed important for the number of product innovations.

8.8 Low lead time in the introduction of the novelty

Description

The lead time in the introduction of the novelty is the time which is needed to introduce a new product. If this lead time is quite low it is easier for a company to appropriate the returns from the investments in knowledge development. That means because the lead time is low companies can conquer a market share in a short time and in this way they are able to be the first mover on the market, i.e. it becomes more difficult for competitors to enter this market because the market has already been taken.

Relationship with innovative ability

In this context, companies operating in branches in which the lead time of the introduction of products is rather short are more likely to appropriate returns from innovative activities and so are more likely to perform innovative activities. In our opinion, this indicates that

companies will generate more ideas when operating in branches in which the products have a low lead time in the introduction. Indeed this suggestion is confirmed by the empirical study of Arvantitis and Hollenstein (1994). A low lead time has a positive effect on the number of product innovations.

9 Innovation infrastructure

It is likely that the innovative ability of an SME depends on a country's general innovation structure. It is often argued that governments should intervene to stimulate innovations because of the many market imperfections. Knowledge creation, as we have seen, can have great spill-overs by which companies are not able to acquire all the benefits of product innovations. This may be reason for governments to intervene in the market by stimulating the innovation infrastructure. Below, we discuss:

- general technological activity and basic knowledge (9.1)
- the existence of patents (9.2)
- the existence of tax reductions (9.3)
- the existence of R&D subsidies (9.4).

9.1 General technological activity and basic knowledge

Description

Idea generation and eventually product innovations can originate from general technological activities or basic knowledge, i.e. the scientific infrastructure. In this context we mean opportunities created by general technological activity: the availability and quality of education; private and public technical services such as test laboratories; and standardisation institutes, as well as research institutes all favouring innovation. Of course, the government can strongly stimulate the scientific infrastructure.

Relationship with innovative ability

If the general technological activities are greater it can be expected that a company's innovative ability is greater, because the companies can both hire better educated people and make more use of the availability of various services (Mangematin and Mandran, 1999). Idea generation will benefit from this as well.

According to Beije (1989) and Baldwin *et al.* (1998) the scientific infrastructure is indeed a significant determinant for innovation. Not only for process but also for product innovations. The scientific infrastructure is especially important for 'new-to-the-sector' innovations and less important for 'new-to-the-company' innovations. Moreover, the scientific infrastructure should be diverse and of high quality to influence the knowledge accumulation within a country (Beije, 1989).

9.2 The existence of patents

Description

A patent is legal mechanism that grants companies monopoly power for a period of time in order to allow them to obtain returns from their innovative efforts. It is an attempt to use the legal system to influence the degree to which the owner of an idea can charge a fee for its use.

Relationship with innovative ability

It is imaginable that the possibility of obtaining patents and so the possibility of knowledge protection increases the innovative ability of a company, because the availability of patents will improve the innovation success. This will cause the entrepreneur to stimulate his employees to generate new ideas. This reasoning of increasing innovative activity and idea generation as the result of the use of patents is confirmed by Geroski *et al.* (1998).

However, most studies recognise that the causal relationship must be stronger from innovation to the possibility of using patents than the other way around. For instance, the studies by Arvantitis and Hollenstein (1994), Baldwin *et al.* (1998) and Brouwer (1997) confirm this hypothesis. Brouwer (1997) has found a systematic relationship between innovation output and patenting. If more innovation has taken place the use of patents has increased. Furthermore, larger companies appear to use patents more than smaller companies do. Summarising, the causality between the use of patents and innovative ability is not clear.

9.3 The existence of tax reductions

Description

One way in which the government can stimulate innovative activities is by imposing tax reductions on R&D and other innovative activities. In this way performing R&D becomes less expensive and, therefore, it will become more attractive for companies to innovate.

Relationship with innovative ability

Geroski *et al.* (1998) find that corporate tax reductions stimulate innovative activities and therefore idea generation. However, they argue that using the same amount of money to directly subsidise R&D would have a far greater effect on innovative activity.

9.4 The existence of R&D subsidies

Description

Another way in which the government can stimulate product-innovation activity is by providing subsidies for R&D activities.

Relationship with innovative ability

Through the existence of subsidies, R&D activities will become less expensive and, as is the case with tax reductions, innovating becomes more attractive. In this way the generation of ideas is stimulated. As we have seen, according to Geroski *et al.* (1998) using subsidies to stimulate R&D has a bigger effect on R&D activity than corporate tax reductions have. These findings are consistent with Favre *et al.* (1999) who have found a positive effect of R&D subsidies on R&D investments.

