Research Report 0010/A

Determinants of innovative ability

An empirical test of a causal model

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Zoetermeer, February 2001

ISBN: 90-371-810-5

Price: NLG 45.00

Order number: H0010

The underlying study forms part of the Programmaonderzoek MKB en Ondernemerschap (Programme Research SMEs & Entrepreneurship) that is financed by the Netherlands Ministry of Economic Affairs.

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Preface

In the past few years, innovation has become a critical success factor for many small and medium-sized enterprises (SMEs). In many markets, it is typically crucial to have a regular stream of successful innovations to be able to achieve goals like profit, return on investments and growth.

Many entrepreneurs will be interested in how they may improve corporate innovative ability. And many policy makers will be interested in the most effective means to stimulate innovation in industrial life. The underlying study shows an empirical test of a causal model to trace the determinants of the innovative ability of SMEs. The model is based on an exhaustive overview of the literature on innovative ability.

We would like to thank our review panel consisting of Dr. Y.M. Prince, Dr. J. Meijaard en Dr. J. Hutjes. We greatly appreciated their remarks on the previous versions of this report.

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Summary

Innovation is a critical success factor for many Dutch enterprises. The share of service businesses in the Dutch economy is still growing, so especially their innovativeness is of interest.

The underlying strategic study focuses on the question which factors determine the innovative ability of service businesses with 10 to 100 employees. For a sample of these enterprises, we examined the influence of 38 factors on innovative ability. The determinants are arranged into eight categories: people characteristics, strategy, culture, structure, availability of means, network activities, firm characteristics and market characteristics.

On the basis of recent literature, we posit hypotheses about the influence of each of the factors on innovative ability. We test our hypotheses on data that we collected from employees and entrepreneurs in the Dutch service industries sector. Based on stepwise regression, 13 factors are of major significance for the innovative ability of service businesses, most importantly the willingness of employees to take risks. Besides, given the factors that are significant, it appears that entrepreneurs themselves should be able to influence the innovative ability of their organizations to a large extent.

Samenvatting

Innovatie is een kritische succesfactor voor veel Nederlandse bedrijven. Het aandeel van dienstverlenende sectoren in de Nederlandse economie groeit nog steeds gestaag, dus begrip aangaande hun innovativiteit is gewenst.

Deze strategische verkenning gaat in op de vraag, welke factoren bepalend zijn voor het innovatievermogen van dienstverlenende bedrijven met 10 tot 100 medewerkers. Voor deze bedrijven hebben wij de invloed van 38 factoren op het innovatievermogen onderzocht. De determinanten zijn gerangschikt in acht categorieën: kenmerken van medewerkers, strategie, cultuur, structuur, beschikbaarheid van middelen, netwerkactiviteiten, bedrijfskenmerken en marktkenmerken.

Op basis van recente literatuur zijn hypothesen geformuleerd over de invloed van elke factor op het innovatievermogen. De hypothesen toetsen wij op een databestand dat is verzameld bij werknemers en ondernemers in Nederlandse dienstverlenende bedrijven. Uit stapsgewijze regressieanalyses blijkt dat 13 factoren van invloed zijn op het innovatievermogen van dienstverlenende bedrijven. Met name is belangrijk de bereidheid van werknemers om risico's te nemen. Verder valt uit de significante factoren te concluderen dat de ondernemer zelf het innovatievermogen in hoge mate zou moeten kunnen beïnvloeden.

1 Introduction

1.1 Motivation

Many small enterprises work in an environment of changing consumer preferences, increasing competition and changing technological requirements. To achieve business goals such as profit and growth, it is crucial to have a continuous flow of successful innovations.

Small enterprises with high innovative ability perform better than small enterprises with lower innovative ability. The strategic position of a small enterprise depends on its ability to offer high-quality products and services that suit market demand. A permanent flow of innovations is, therefore, of substantial significance. Various authors confirm this (Buijs (1988), Geroski (1995), Banbury and Mitchell (1995), Soni, Lilien and Wilson (1993), Cobbenhagen (2000)).

As a consequence, Dutch policy makers started to recognize the significance of innovations for small enterprises as well. For instance, the Netherlands Ministry of Economic Affairs initiates various activities to improve the number of innovations by Dutch enterprises (Ministerie van Economische Zaken (2000)).

1.2 Research question

A permanent stream of innovations is important for almost any small or medium-sized enterprise (SME). The objective of the underlying study is to discover which factors determine the innovative ability of SMEs. The research question is formulated as follows:

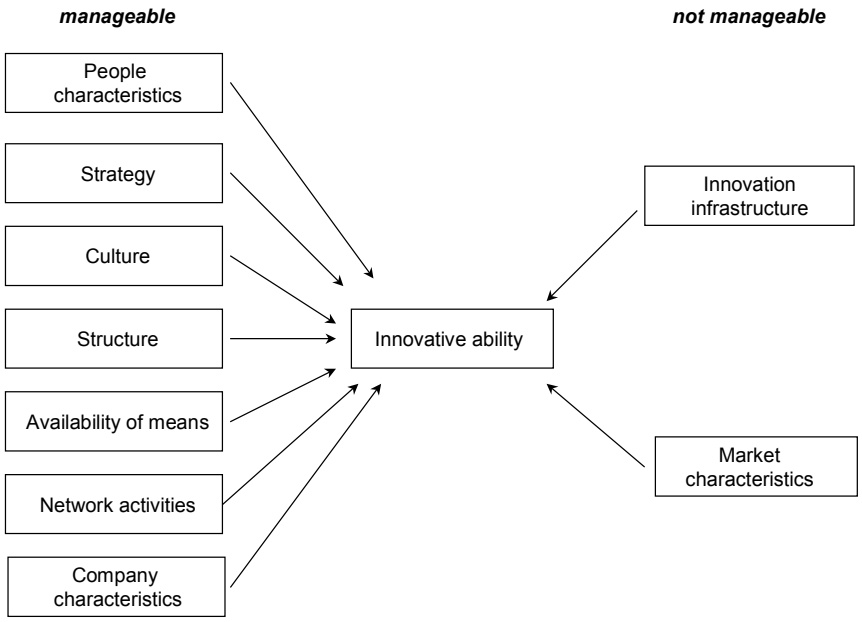
> What factors determine the innovative ability of SMEs?

The relation between innovation and innovative ability will be discussed in detail in section 2.1.

1.3 Causal model

De Jong and Brouwer (1999) provide an exhaustive overview of the recent literature on the determinants of innovative ability. They present a model that includes about 50 determinants that are narrated in the literature. These determinants may be grouped into nine categories (see Figure 1).

Figure 1 Model for explaining innovative ability of SMEs



Source: De Jong and Brouwer (1999).

De Jong and Brouwer (1999) differentiate between determinants that are manageable and those that are not manageable to an entrepreneur.

Two traditions of innovation research

Adler (1989) splits the innovation research into two broad areas of inquiry. These areas are the general-economic tradition and the organizational 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 enterprises to innovate. One usually focuses on determinants of innovative ability that may be influenced by policy makers (for instance, the innovation infrastructure) and not by the entrepreneur himself. The level of analysis is at the macro or meso level.

The organizational tradition focuses at a micro level regarding how specific innovations are developed, and how corporate innovative ability may be improved. In this tradition, an innovation is not necessarily related to products and technologies, but also to work processes, the organization, the market, and so on. In this tradition, one usually focuses on determinants that may be

influenced by an entrepreneur himself (for instance, people characteristics, strategy, culture, structure, etc.).

As far as we know, there have been no studies as yet which examine the determinants from both traditions simultaneously. Therefore, de Jong and Brouwer (1999) integrated both traditions in their conceptual causal model, which we shall apply in our study.

1.4 Objective

Empirical test

De Jong and Brouwer (1999) state that their model presumes several hypotheses about the correlation between each determinant and the innovative ability of an SME. The objective of the underlying study is to empirically test these hypotheses. This empirical test enables us to:

- provide an indication about the extent as to which an entrepreneur himself may actually influence innovative ability (because the model consists of categories that are manageable and exogenous categories that cannot be managed by an entrepreneur).
- produce a statement about which determinants are typical and might be handled first when trying to improve the innovative ability of an SME.

Focus on service industries

De Jong (1999) states that the determinants of innovative ability will differ between sectors. In manufacturing businesses, for instance, innovations are often stimulated by the R&D department. In service businesses, such as advertising agencies, the 'creative manager' is in many cases responsible for innovations.

Our study focuses on SMEs in the Dutch service industry. The importance of service businesses for the Dutch economy is large and still growing. Bangma (2000) states that service businesses account for more than one third of Dutch SMEs. Bangma and Verhoeven (1999) show that the service industry has been the fastest-growing Dutch sector in the past ten years. This sector has a yearly growth rate of 8% (in number of enterprises). This is much higher than the average growth rate of about 4%.

The content of this report is as follows:

- Chapter 2 discusses the details of the hypotheses that will be tested in this study
- Chapter 3 discusses the outline of our empirical examination to test our hypotheses (questionnaires used, data collection, construction of scales, etc.)
- Chapter 4 presents the findings of the empirical test
- Chapter 5 discusses our conclusions, the limitations of this study and our suggestions for future research.

2 Background

In this chapter, we discuss the model of de Jong and Brouwer (1999) in detail. In section 2.1, the innovative ability is explained along with its relation with innovation. In sections 2.2 – 2.10, we shall discuss the nine categories that may explain innovative ability. For each determinant, we shall present the hypothesis that we shall test in our study.

2.1 Innovative ability

What is innovation?

Innovation roughly means renewal. De Jong and Brouwer (1999) discuss that the literature provides many definitions. According to Cozijnsen and Vrakking (1992), an innovation may be related to several objects, such as:

- New products
- New markets
- New technologies
- New work processes
- etc.

Following de Jong and Brouwer (1999), we define an innovation as follows:

> 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.

What is innovative ability?

To be able to realize a permanent flow of innovations, an enterprise must have sufficient innovative ability. Similar to de Jong and Brouwer (1999), we define innovative ability as follows:

> Innovative ability is the ability of an enterprise's employees to generate ideas and to work with these ideas to develop new or improved products, services, technologies, work processes or markets.

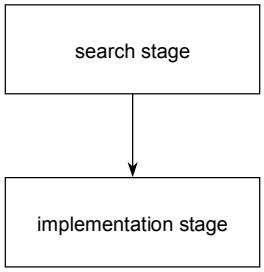
Note that our definition of innovative ability is rather narrow. The employees of an enterprise are at the heart of the innovation process (Brown and Eisenhardt (1995)); people who come up with vague ideas, concepts and specifications, and turn these into successful innovations. Gosselink (1996) notes that innovations are rooted in the knowledge, the motivation and the skills of employees who are involved in the innovation process. Employees generate inno-

vative ideas and then put themselves forward as advocates of their ideas in order to enable them to grow into commercial successes.

Limitation to the search stage of the innovation process

Innovations are developed and implemented in processes that consist of various stages. Buijs (1987) presents a simple model to illustrate the innovation process. He divides the innovation process into two stages (Figure 2).

Figure 2 Two-stage model



Source: Buijs (1987).

This model illustrates the relation between innovation and innovative ability. In the search stage, the employees of an organization generate ideas, make a first selection of promising ideas, and determine the objectives for further development. In the search stage, innovative ability is a key concept. If there is no innovative ability, there will be no innovation projects, products, etc. that may be implemented in the implementation stage. Next, in the implementation stage, the idea is developed into an actual innovation: a new product, work process, etc. Therefore, the innovative ability is a prerequisite condition to be innovative.

Our study focuses on the search phase of the innovation process. We shall outline the factors that cause or stimulate entrepreneurs and employees of an organization to generate new ideas and to work with these ideas, i.e. the antecedents of innovative ability. We shall not pay explicit attention to the determinants of successful implementation of those ideas.

2.2 People characteristics

As the first category of explanatory variables, de Jong and Brouwer (1999) discuss a number of people characteristics that affect innovative ability. On the basis of extensive literature research, they discuss:

- The willingness to take risks
- The entrepreneur's commitment

- The presence of internal capabilities.

Willingness to take risks

Cooper (1993) stresses the importance of people's willingness to take risks for their innovative ability. The only way to avoid mistakes is by not taking any risks at all. Employees who are willing to take risks accept ambiguities and uncertainties in their work. They have higher tolerance levels for mistakes. This enhances creativity and innovative behaviour.

Gaspersz (1998) identifies tolerance for failures as a crucial factor in the capacity for innovation. Employees should feel free to propose and further develop their ideas, however unpractical they may seem at first sight.

Hypothesis 1A. Service businesses with more employees willing to take risks will have more innovative ability.

The entrepreneur's commitment

Gosselink (1996) argues that an entrepreneur should pay particular attention to individual innovative efforts. Ultimately, the employees in an organization are the ones who generate new ideas and carry them out. An entrepreneur who is committed to innovation encourages creative behaviour, not only by emphasizing the importance of innovation in words, but also by setting examples by his own actions.
According to McGourthy *et al.* (1996), it is important that the entrepreneur constantly encourages creative behaviour. Suppose, for instance, that a manager incorporates innovation objectives into corporate strategy, but then does not have the time or patience in daily activities to listen to ideas from employees and does not make funds available for working out these ideas. In the end, idea generation in that enterprise will be minimal. In this context, Zien and Buckler (1997) discuss that an entrepreneur should have a high degree of confidence in his employees, not blaming them for every mistake or wrong decision.

Hypothesis 1B. Service businesses run by entrepreneurs who are more committed to innovation will have more innovative ability.

The presence of internal capabilities

Internal capabilities refer to having flexible employees with the right education. This will enhance the capacity to generate and absorb new ideas. Having flexible employees is important, because in a bureaucratic and rigid enterprise, many steps have to be taken to accept a new idea. In this situation, the incentive to generate ideas is missing (Acs and Audretsch (1989)).

Hypothesis 1C. Service businesses with flexible, well-educated employees will have more innovative ability.

Other determinants

De Jong and Brouwer (1999) also state the presence of internal entrepreneurial activities as a determinant of innovative ability, as employees who develop activities on their own initiative and act like entrepreneurs to work these ideas out, enhance the innovative ability of an SME. They conclude that this determinant serves as a summary of many other determinants.

We did not use this determinant in our empirical test, since its content is too closely related to innovative ability itself (contamination). This would lead to a very high effect indicator by default.

2.3 Strategy

As a second category of explanatory variables, de Jong and Brouwer (1999) discuss two determinants that are related to corporate strategy:

- Innovation in the mission statement
- Innovation objectives in the strategy.

Innovation in the mission statement

A mission statement provides direction for the activities that an enterprise will develop in the future. The difference between a mission and traditional business goals lies in the fact that a mission lacks quantitative and time-related elements.
Bart (1996) states that a mission statement plays a significant role in influencing and encouraging employee behaviour within an organization. He concludes that corporate innovative ability expands when the mission statement incorporates the notion of innovation and when the enterprise communicates this mission statement to its employees in a clear and forceful way (by means of tangible objectives, for instance). Sneep (1994) states that having a clear business vision is a condition for successful innovation.

Hypothesis 2A. Service businesses with the notion of innovation in their mission statement and communicating this in a forceful way to employees will have more innovative ability.

Innovation objectives in the strategy

Tushman and O'Reilly (1997) conclude that innovation objectives play a significant role in increasing innovative ability. Strategic attention is important to keep the organization from viewing innovation as an ad hoc process. The innovation strategy may be made operational in various ways. Zien and Buckler

(1997) point out that each employee in an enterprise is a source of ideas. It is, therefore, important to make product innovation the responsibility of the entire organization. This could be translated into innovation objectives for each individual employee.