10 Market characteristics

The innovative ability of a company is influenced by several market conditions. These conditions are not manageable by the entrepreneur himself. We discuss the following:

- open economy (10.1)
- a mid-degree of competition (10.2)
- high intensity of non-price competition in the product market (10.3)
- low intensity of price competition in the product market? (10.4)
- a short length of the product life cycle (10.5)
- high degree of demand-pull (10.6)
- low price elasticity (10.7)
- more heterogeneous demand (10.8)
- high uncertainty of demand (10.9).

10.1 Open economy

Description

An open economy is an economy which has many trade- and capital flows to and from the outside world. In this regard, we should distinguish two separate parts in the country's innovation system. One part of the system consists of institutions that direct the way in which knowledge is created and distributed around the economy. In an open economy, it is likely that these institutions are influenced by institutions in other countries. The other part of the system is made up of companies which innovate.

Relationship with innovative ability

In theory one can think of many arguments for an open economy favouring the innovative ability of SMEs because the knowledge developed in foreign countries can easily flow to the home country. In this way the possibility of the generation of new ideas by domestic companies is enhanced. Unfortunately, not much empirical research has been done on this subject, so this discussion is left to theoretical foundations here.

It might be expected that the innovation system in a open economy will be influenced more by its neighbouring countries than in a more closed economy. This innovation system can be influenced by foreign countries through export activities, foreign investments or other interactions between parties in the countries. Not only will exporting or importing companies in open economies benefit from the know-

ledge and innovative activities of neighbouring countries or companies' performance, but also from companies which operate purely domestically. To what degree these latter companies' innovative activities will be influenced by the innovative ability of foreign countries will partly depend on the first part of the innovative system, namely the institutions directing the distribution of knowledge (Baldwin *et al.*, 1998).

10.2 A mid-degree of competition

Description

The competition in a market is low if only few or no competitors are present, i.e. the market concentration is high. In such a case a company possesses market power.

Relationship with innovative ability

The famous Schumpeter hypothesis states that companies possessing market power are more innovative because they can more easily get hold of the returns from innovation. In this respect, it would be more attractive for companies possessing market power to invest in innovative activities. Consequently, in theory companies operating in markets in which the degree of competition is low would be more likely to generate ideas. Brouwer (1997) tested this hypothesis. However, he found that this hypothesis does not hold: companies which possess market power do not sell relatively more new products than companies in competitive markets. The findings of Felder *et al.* (1996) give an explanation for this phenomenon. Felder *et al.* did not find a significant relation between market concentration and R&D intensity for companies in Germany. So a higher market concentration has no significant influence on innovation because companies in this situation are not investing more in R&D.

On the contrary, we could ask ourselves whether high competition will lead companies to be more innovative and so to generate more new ideas. The rationale behind this would be that companies operating in competitive markets need to innovate to maintain their market share. Brouwer (1997) investigated the influence of a high SME presence, that is a high share in numbers of companies taken by companies with fewer than fifty employees, on the innovation success. He found indications that a high SME presence stimulates the emergence of products 'new to the company', but not of products 'new to the sector'. So, with a strong SME presence an innovation introduced by a company is likely to be spread around the sector.

Finally, Baldwin *et al.* (1998) found something like an inverted U-curve. A rise in the number of competitors first increases the probability of companies innovating, but further increasing the number of competitors will decrease this probability. So a mid-degree of competition may be best for innovation purposes.

10.3 High intensity of non-price competition in the product market

Description

In this respect, one should think of competition involving the best products or the best quality of products. In economic terms this is called monopolistic competition, companies are assumed to be able to differentiate their products from their competitors but take the prices charged by their competitors as given.

Relationship with innovative ability

It is obvious that non-price competition gives rise to new or improved products, because companies have to generate new ideas constantly to compete for the best products. Arvantitis and Hollenstein (1994) investigated this reasoning. They did indeed find that the intensity of non-price competition has a positive influence on innovation success (both product and process innovation). So non-price competition has a positive impact also on the generation of new ideas concerning products as well.

10.4 Low intensity of price competition in the product market

Description

In this context one should think of a market in which production should be as cheap as possible, so products can be sold at a price as cheap as possible.