Hypothesis 2B. Service businesses with innovation objectives in their strategy and for every individual will have more innovative ability.

2.4 Culture

De Jong and Brouwer (1999) discuss six determinants that are related to corporate culture:

- Loose control
- People orientation
- Openness
- Result orientation
- Professionalism
- Spread of information.

Loose control

In enterprises enforcing loose control, we find relatively little structure or rules. In tightly controlled cultures, there is a strong degree of discipline. In these tightly controlled cultures, employees are very aware of cost, and there is strict adherence to meeting times.
Sanders and Neuijen (1992) recommend a culture characterized by loose control to promote innovative ability. Innovative enterprises generally have many non-standardized activities. Loose control is best suitable for managing such activities. Tight control results in strict observance of existing rules and procedures, causing a slowdown of creativity.

Hypothesis 3A. Service businesses with a loose control will have more innovative ability.

People orientation

In people-orientated cultures, people feel that allowance is being made for personal problems, and that the enterprise assumes responsibility for the well-being of its employees. On the opposite, in a work-orientated culture, people feel pressured to get their work done, and the enterprise only worries about the work performed by staff.
Sanders and Neuijen (1992) recommend a people-orientated culture to enhance innovative ability. This type of culture grants employees a greater voice in decision-making, increasing their commitment to the work, so that they will feel more free to come up with ideas for new or improved products. In this re-

spect, Zien and Buckler (1997) state that there should be a culture in which the employee is the central figure.

Hypothesis 3B. Service businesses with a stronger people orientation will have more innovative ability.

Openness

In an enterprise with an open culture, new employees and outsiders feel quickly at home. Nearly every new employee will fit in with such an organization. New employees only need limited time to settle into their jobs. The opposite holds true for closed cultures, in which employees do not have a very close relationship with the entrepreneur and colleagues.
Sanders and Neuijen (1992) believe that an open organization culture contributes to corporate innovative ability. Open cultures provide better support for an exchange of ideas. Mutual trust and respect is common here, and since employees more quickly feel at home in open cultures, they will sooner come up with new ideas for (product) innovations. Gaspersz (1998) notes that organizations that succeed in creating innovative climates, virtually without exception, have open cultures.

Hypothesis 3C. Service businesses with a more open culture will have more innovative ability.

Result orientation

A results-orientated culture emphasizes the results of the work process. How these results are realized is of less importance. Results-orientated cultures have few rules and procedures for carrying out the work and solving problems. The opposite of this is a process-orientated culture in which the emphasis is on rules and procedures for doing the work (Sander and Neuijen (1992)).
According to Amabile (1998), a results-orientated culture strongly contributes to the innovative capacity of SMEs. Results-orientated enterprises grant their employees greater freedom of action. Employees are challenged by their work every day: they are free to do their work as they deem it right. When people are able to decide about their own work processes, this is an incentive to creativity. Moreover, they may tackle problems in ways that take full advantage of their own expertise.

Hypothesis 3D. Service businesses with more result orientation will have more innovative ability.

Professionalism

Sanders en Neuijen (1992) discuss the degree of professionalism of an organizational culture. In a professional culture, employees mainly focus on their jobs. They often have a high education level, and generally think years ahead about the enterprise's future.

Neuijen (1992) states that a professional culture has a more positive effect on innovative ability than an organizational culture does. In a professional culture, employees are more focused on their jobs and will be more open to extra-firm information. These are all factors that will improve idea generation in the enterprise.

Hypothesis 3E. Service businesses with a more professional culture will have more innovative ability.

Spread of information

Oden (1997) states that the spreading of the available information within an organization is relevant for the innovative ability. The availability of a large diversity of information for the employees affects the corporate idea-generating ability. Good internal communications facilitates the dissemination of ideas within an enterprise, contributing to a culture in which ideas are more likely to be translated into action.

Hypothesis 3F. Service businesses with a better spread of information will have more innovative ability.

2.5 Structure

De Jong and Brouwer (1999) discuss a number of determinants that are related to an enterprise's organizational structure. In this study we shall test:

- De-standardization
- Vertical integration
- Multifunctional teams
- Task assignment and expansion
- Job rotation
- Autonomy
- Reward structure.

De-standardization

De-standardization reflects the degree as to which an organization's work processes are stipulated by rules and procedures. The most extreme form of de-standardization is the total absence of rules and procedures.

Shane (1994) concludes that the innovative ability of SMEs derives no benefit from a multitude of rules and procedures. A low emphasis on work rules facilitates innovation. Few rules and procedures permit openness, which encourages new ideas and innovative behaviour.

Hypothesis 4A. Service businesses with a higher degree of de-standardization will have more innovative ability.

Vertical integration

Vertical integration is the presence of few hierarchical levels. The number of management layers is limited, leaving short lines of communication between employees and entrepreneur.

Damanpour (1991) states that in vertically integrated enterprises, more ideas are produced than in enterprises 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. Oden (1997) says that in vertically integrated organizations, instead of satisfying managers (vertical relationships), employees concentrate on satisfying the needs of their internal and external customers (horizontal relationships), which in turn improves innovative ability.

Hypothesis 4B. Service businesses with more vertical integration will have more innovative ability.

Multifunctional teams

A multifunctional team is a group of persons with different backgrounds (work, education, experience, etc.) that carries out a particular job.

Brown and Eisenhardt (1995) conclude that working in multifunctional teams generally improves corporate innovative ability. To improve innovative ability, interdisciplinary activities (confrontation of people with different backgrounds) are of extreme importance. Owing to interdisciplinary backgrounds of team members, people may look at problems from different angles. This improves their ability to generate ideas. This is confirmed by Tidd *et al.* (1997).

Hypothesis 4C. Service businesses that organize their work in multifunctional teams will have more innovative ability.

Task assignment

Amabile (1998) points out the importance of good task assignment to employees as a means of improving innovative ability. The decisive factor here is the challenge presented by the work. The challenge should not be too small that people get bored, nor should it be too great that they lose control or feel

threatened. When employees face challenges in doing their work, they will display more innovative behaviour. When tasks are broadly formulated and overlap, the exchange of thoughts and ideas between employees is stimulated. In this context, Dougherty (1992) states that in innovative enterprises, tasks should be more broadly formulated than in traditional enterprises.

Hypothesis 4D. Service businesses with a more challenging assignment of tasks among employees will have more innovative ability.

Job rotation

Job rotation is frequently exchanging tasks and jobs among employees. Job rotation is a method for broadening an employee's point of view. It makes employees in an organization familiar with each other's work (Prakken (1994)). Employees will find it easier to place problems in a wider context. Work experience in different job areas enhances creative potential, for instance, since the broad experience gained by employees will more quickly enable them to come up with ideas for improvement in products, work processes, etc. Maira and Thomas (1999) state that when employees come into contact with other job areas through job rotation, they may gain new ideas and insights.

Hypothesis 4E. Service businesses that frequently exchange tasks among employees will have more innovative ability.

Autonomy

Autonomy refers to SME employees who do their work freely and independently and, therefore, decide their own approaches for doing the work. According to Prakken (1994), the decentralization of decision-making power enhances idea generation. Participatory work environments facilitate innovation by increasing employees' awareness and commitment.

Dougherty and Hardy (1996) also argue in favour of substantial autonomy for employees. According to them, centralized structures and processes are geared towards maintaining the status quo. This is in opposition to innovation, because it creates a hostile climate with respect to creativity.

Oden (1997) discusses 'decentralized decision-making' that promotes corporate innovative ability. He uses the term 'empowerment' to describe employees who have a high degree of influence in the course of events and may take their own decisions. Owing to their influence on decision-making, they will generate and propose ideas more often.

Hypothesis 4F. Service businesses with autonomous employees will have more innovative ability.

Reward structure

Many entrepreneurs employ reward systems that are directed towards improving the efficiency of existing work processes. With such reward systems, improvement means 'doing a job better'. However, these traditional reward systems imply an upholding of the regular rules and procedures in an enterprise. In an innovative organization, there must be possibilities for constant change. Therefore, a reward structure that motivates employees to innovative behaviour is required.

McGourthy *et al.* (1996) state that the reward system may play a significant role in stimulating corporate innovative behaviour. They discuss a number of examples, for instance: reward team performance (this stimulates interdisciplinarity and, therefore, the creativity of employees), innovative efforts (the reward could be based on the number of ideas generated) and innovation results (the reward could be based on the number of patents obtained).

Hypothesis 4G. Service businesses with reward systems stressing creativity and renewal will have more innovative ability.

Other determinants

De Jong and Brouwer (1999) also discuss the co-operation between departments as a determinant of innovative ability. This will increase the variety of information, so that employees may look at problems from different angles (which in turn enhances idea generation).

We opted for omitting this determinant from our study. We shall focus on SMEs in the Dutch service industry. Most small enterprises in this sector are not organized in departments, which makes this determinant irrelevant for the underlying study.

2.6 Availability of means

Most innovations require time, money and knowledge to be developed. De Jong and Brouwer (1999) discuss four means that may be prerequisite conditions for the innovative ability of a service business:

- Freedom to experiment
- Financial resources
- Education and training
- Use of creativity techniques.

Freedom to experiment

Enterprises with much freedom to experiment give their employees the time to try out their ideas. Zien and Buckler (1997) argue that being able to experiment in each job is important. Many ideas for improvement are discovered

accidentally. Giving the employees the time to try out ideas and treating the results of such experiments seriously, increases innovative ability. Their research shows that innovative organizations offer many opportunities for experiments.

Hypothesis 5A. Service businesses with employees who are free to experiment will have more innovative ability.

Financial resources

Gosselink (1996) identifies the presence of financial resources as a determinant of innovative ability. When an employee is aware of the fact that there are no resources available to work out ideas, then s/he will not be very motivated to generate ideas at all. According to Amabile (1998), it is not necessary to allocate more resources to employees than strictly required. However, when an entrepreneur does not allocate sufficient resources, this is definitely devastating for the creativity of his employees. Dougherty and Hardy (1996) recommended the introduction of 'pockets of seed money' in an enterprise. 'Pockets of seed money' are budgets that are distributed among employees of an enterprise. Every employee is allowed to allocate his budget to work out promising ideas. The result is that every idea gets an opportunity to prove itself.

Hypothesis 5B. Service businesses with financial resources for innovative efforts will have more innovative ability.

Education and training

Education and training may advance the capacity for innovation in various ways, according to Tidd *et al.* (1997). Firstly, training programmes may be directed towards enlarging the body of knowledge. This directly increases creative capacities of employees. Secondly, training may serve as a motivating factor. In general, employees appreciate it when they get 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 organizations and come up with potential solutions (ideas).

Hypothesis 5C. Service businesses with better possibilities for education and training will have more innovative ability.

Use of creativity techniques

Creativity techniques contribute directly to the capacity of employees to generate solutions and ideas. There are many techniques designed to advance human creativity in a direct manner. Buijs (1987) identifies no less than 50 creativity techniques. Creativity techniques enlarge the capacity to abandon

programmed ways of thinking, which frees the way for creative ideas. The most widely used creativity technique is brainstorming.

Hypothesis 5D. Service businesses that use creativity techniques will have more innovative ability.

2.7 Network activities

De Jong and Brouwer (1999) identify four types of network activities that SMEs may employ to enhance corporate innovative ability:

- External orientation
- Customer orientation
- Co-operation with other enterprises
- Transfer of (technical) knowledge.

External orientation

When employees maintain frequent, intensive contacts with actors in the corporate environment (suppliers, competitors), this provides additional information that stimulates idea generation. Enterprises with a strong external orientation identify market opportunities and threats from their working environments much faster and use them to create or improve products.

According to Cooper and Kleinschmidt (1995), the extent as to which an enterprise is knowledgeable of its environment is a critical success factor for innovative ability. Developing and implementing external orientation in each job constitutes a major step in creating and maintaining an innovative organization. Heydebreck (1997) discusses a number of external parties that may help SMEs to enhance innovative ability, for instance suppliers and competitors.

Hypothesis 6A. Service businesses with a stronger external orientation will have more innovative ability.

Customer orientation

When an SME is sensitive to signals from its clients, the enterprise will expand its innovative ability. Intensive contacts between employees and customers provide additional information that is a valuable source for ideas and improvements. Ottum and Moore (1997) conclude that enterprises using customer information have more successful innovations.

Hypothesis 6B. Service businesses with a stronger customer orientation will have more innovative ability.

Co-operation with other enterprises

Gosselink (1996) identifies technological co-operation with parties from the external environment as a determinant of innovative ability. Each participant brings in his own knowledge and skills. Using the knowledge and skills of external participants causes an increase in the variety of information. The participants may look at problems from different angles. Idea generation benefits from this.

Hulshoff and Snel (1998) state that gaining increased knowledge is one of the most important motives for inter-firm co-operation. In their opinion, new ideas may easily emerge from this knowledge.

Hypothesis 6C. Service businesses that co-operate more with other enterprises will have more innovative ability.

Transfer of (technical) knowledge

An enterprise might increase corporate innovative ability by acquiring (technical) knowledge from external parties in exchange for money. This may enhance the cross-fertilization of ideas. In the study of Brouwer (1997), it appears that expenditure on innovations increase when an enterprise acquires more external knowledge.

Hypothesis 6D. Service businesses that transfer technical knowledge in exchange for money will have more innovative ability.

2.8 Firm characteristics

De Jong and Brouwer (1999) discuss some firm characteristics as well. These characteristics are not as manageable for the entrepreneur as the determinants discussed in the previous sections. In our empirical test, we shall examine:

- Technological competence
- Firm size
- High diversification scheme
- Exporting activities
- Location of the business in urban areas
- High complexity of product design.

Technological competence

Nagel (1993) defines technology as an enterprise's specific knowledge, skills and affinity with its products and work processes. Gosselink (1996) states that technology also consists of technological know-how that is present in an enterprise to keep pace with technical developments.

According to Cooper and Kleinschmidt (1995), the technology present in an enterprise is often a prerequisite for being able to innovate. For instance, without any up-to-date technology, it is difficult to develop a new product that satisfies the needs of a modern customer. The greater the technical knowledge, the easier new technical ideas may be understood and dispersed within an enterprise.

Hypothesis 7A. Service businesses with more technical knowledge will have more innovative ability.

Firm size

De Jong and Brouwer (1999) state that the impact of firm size on the generation of ideas is ambiguous. On the one hand, larger enterprises are reasoned to have more innovative ability because many employees are present, which increases the possibilities of interdisciplinary activities (Brouwer (1997)), and because the corporate risk as a whole is lower (Vossen and Nooteboom (1996)). On the other hand, smaller enterprises tend to be more flexible than larger ones. This encourages the generation of ideas as well (Scherer (1988)). In our study, we shall test the following hypothesis:

Hypothesis 7B. Service businesses that have more employees will have more innovative ability.

High diversification scheme

The diversification scheme of an enterprise reflects the extent as to which an enterprise's line of business extends. A high diversification scheme refers to a wide range of business activities, and customers in many sectors and markets. This usually enhances the variety of information and possibilities of interdisciplinary activities, and may cause more idea generation (see Lunn (1987) and Felder *et al.* (1996)).

Hypothesis 7C. Service businesses with a wider range of business activities will have more innovative ability.