Relationship with innovative ability

We can expect a negative influence of the intensity of price competition on product innovations, because there is no money left to work out ideas. Arvantitis and Hollenstein (1994) investigated this relation. However, they did not find an impact of price competition on the innovation success. They give two explanations for this. The first one is subsistent to the data being used. The data is, namely, extended to a period of the business cycle where price competition was

high for all industries. Therefore no significant difference could be made between sectors with low and high price competition. Using data from another period gives reason to think that this explanation might be true. The second explanation given is that the expected negative influence on product innovations might be cancelled out by companies which introduce new products to avoid intensive price competition.

10.5 A short length of the product life cycle

Description

The product life cycle can be defined as the average lifetime of a product. For some markets the lifetime of products is quite long. For other markets the lifetime of the products is very short, and products are continuously replaced by others.

Relationship with innovative ability

It could be argued that the average length of the product life cycle has an effect on the innovative efforts of a company. Products with a short life-cycle will necessitate companies renewing their products more frequently. Consequently, employees will be stimulated by the entrepreneur to be creative and continuously generate new ideas. According to Brouwer (1997), however, the average length of the life cycle of innovative products in a sector has no influence on the probability that a company is innovative. The average length of the product life cycle holds only in respect of products 'new to the company', but not for innovations 'new to the sector'. One explanation Brouwer gives for this phenomenon is that the life cycle measure is probably dominated by the influence of imitative innovations since these are much larger in number, and it is therefore a less adequate measure for 'true' innovators.

10.6 High degree of demand-pull

Description

A high degree of demand-pull is characterised by a high degree of demand growth.

Relationship with innovative ability

Schmookler's (1966) demand-pull hypothesis implies that ups (or downs) of demand are likely to encourage (or frustrate) the innovation process. A rise in the demand for a product will stimulate the innovative ability of companies. When the economy is booming and

demand is high, companies are more likely to innovate than when the economy is in a recession. The reasoning behind this is that the risk of not getting rid of your production is lower when demand is high. This would indicate that companies operating in markets or economies in which demand expectations are high are more likely to be innovative.

According to Brouwer (1997), the demand growth does indeed have a positive influence on the probability that a company is innovative and on the level of innovation. In small and medium-sized companies in particular the demand-pull effect is important. This is consistent with the research done by Arvantitis and Hollenstein (1994). They found that demand growth in the medium run (next three years) stimulates the generation of new products.

10.7 Low price elasticity

Description

The price elasticity of a product is the extent to which consumer demand for a specific product changes in response to an alteration in the product's price. A high price elasticity means that consumer demand changes more than proportionally in response to a marginal change in the product's price, and a low price elasticity means that consumer demand changes only slightly to meet such a marginal change.

Relationship with innovative ability

A low price elasticity is likely to stimulate product innovations because the cost of product innovations can be financed by an increased price without causing an enormous drop in demand. Consequently, when the price elasticity of a product is low employees are stimulated to renew the product and so the possibility to generate new ideas is high. Le Bas and Cabagnols (1999) find that a low price elasticity of demand stimulates product innovation. If a price is raised marginally, few consumers will buy less of the product. In this case, consumers are willing to pay slightly more to have higher quality and the product can be innovated. So, when the price elasticity of the product is low the generation of new product ideas is stimulated.

In this respect, we can use as an example the sale of cars. The price elasticity of a specific car is mostly rather low. People select the car because of the brand or because of the safety of the car. Innovating this car, for instance introducing power steering, would not induce

people to switch to another car, they will still buy this specific car although the price has increased somewhat.

10.8 More heterogeneous demand

Description

The demand for a product is heterogeneous when consumer demand is differentiated: various consumers demand only slightly different products. Heterogeneous demand can be expected to encourage the innovative ability of a company.

Relationship with innovative ability

In the context of a heterogeneous demand it seems to pay off to generate new ideas in order to differentiate the product better. Le Bas and Cabagnols (1999) find that a heterogeneous demand directed toward small series indeed enhances the number of product innovations in SMEs.

10.9 High uncertainty of demand

Description

Companies are never certain of the characteristics of demand: they have no clear notion of consumers' wishes and their behaviour.

Relationship with innovative ability

In the context of an uncertain demand product innovations can be expected to be encouraged. When a company initiates activities to discover the characteristics of demand and the needs of their customers, new ideas may emerge. According to Klepper (1996) companies facing high uncertainty about the characteristics of demand will indeed generate more ideas and develop more product innovations.

11 Conclusions and future research

11.1 Conclusions

Purpose and added value

The purpose of this study was to investigate which factors determine the innovative ability of an SME, i.e. factors which result in the amount of ideas for new or improved products, generated by the entrepreneur and his employees, being increased. Our research consisted of an extensive literature review, focusing on both the organisational and the general economic literature. This broad focus gives our study an added value compared to previous studies, because there has been no research yet which attempts to integrate both traditions.