Exporting activities

One may expect exporting businesses to have more innovative ability than enterprises operating solely in national markets, because exporting businesses are likely to gather more cross-border information. This increases the variety of available information, and hence stimulates idea generation. Felder *et al.* (1996) conclude that there is a significant correlation between exporting businesses and innovation intensities.

Hypothesis 7D. Service businesses with more export activities will have more innovative ability.

Location of the business in urban areas

In an urban area, more enterprises are agglomerated. Besides, more knowledge centres (universities, for instance) are located in urban areas. This implies that there are more positive knowledge externalities to be expected in urban areas than in rural areas. Therefore, enterprises in urban areas might benefit from this knowledge concentration, which might have a positive effect on innovative ability. Brouwer (1997) found support for this hypothesis.

Hypothesis 7E. Service businesses that are located in urban areas will have more innovative ability.

High complexity of product design

A highly complex product design is a way to protect corporate knowledge. If a product design is highly complex, it is more difficult for competitors to copy the product. As a result, the service business creates a temporary monopoly and may gain more benefits from an idea. This might stimulate the amount of idea generation (Arvantitis and Hollenstein (1994)).

Hypothesis 7F. Service businesses with a more complex product design will have more innovative ability.

Other determinants

De Jong and Brouwer (1999) also discuss a low lead-time for developing and introducing innovations as a determinant of innovative ability. If lead-time is low, the returns of the innovation may be invested in (new) knowledge development and innovation. Again, we opted for not using this determinant in our empirical test, because its content is too closely related to innovative ability itself (contamination). This would lead to a very high effect indicator by default.

2.9 Innovation infrastructure

De Jong and Brouwer (1999) state that innovative ability of SMEs might be dependent on a country's general innovation infrastructure. In this context, they discuss four determinants:

- General technological activity and basic knowledge. With more general technological activity in the corporate environment (i.e. scientific infrastructure), one may acquire better educated people and use several services (Mangematin and Mandran (1999)). Innovative ability might benefit from this.

- The existence of patents. Patents offer the possibility of knowledge protection, so the enterprise may get more benefits from a successful innovation (Geroski et al. (1998)). This might stimulate the innovative efforts of SMEs as well.
- The existence of tax credit. By using tax credit, performing innovative activities becomes less expensive; it will, therefore, be more attractive for enterprises to generate and develop ideas for new products, work processes, etc. (Geroski et al. (1998)). Again, this might have a positive effect on the innovative efforts of SMEs.
- The existence of R&D subsidies. By using R&D subsidies, performing R&D becomes less expensive, so it will be more attractive for enterprises to generate ideas for new products (Favre et al. (1999)).

In our empirical test, we did not study any of the determinants mentioned above. The reason is that our study focuses on service businesses only. Between the various Dutch service sectors there are hardly any differences in the existence of patents, tax credit, R&D subsidies and general technological activity. Therefore, we decided to omit these determinants due to a lack of variation.

2.10 Market characteristics

Finally, de Jong and Brouwer (1999) discuss determinants that are summarized in the 'market characteristics' category. These characteristics cannot be managed by an entrepreneur himself, but may certainly be relevant for the innovative ability of service businesses. In our test, we shall examine:

- High degree of demand-pull
- High intensity of non-price competition
- Short length of product life cycle
- Low price elasticity
- More heterogeneous demand
- High uncertainty of demand.

High degree of demand-pull

A high degree of demand-pull is characterized by a high degree of demand growth. In this context, the degree of competition is relevant as well. When demand growth is high, competition is usually not that intense.

When the economy is booming, demand is high, and intense competition lacks, enterprises 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 one's production is lower when demand is high. According to Brouwer (1997), demand growth has indeed a positive influence on the probability that an enterprise is innovative, and on the level of innovation.

Hypothesis 8A. Service businesses that operate in a fast-growing market will have more innovative ability.

High intensity of non-price competition

It seems obvious that non-price competition gives rise to more ideas for new products. Enterprises compete with each other on issues like product characteristics, advertisement, etc. Therefore, enterprises continuously want to differentiate their products from their competitors. This is confirmed by Arvantitis and Hollenstein (1994). In a situation of non-price competition, enterprises will differentiate their products from their competitors as much as possible and will pay more attention to corporate innovative ability. On the contrary, intense price competition will leave employees with no money to work out ideas. This decreases the motivation to show innovative behaviour.

Hypothesis 8B. Service businesses that operate in markets with less price competition will have more innovative ability.

Short length of product life cycle

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

A short life cycle may stimulate enterprises to be more creative. Although Brouwer (1997) found no relation between the average length of the life cycle of innovative products in a sector and the probability that an enterprise is innovative, we shall test the following hypothesis.

Hypothesis 8C. Service businesses that operate in markets where product life cycles are short will have more innovative ability.

Low price elasticity

The price elasticity of a product reflects the extent as to which consumer demand for a specific product is changed in response to an alteration in product price. A low price elasticity is likely to stimulate product innovations because the cost of product innovations may be financed by an increased price without causing an enormous fall in demand. Consequently, when the price elasticity of a product is low, employees are stimulated to renew the product, and, therefore, the possibility to generate new ideas is high (Le Bas and Cabagnols (1999)).

Hypothesis 8D. Service businesses that offer services with a low price elasticity will have more innovative ability.

More heterogeneous demand

The demand for a product is heterogeneous when consumer demand is differentiated: various consumers demand only slightly different products. Heterogeneous demand may be expected to encourage corporate innovative ability, because it seems to pay off to generate new ideas in order to differentiate the product better and link up with customer needs. Le Bas and Cabagnols (1999) find that heterogeneous demand directed toward small series indeed enhances the number of product innovations in SMEs.

Hypothesis 8E. Service businesses that operate in markets with a more heterogeneous demand will have more innovative ability.

High uncertainty of demand

Enterprises may be uncertain of the characteristics of demand: they have no clear notion of consumers' wishes and are not aware of consumer behaviour. In this situation, innovative ability may be expected to be encouraged. When an enterprise initiates activities to discover the characteristics of demand and the needs of customers, new ideas may emerge. According to Klepper (1996), enterprises facing high uncertainty about the characteristics of demand will indeed generate more ideas and have more innovative ability.

Hypothesis 8F. Service businesses that operate in markets where demand is highly uncertain will have more innovative ability.

Other determinants

De Jong and Brouwer (1999) also identify the openness of the national economy as a determinant of innovative ability. In open economies, foreign knowledge may easily flow to the home country, which for domestic enterprises might enhance possibilities to generate ideas.

This determinant will not be part of our empirical test because of a lack of dispersion: we only look at service businesses in the Netherlands. To be able to estimate the effect of an open economy on the innovative ability of SMEs, one should perform an international benchmark.

2.11 Other models

De Jong and Brouwer (1999) state that there are several models to explain the innovative ability of small enterprises. For instance, they refer to the model for new product development and the two-stage model for innovation.

One should realize that the model discussed in this chapter is not the only model available to outline innovative ability. However, we opted for using it because it integrates two traditions of innovation research. In chapter 1, we already narrated that there has been no research as yet that examines both traditions simultaneously.

3 Methodology

As discussed in chapter 1, the empirical test focuses on small and medium-sized enterprises in the Dutch service industry. Before we present our findings, we shall discuss:

- Our research population
- Questionnaires used
- Data collection
- Scale construction.

3.1 Research population

Focus on small and medium-sized service businesses

As discussed in chapter 1, our empirical test focuses on small and medium-sized enterprises in the Dutch service sector. When defining a small or medium-sized enterprise, one often adopts the number of employees in an enterprise as a guideline. In the Netherlands, a small or medium-sized enterprise is defined as a business with no more than 100 employees[1].

The enterprises included in our sample were drawn from the SME Policy Panel. This panel is set up and controlled by EIM. It's major objective is to collect information on the knowledge, attitude and opinion of entrepreneurs about various (government) policy-related issues. The SME Policy Panel consists of a disproportionately stratified sample of over 2,000 SMEs. It covers all sectors of the Dutch economy. Three firm sizes are distinguished: 0-9 employees, 10-49 employees and 50-99 employees.

Sampling frame

For our purposes, we approached only services businesses in the SME Policy Panel. The sample consists of enterprises delivering business-to-business, financial and personal services.

Besides, we opted for approaching enterprises with 10 to 100 employees (measured in full-time equivalents). For enterprises with less than 10 employees, it is likely that the determinants of innovative ability will be very different than for enterprises with 10 to 100 employees. For instance, the structural determinants as discussed in section 2.5 will not be relevant, because enterprises with less than 10 employees usually have no formal organizational structure. Besides, the people characteristics as discussed in section 2.2 will be relevant

[1] This is a major difference with many other countries, where an SME is defined as an enterprise with a maximum of 250 employees and/or is defined on the basis of total turnover.

neither for many of the smallest enterprises because they have no employees at all.

In appendix I, the sampling frame is discussed in more detail. Summarizing, our findings will be relevant for service businesses with 10 to 100 employees delivering business-to-business, financial or personal services.

3.2 Questionnaires

Multi-level problem

Managers and employees of Dutch service businesses formed the sources of data for our study. To test our hypotheses, we had to collect data for every determinant delineated in chapter 2. When testing the model, we had to account for the so-called multi-level problem:

- Some determinants may be assessed very well by asking the entrepreneur or general manager of a service business. For instance, determinants related to the enterprise (section 2.8) and market characteristics (section 2.10) may be measured by asking one person. Furthermore, not all employees know the ins and outs of, for instance, market characteristics.
- Other determinants may be measured in a reliable way only by asking several employees. For instance, the determinants related to structure (section 2.5) and culture (section 2.4) are latent constructs that are not directly measurable. To obtain reliable data for these constructs, we had to ask the opinion of various employees.

The multi-level problem is the consequence of our interest in economic and organizational determinants. To obtain an exhaustive overview of the determinants of innovative ability, we accounted for both traditions of innovation research. As discussed in section 1.3, the general-economic tradition focuses mainly on the macro and meso level. The organizational tradition focuses on the micro level. This difference in focus causes the problem outlined above.

Two questionnaires

To deal with the multi-level problem, we constructed two questionnaires:

- The first questionnaire was completed by the entrepreneur or the general manager of the service business.
- For the second questionnaire, answers were provided by the employees in the service businesses that participated in our study.

In Table 1 we present an overview of all our hypotheses and determinants. The fourth column shows whether the data are collected in the entrepreneur's questionnaire. The fifth column does the same for data collected in the employees' questionnaire.

Table 1 Subjects in the entrepreneur's questionnaire and the employees' questionnaire

Category	Hypothesis	Determinant	Entrepreneur	Employees
People	1A	Willingness to take risks		x
	1B	Entrepreneur's commitment		x
	1C	Presence of internal capabilities	x	
Strategy	2A	Innovation in the mission statement		x
	2B	Innovation objectives in the strategy		x
Culture	3A	Loose control		x
	3B	People orientation		x
	3C	Openness		x
	3D	Result orientation		x
	3E	Professionalism		x
	3F	Spread of information		x
Structure	4A	De-standardization		x
	4B	Vertical integration		x
	4C	Multifunctional teams		x
	4D	Task assignment and expansion		x
	4E	Job rotation		x
	4F	Autonomy		x
	4G	Reward structure		x
Availability of means	5A	Freedom to experiment		x
	5B	Financial resources		x
	5C	Education and training		x
	5D	Use of creativity techniques		x
Network activities	6A	External orientation		x
	6B	Customer orientation		x
	6C	Co-operation with other enterprises	x	
	6D	Transfer of (technical) knowledge	x	
Enterprise	7A	Technological competence	x	
	7B	Firm size	x	
	7C	High diversification scheme	x	
	7D	Exporting activities	x	
	7E	Location of the business in urban areas	x	
	7F	High complexity of product design	x	
Market	8A	High degree of demand-pull	x	
	8B	High intensity of non-price competition	x	
	8C	Short length of product life cycle	x	
	8D	Low price elasticity	x	
	8E	More heterogeneous demand	x	
	8F	High uncertainty of demand	x	

This follows the overview presented by de Jong and Brouwer (1999), in which they present the origin of the determinants found[1]. The determinants in the entrepreneur's questionnaire stem from the general-economic tradition and the ones in the employees' questionnaire from the organizational tradition.

Likert scales

Most determinants are latent constructs that are not directly measurable. Generally, a measure consisting of multiple-item indicators is more reliable and valid than single-item indicators (Churchill (1999)). We opted for measuring almost every determinant with a Likert scale. This also includes the innovative ability itself.

Thus, in both questionnaires we used Likert scales to collect most of the data. For instance, in the employees' questionnaire the 'spread of information' (hypothesis 3F) was measured with a Likert scale that consisted of three indicators (Frame 1).

Frame 1 Measurement scale for the spread of information (hypothesis 3F)

'In my company I hear about changes in time'
'In my company I get enough information about the decisions made'
'I can have a chat with every colleague at my work'

Notice that each indicator was formulated as a statement. In both questionnaires, the respondent could answer each statement with:

- Does not apply to me (score 1)
- Does apply slightly to me (score 2)
- Does apply to me to some degree (score 3)
- Does apply to me to a high degree (score 4)
- Does fully apply to me (score 5).

The innovative ability itself was measured with a Likert scale as well. This construct was measured in the employees' questionnaire, because the employees of an organization fulfill a key role in the innovative ability. In Frame 2, the four indicators of the scale for innovative ability are recapitulated. Note that according to our definition (see section 1.2), the innovation results are no part of our measurement scale for innovative ability.

[1] See de Jong and Brouwer (1999), p. 102.

Frame 2 Measurement scale for innovative ability

'I like to try things in a new way'

'I think of innovative projects as a challenge'

'The people in my company consider me as a strong advocate of renewal and change'

'In my work, I often come up with ideas'

Validity and reliability

Churchill (1999) identifies a number of criteria to assess the quality of a measurement scale. *Content validity* focuses on the adequacy with which the domain of the construct is captured by the measure. One of the most critical elements in generating a content valid measurement scale is to base its indicators on the (recent) literature. By doing this, one accounts for how the construct has previously been defined and used. In our study, we used the most recent literature (as discussed in chapter 2) to define our indicators. Besides, expert interviews were used to improve the content validity of our measurement tool (see de Jong and Brouwer (1999)).

Churchill (1999) also discusses the use of *reliability* measures. One may combine several indicators into a measurement scale only after its reliability has been assessed. After the data were collected, we performed a reliability analysis by using Cronbach's Alpha to find out whether we could combine the indicators into a single score. We refer to section 3.4 for a detailed discussion of the results.

Other types of questions

Only two determinants were not measured with Likert scales. These were all part of the entrepreneur's questionnaire:

- Firm size (hypothesis 7A) was measured via the number of employees (measured in full-time equivalents).
- Location of the business in urban areas (hypothesis 7E) was indicated by recoding the zip code of the enterprise's business-site location. Service businesses that are settled in cities with more than 100,000 inhabitants were considered to be located in an urban area.

3.3 Data collection

Collecting relevant service businesses

The first step consisted of collecting enterprises that were interested in joining our research. A total of 477 service businesses with 10 to 100 employees were summoned with information about the objectives of our study and the necessary activities to be employed. These enterprises were already familiar with doing research by means of questionnaires, since they are all members of the SME Policy Panel (see appendix I). As an incentive for cooperation, we promised some feedback by sending the individual results.

The entrepreneur could join the research by sending in a fax form. Eventually, 101 service businesses were interested in our study. This response seems to be low, but one should take into account that our study is a heavy burdening because several employees had to complete a questionnaire as well.