Conceptual model and checklist

Our literature research yielded a list of 49 factors that seem to influence the innovative ability of an SME. In a focus group we have integrated these determinants into a conceptual model to explain the innovative ability. This model consists of seven categories that can be managed by the entrepreneur:

- people characteristics
- strategy
- culture
- structure
- availability of means
- network activities
- company characteristics.

In addition, we have found some environmental characteristics that stimulate the innovative ability of an SME:

- innovation infrastructure
- market characteristics.

Below, we summarise the relation between each determinant and the innovative ability. This list serves as a checklist when trying to improve a company's innovative ability (table 2).

table 2 relation between each determinant and the innovative ability (idea generation for new products)

| determinant | relationship |
|---------------------------------------|--|
| People characteristics | |
| Willingness to take risks | The acceptance of uncertainties and tolerance for failures enhances creativity. |
| The entrepreneur's commitment | An entrepreneur who sets innovative examples by his own actions and radiates confidence in an employee's ideas, encourages creative behaviour and an internal climate supporting innovation. |
| Internal entrepreneurial activities | Employees who develop activities on their own initiative and act like entrepreneurs to work these out, increase the number of ideas and successful implementations. |
| The presence of internal capabilities | Having flexible, inventive employees with the right education in the right places enhances the capacity to generate and absorb new ideas. |
| Strategy | |
| Innovation in the mission statement | Incorporating the notion of innovation in the mission statement and communicating this in a forceful way to the employees increases the innovative ability. |
| Innovation objectives in the strategy | Strategy is important to keep the organisation from viewing innovation as an ad-hoc process. It mobilises the employees to make active contributions. |
| Culture | |
| Loose control | Little structure and few rules suit innovative activities best. Tight control results in a strict observance of existing rules and procedures, causing a slow-down of creativity. |
| People orientation | Making allowance for personal problems and giving employees a greater voice in decision-making increases their commitment and the amount of ideas generated. |
| Openness | Open cultures provide better support for the exchange of ideas. Since employees feel more quickly at home, they will come up with more ideas. |
| Result orientation | Result orientation gives the employees more freedom of action than process orientation does; this is an incentive to creativity. |
| Professionalism | In a professional culture the employees are involved with their job and open to information from outside the company, causing a commitment to move beyond the status quo. |
| Spread of information | The availability of a large diversity of information results in the cross-fertilisation of ideas and an internal environment supporting the survival of new ideas. |
| Structure | |
| De-standardisation | Flexibility and low emphasis on work rules facilitate innovation. Few rules and procedures |

| | |
|----------------------------------|--|
| Vertical Integration | <p>permit openness, which encourages new ideas and behaviour.</p> <p>Few hierarchical levels decreases the number of links in communication channels, making communication between levels easier and enhancing the flow of innovative ideas.</p> |
| Multi-functional teams | <p>The interdisciplinary background of team members means that people can look at problems from different perspectives, and together come up with new ideas.</p> |
| Co-operation between departments | <p>Horizontal co-operation increases the variety of information. Employees can look at problems from different perspectives, and together come up with new ideas.</p> |
| Task assignment and expansion | <p>Employees facing challenges in their work will display more innovative behaviour. When tasks are broadly formulated and overlap, co-operation between employees is stimulated.</p> |
| Job rotation | <p>Work experience in different job areas enhances creative potential. Frequently exchanging tasks broadens the employees' point of view and ability to place problems in a wider context.</p> |
| Autonomy | <p>The decentralisation of decision-making power enhances idea generation. Participatory work environments facilitate innovation by increasing the employees' awareness and commitment.</p> |
| Reward structure | <p>A reward system stressing creativity and criticising existing rules and procedures enhances innovative behaviour. A reward system directed towards effectiveness and efficiency impedes innovative behaviour.</p> |
| Availability of means | |
| Freedom to experiment | <p>Many ideas for new products are discovered accidentally. Giving the employees the time to try out ideas, and treating the results of such experiments seriously increases the innovative ability.</p> |
| Financial resources | <p>Most innovations require money to be developed. When an employee is aware that no means are available, there will be no motivation to come up with ideas. Financial resources allow a company to afford failure.</p> |
| Education and training | <p>Education and training enlarges the body of knowledge, increases the cross-fertilisation of ideas, serves as a motivating factor, and does away with resistance to changes.</p> |
| Use of creative techniques | <p>Creative techniques support the capacity to abandon programmed ways of thinking, which frees the way for new product ideas.</p> |
| Network activities | |
| External orientation | <p>Frequent, intensive contacts with the environment (suppliers, competitors) provides extra information that can be used to create or improve new products.</p> |