Completing the questionnaires

The data were collected in October and November 2000. Both questionnaires were composed in Dutch and completed by mail. As mentioned above, the first questionnaire was completed by the entrepreneur. It had a length of about five minutes. The second questionnaire was completed by the employees. This one took about ten minutes to complete.

For the employees' questionnaire, the entrepreneur was in some cases allowed to draw a (random) sample from his staff population:

- In enterprises with less than 20 employees, every employee was asked to complete the questionnaire.
- In enterprises with 20 to 40 employees, the entrepreneur was asked to take a random sample of 10 employees.
- In enterprises with more than 40 employees, the entrepreneur was asked to take a random sample of 20 employees.

This procedure was followed because in the larger enterprises, it is not necessary to approach every employee to obtain a good estimate of the determinants outlined in Table 1. The random sample was drawn by choosing the ten (or twenty) employees whose birthday came up first.

After six weeks, a reminder letter was sent to every enterprise that had not returned any questionnaire as yet. Since our study was quite a burdening, not every enterprise participated in the end. Eventually, the employees' questionnaire was completed by 725 employees from 72 enterprises[1]. The entrepreneur's questionnaire was completed by 65 respondents.

3.4 Scale construction

Assessment of reliability by means of Cronbach's α

The basic assumption in constructing a measurement scale is that when several indicators are summed into a single score, the indicators are measuring the same underlying construct. Before we tested our hypotheses, we performed a reliability analysis for each determinant to check this. Reliability is the similarity of results provided by independent measures of the same construct (Churchill (1999)).

[1] Our sample eventually consisted of 25 enterprises with less than 20 employees, 15 enterprises with 20 to 40 employees, and 32 enterprises with more than 40 employees.

Churchill (1999) identifies Cronbach's α as an appropriate measure for the reliability of a measurement scale. When every indicator in a scale measures the same construct, the correlation between the indicators should be high. Cronbach's α is a summary measure of intercorrelations that exist among a set of indicators. Its square root may be considered as the estimated correlation of the measurement scale with the true scores one attempts to measure.

The value of Cronbach's α has a maximum value of 1. One should be aware that the number of indicators has a strong influence on the value of α. In fact, its critical value depends on the number of indicators. In our study, we followed the guidelines outlined in Table 2.

Table 2 Critical values of Cronbach's α

Number of indicators	Critical value
2	0.57
3	0.67
4	0.73
5	0.77

Source: Adapted from Sloot and Verhoef (1997).

If the value of Cronbach's α is too low, some indicators should be eliminated. This is called the item-selection process. We refer to Churchill (1999) and Swanborn (1993) for a detailed discussion.

Results

For the employees' questionnaire, the analysis was performed on the dataset with 725 respondents. For the entrepreneur's questionnaire, Cronbach's α was calculated on the basis of 65 respondents.

In Table 3, the results for every determinant are shown. The fourth column states the original number of indicators as included in the questionnaires. The fifth column shows the number of indicators after the item-selection process (eliminating the 'poor' indicators). The last column shows the value of Cronbach's α.

Table 3 Results of the scale construction

Category	Hyp.	Determinant	Original # indicators	Final # indicators	Cron-bach's α
People	1A	Willingness to take risks	5	4	0.77
	1B	Entrepreneur's commitment	2	2	0.63
	1C	Presence of internal capabilities	3	2	0.60
Strategy	2A	Innovation in the mission statement	2	2	0.61
	2B	Innovation objectives in the strategy	2	2	0.58
Culture	3A	Loose control	4	2	0.61
	3B	People orientation	3	2	0.79
	3C	Openness	2	2	0.62
	3D	Result orientation	3	2	0.63
	3E	Professionalism	4	2	0.69
	3F	Spread of information	3	2	0.76
Structure	4A	De-standardization	3	2	0.72
	4B	Vertical integration	3	3	0.67
	4C	Multifunctional teams	4	1	n.a.
	4D	Task assignment and expansion	3	3	0.72
	4E	Job rotation	3	1	n.a.
	4F	Autonomy	3	3	0.75
	4G	Reward structure	3	3	0.73
Availability of means	5A	Freedom to experiment	3	1	n.a.
	5B	Financial resources	3	2	0.74
	5C	Education and training	2	2	0.79
	5D	Use of creativity techniques	2	1	n.a.
Network activities	6A	External orientation	4	2	0.60
	6B	Customer orientation	4	2	0.57
	6C	Co-operation with other enterprises	3	2	0.74
	6D	Transfer of (technical) knowledge	3	2	0.66
Enterprise	7A	Technological competence	2	2	0.78
	7B	Firm size	1	1	n.a.
	7C	High diversification scheme	4	2	0.67
	7D	Exporting activities	3	3	0.78
	7E	Location of the business in urban areas	1	1	n.a.
	7F	High complexity of product design	4	2	0.67
Market	8A	High degree of demand-pull	2	1	n.a.
	8B	High intensity of non-price competition	3	2	0.68
	8C	Short length of product life cycle	3	2	0.62
	8D	Low price elasticity	2	1	n.a.
	8E	More heterogeneous demand	3	2	0.65
	8F	High uncertainty of demand	3	2	0.60
Innovative ability	-	Innovative ability	4	4	0.79

n.a. = not applicable

From Table 3, a number of conclusions may be drawn. In our questionnaires, two to four statements were used to operationalize a determinant. We opted for not using more indicators, because the questionnaires would then become too long. We expected this would have been devastating for the response rate.

Eventually, most measurement scales appear to consist of two indicators. The last column shows that Cronbach's α always exceeds the critical values outlined in Table 2. For all determinants, we computed a summary score by taking the average of the scores on its statements. After that, for each determinant of the employees' questionnaire, a summary score per enterprise was calculated by taking the average of the respondent scores. This resulted in a dataset with 72 cases.

In Table 3, a few exceptions are shown as well. We already mentioned that the firm size (hypothesis 7A) and the location of the business in an urban area (hypothesis 7E) were measured with a single question (the number of employees in full-time equivalents and settled in a city with more than 100,000 inhabitants or not). Obviously, Cronbach's α cannot be computed for these measures.

Besides, we did not manage to find reliable measurement scales for six determinants. This applies for: multifunctional teams (hypothesis 4C), job rotation (hypothesis 4E), freedom to experiment (hypothesis 5A), use of creativity techniques (hypothesis 5D), high degree of demand-pull (hypothesis 8A) and low price elasticity (hypothesis 8D). For each determinant, we selected the statement that fits the content best in our opinion. In Frame 3, we present an overview of these statements.

Frame 3 Statements to make six determinants operational

(Multifunctional teams)	'I do my work with always different colleagues'
(Job rotation)	'In my company, it's easy to change your job'
(Freedom to experiment)	'In my work, I'm free to work out ideas'
(Use of creativity techniques)	'In my work, we are used to organize brainstorm sessions'
(High degree of demand-pull)	'The market of my company has grown rapidly in the past few years'
(Low price elasticity)	'In our market, customers are not sensitive to small price increases: they will keep coming anyhow'

4 First empirical findings

4.1 Introduction

Three analytical steps

In this chapter, we shall discuss the results of the causal analysis of the determinants of innovative ability. Following our model (Figure 1) and hypotheses (chapter 2), we shall focus on the direct effect of each determinant on the innovative ability of service businesses. Our analysis consists of three steps:

- We shall start with an analysis of the correlations between innovative ability and the 38 determinants outlined in the previous section. These correlations provide a first impression of the importance of the determinants (section 4.2).
- We shall continue with a stepwise regression per category. De Jong and Brouwer (1999) already noticed that some determinants overlap to some extent. With stepwise regression, we shall identify the most important determinants per category and partially test the hypothesis as presented in chapter 2 (section 4.3).
- These most important (significant) determinants will be used in the final analysis to determine the importance of the categories of innovative ability. For this analysis, we shall also use stepwise regression (section 4.4).