Conclusions and future research

| | |
|--|--|
| Customer orientation | Intensive contacts with the customers provides extra information which is a valuable source for ideas and improvements. |
| Co-operation with other companies | Using the knowledge and skills of external participants results in an increase in the variety of the information. The participants can look at problems from different perspectives. Idea generation benefits from this. |
| Transfer of technology and information | Acquiring technical knowledge and information in exchange for money enlarges the body of knowledge and increases the cross-fertilisation of ideas. |

Company characteristics

| | |
|--|--|
| Technological competence | The greater the technical knowledge, the easier new technical ideas can be understood and dispersed within the company. |
| Company size | Large companies have more employees, increasing the possibilities of interdisciplinary activities. On the other hand, small companies are less bureaucratic and easier to motivate about ideas. |
| High diversification scheme | A wide range of business activities increases the variety of information and possibilities of interdisciplinary activities, causing more idea generation. |
| High range of activities along the production line | A high range of activities along the production-line increases the possibilities of interdisciplinary activities and therefore idea generation. |
| Export activities | Exporting companies are more likely to gather cross-border information. This increases the variety of available information, and hence stimulates idea generation. |
| Location of the company in urban areas | Companies in urban areas benefit from a higher information density (competitors, knowledge centres, etc.), which has a positive effect on the number of ideas generated. |
| High complexity of product design | If a product design is complex it is rather difficult for competitors to copy the product, so the company can get more benefits from an idea. This will stimulate the amount of idea generation. |
| Low lead time in the introduction of the novelty | If the lead time is low it is easier to appropriate the returns from investments in knowledge development and product innovation. |

Innovation infrastructure

| | |
|--|--|
| General technological activity and basic knowledge | With more general technological activity (i.e. scientific infrastructure) a company can acquire better educated people and use various services. Idea generation will benefit from this. |
| The existence of patents | Patents offer the possibility of knowledge protection, so the company can reap more benefits from an idea. This will stimulate idea generation. |
| The existence of tax reductions | Taking advantage of tax reductions makes performing R&D less expensive, so it will be more attractive for companies to generate ideas for new products. |

| | |
|---|---|
| The existence of R&D subsidies | R&D subsidies make R&D less expensive, so it will be more attractive for companies to generate ideas for new products. |
| Market characteristics | |
| Open economy | In open economies foreign knowledge can easily flow to the home country, which for domestic firms enhances the possibility to generate ideas. |
| A mid-degree of competition | An increase in the number of competitors first increases the number of product innovations (because companies need to maintain their market share), but a further increase will decrease the number of new products (due to price competition). |
| High intensity of non-price competition | Non-price competition gives rise to more ideas for new products, because companies continuously want to differentiate their products from their competitors. |
| Low intensity of price competition | Price competition will leave a company no money to work out ideas. This decreases the motivation to show innovative behaviour. |
| A short product life cycle | A short life cycle will force companies to renew their products more frequently. This stimulates the employees to be creative. |
| High degree of demand-pull | A high demand will stimulate the innovative behaviour of companies. The risk of not being able to sell new products is lower when demand is high. |
| Low price elasticity | A low price elasticity stimulates product innovations because the costs can be financed by an increased price without causing a significant drop in demand. |
| More heterogeneous demand | With a heterogeneous demand it pays off to generate new ideas in order to differentiate the product better. |
| High uncertainty of demand | Uncertainty of demand can cause a company to investigate what customers really want. New product ideas may emerge from this. |

11.2 Suggestions for further research

Empirical test

In section 1.3 we discussed a number of limitations of this study. We did not conduct an empirical test on the significance of the determinants found. Our literature research has yielded an extensive list of factors which seem to influence the idea generation for new or improved products. However, the literature does not always give a clue whether a determinant is relevant for an SME. Our conceptual model presumes a number of hypotheses about the relation between each determinant and the innovative ability. This model should be tested on the suitability of its categories (in terms of the internal con-

sistency of the attached determinants) and the significance of its presumed causal effects. We have noticed that some determinants overlap each other to some extent. For instance, de-standardisation is a characteristic of a result-orientated culture (see sections 5.1 and 4.4). It is not clear which determinants influence the innovative ability most, and which are relevant for an SME at all. To be able to make a statement about which ones should be handled first when trying to improve the innovative ability, an empirical test is necessary. Because our conceptual model consists of categories that are manageable and exogenous categories that cannot be managed, future research will also give an indication about the extent to which an entrepreneur can actually influence the innovative ability himself.

Measuring innovative ability

Before the conceptual model can be tested one must tackle the problem of how to measure the concept of innovative ability. Future research should give a clear answer to this. According to Wolfe (1994) many different measures are employed when conducting empirical tests on the significance of the determinants of innovative ability. It seems likely that the content of this measurement scale depends on the focus of the study and the assumptions made.

Determinants of successful implementation

The innovation process consists of various stages. In this study we focused on factors relevant to the search phase of the innovation process, in which the organisation recognises a need for innovation, generates and screens ideas. We did not pay explicit attention to the factors that determine the successful implementation of the generated ideas. Although it seems likely that many of our determinants do have an effect on the implementation stage as well (for instance, according to Brown and Eisenhardt (1995) co-operating in multi-functional teams is an excellent way to develop and implement new product ideas), we did not investigate this subject explicitly. In future research one could investigate to what extent the determinants of innovative ability overlap and differ between the various stages of the innovation process. Of course, this subject is very relevant for entrepreneurs trying to improve their innovative ability.

Determinants of other types of innovations

An innovation can be related to several objects, like new or improved products, markets, technologies, work processes, etc. In this study we focused on the determinants of successful product innovations, but we did not pay attention to the determinants of other types

of innovations. Again, it seems likely that many of our determinants do have an effect on other types of innovation as well, but we did not investigate this explicitly. In future research one could investigate to what extent the determinants of innovative ability between different kinds of innovations overlap and differ from each other.

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Appendix I: Review panel and project team

Review panel

Dr. P.R. Beije (Paul), business unit manager at TNO/STB, Delft, the Netherlands

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Project team

Dr. E. Brouwer (Erik), senior researcher at SEO Foundation for Economic Research, Amsterdam, the Netherlands

Drs. J.P.J. de Jong (Jeroen), researcher at EIM Small Business Research and Consultancy, Zoetermeer, the Netherlands

Appendix II: Origin of the determinants found

The determinants covered by people characteristics, strategy, culture and structure are mainly taken from the organisational tradition. Those of company characteristics, innovation infrastructure and market characteristics are generated by the general economic tradition. Finally, both traditions pay attention to network activities and availability of means.

table 3 origin of the determinants found: organisational or general economic tradition

| Category | Organi- Determinant | General sational? | economic? |
|----------------------------------|--|----------------------|-----------|
| People characteristics | Willingness to take risks | x | |
| | The entrepreneur's commitment | x | |
| | Internal entrepreneurial activities | x | |
| | The presence of internal capabilities | | x |
| Strategy | Innovation in the mission statement | x | |
| | Innovation objectives in the strategy | x | |
| Culture | Loose control | x | |
| | People orientation | x | |
| | Openness | x | |
| | Result orientation | x | |
| | Professionalism | x | |
| | Spread of information | x | |
| | Structure | De-standardisation | x |
| Vertical Integration | | x | |
| Multi-functional teams | | x | |
| Co-operation between departments | | x | |
| Task assignment and expansion | | x | |
| Job rotation | | x | |
| Autonomy | | x | |
| Reward structure | | x | |
| Availability of means | Freedom to experiment | x | |
| | Financial resources | x | x |
| | Education and training | x | |
| | Use of creative techniques | x | |
| Network activities | External orientation | x | x |
| | Customer orientation | x | |
| | Co-operation with other companies | x | |
| | Transfer of technology and information | | x |
| Company characteristics | Technological competence | x | |
| | Company size | | x |
| | High diversification scheme | | x |
| | High range of activities along the production line | | x |
| | Export activities | | x |
| | Location of the company in urban areas | | x |
| | High complexity of product design | | x |
| | Low lead time in the introduction of the novelty | | x |
| Innovation infrastructure | General technological activity and basic knowledge | | x |
| | The existence of patents | | x |
| | The existence of tax reductions | | x |
| | The existence of R&D subsidies | | x |
| Market characteristics | Open economy | | x |
| | A mid-degree of competition | | x |
| | High intensity of non-price competition | | x |
| | Low intensity of price competition | | x |
| | A short length of the product life cycle | | x |
| | High degree of demand-pull | | x |
| | Low price elasticity | | x |
| | More heterogeneous demand | | x |
| | High uncertainty of demand | | x |