For the second and third step, we shall determine the importance of each significant determinant by partitioning the explained variance. This partitioning will be based on commonality analysis. We refer to Lammers *et al.* (1980) for a detailed discussion on commonality analysis.

Discussion of the analytical steps

Note that in the second and third step, we assume that our (theory-based) model as outlined in chapter 1 is true. The model itself is not tested in this study. To examine the robustness of our findings, at the end of this chapter, we shall perform a stepwise regression with all 38 determinants together. Although our number of observations is limited compared to the number of independent variables (Hair *et al.* (1995) recommend a ratio of at least 1:5), the stepwise procedure guarantees that our estimates will be statistically reliable, since the determinants are added into the regression equation one by one.

4.2 Bivariate correlation

The Pearson bivariate correlation coefficient provides a first impression of the strength of a correlation between two variables. In Table 4, the correlations between innovation ability and the 38 determinants are presented. We refer to appendix 2 for the complete correlation matrix.

Table 4 Bivariate correlation between innovative ability and its determinants

Category	Hyp.	Determinant	Innovative ability
People	1A	Willingness to take risks	0.79**
	1B	Entrepreneur's commitment	0.38**
	1C	Presence of internal capabilities	-0.17
Strategy	2A	Innovation in the mission statement	0.46**
	2B	Innovation objectives in the strategy	0.42**
Culture	3A	Loose control	-0.02
	3B	People orientation	0.16
	3C	Openness	0.24*
	3D	Result orientation	0.40**
	3E	Professionalism	0.42**
	3F	Spread of information	0.18
Structure	4A	De-standardization	-0.08
	4B	Vertical integration	0.11
	4C	Multifunctional teams	0.53**
	4D	Task assignment and expansion	0.04
	4E	Job rotation	0.31**
	4F	Autonomy	0.24*
	4G	Reward structure	0.21
Availability of means	5A	Freedom to experiment	0.41**
	5B	Financial resources	0.34**
	5C	Education and training	-0.06
	5D	Use of creativity techniques	0.46**
Network activities	6A	External orientation	0.35**
	6B	Customer orientation	0.30*
	6C	Co-operation with other enterprises	0.22
	6D	Transfer of (technical) knowledge	0.32*
Enterprise	7A	Technological competence	-0.01
	7B	Firm size	0.04
	7C	High diversification scheme	0.15
	7D	Exporting activities	0.21
	7E	Location of the business in urban areas	0.15
	7F	High complexity of product design	-0.15
Market	8A	High degree of demand-pull	-0.08
	8B	High intensity of non-price competition	0.40**
	8C	Short length of product life cycle	0.11
	8D	Low price elasticity	-0.11
	8E	More heterogeneous demand	0.24
	8F	High uncertainty of demand	0.49**

** Significant at the .01 level (2-tailed).
* Significant at the .05 level (2-tailed).
Source: EIM.

Of the 38 determinants, 18 are significant at the 5% level. The correlation of innovation ability with the willingness to take risks is by far the highest. Most categories have at least one determinant that is significantly related with the innovation ability of service businesses. Only the 'firm characteristics' category seems to have no significant determinants at all. Finally, when looking at the market characteristics, merely the intensity of non-price competition and the uncertainty of demand seem to be relevant for the innovative ability of service businesses with 10 to 100 employees.

The correlations do not narrate everything about the uniqueness of each determinant per category. In the following section, we shall analyze the contribution of each determinant per category.

4.3 Stepwise regression per category

Procedure

In this section, we shall discuss the results of the stepwise regression per category. The regression analysis is performed with innovative ability as the dependent and the determinants per category as the independent variables. The inclusion of determinants is based on the partial correlation[1]. The independent variable with the highest (significant) partial correlation will be included in the next step of the stepwise regression procedure. Therefore, we shall outline the partial correlations between each determinant and the innovative ability as well.

To give an indication of the unique and shared variance (if more than one determinant is included in the regression) of each determinant to the total explained variance of the dependent variable, we shall perform a commonality analysis (see Lammers *et al.* (1980) and Hair *et al.* (1995)).

People characteristics

The 'people characteristics' category consists of three determinants:
- Willingness to take risks
- Entrepreneur's commitment
- Presence of internal capabilities.

In section 2.2, the hypotheses concerning these determinants are discussed. The results are presented in Table 5.

[1] The partial correlation is the correlation of an independent variable with the unexplained variance of the dependent variable.

Table 5 Results stepwise regression of the 'people characteristics' category

Hyp.	Variable	Beta	Sign.	Partial corr.	R^2
	Included (step)				
1A	Willingness to take risks (1)	.78	.00	.78	.61
	Excluded				
1B	Entrepreneur's commitment			-.02	
1C	Presence of internal capabilities			-.08	

Source: EIM.

Of the three determinants, only willingness to take risks is significant (significance level is .00). This implies that willingness to take risks is the most important determinant of innovative ability in the 'people characteristics' category. Therefore, we found strong support for hypothesis 1A.

We find no support for hypotheses 1B and 1C. This means that the entrepreneur's commitment and the presence of internal capabilities do not have a significant unique correlation with innovative ability. For the presence of internal capabilities (1C), this implies that this determinant does not have a direct effect on innovative ability (see also the non-significant bivariate correlation in table 4).

For the entrepreneur's commitment (1B), our conclusion is more complicated. The determinant of the entrepreneur's commitment is significantly correlated with innovative ability (see table 4). In combination with the results of the stepwise regression, this may imply that the entrepreneur's commitment has a direct effect on innovative ability, but the explained variance is shared with the willingness to take risks. The unique contribution of the entrepreneur's commitment in explaining innovative ability is limited. It is also possible that there is an indirect effect of the entrepreneur's commitment on innovative ability via the determinant 'willingness to take risks' (1A). The explained variance of the regression is rather high ($R^2 = 0.61$), so the willingness to take risks seems to be very closely related to the innovative ability of medium-sized service businesses.

Unique variance per determinant

Since willingness to take risks is the only significant determinant in the 'people characteristics' category, it is responsible for all the explained variance.

Strategy

The 'strategy' category consists of two determinants. We refer to section 2.3 for a detailed discussion of the hypotheses regarding:

- Innovation in the mission statement
- Innovation objectives in the strategy.

The results are presented in Table 6. Both determinants proved to be significantly related with innovative ability. Therefore, we find support for both hypotheses 2A and 2B.

Table 6 Results stepwise regression of the 'strategy' category

Hyp.	Variable	Beta	Sign.	Partial corr.	R^2
	Included (step)				
2A	Innovation in the mission statement (1)	.37	.00	.40	.31
2B	Innovation objectives in the strategy (2)	.32	.00	.34	
	Excluded				
	-				

Source: EIM.

Unique variance per determinant

If we have a look at the respective contribution of each determinant to the total explained variance of innovative ability, we see that the presence of innovation in the mission statement is responsible for more than 40% of the total explained variance (see Table 7). The innovation objectives in the strategy are responsible for about 30% of the total explained variance. The same is true for the shared variance of the two indicators.

Table 7 Results commonality analysis of the 'strategy' category

	Explained variance
Innovation in the mission statement	.13
Innovation objectives in the strategy	.09
Shared variance	.09
Total explained variance	.31

Source: EIM.

Summarizing, it seems that enterprises with the notion of innovation in the mission statement and communicating this in a forceful way to employees (hypothesis 2A), is the most important aspect of the strategy when attempting to improve a service business's innovative ability.

Culture

Culture is measured by six determinants. The related hypotheses are discussed in section 2.4, and entail:

- Loose control
- People orientation
- Openness
- Result orientation
- Professionalism
- Spread of information.

All these determinants are predicted to be positively related with innovative ability. In Table 8, the results of the stepwise regression are presented.

Table 8 Results stepwise regression of the 'culture' category

Hyp.	Variable	Beta	Sign.	Partial corr.	R^2
	included (step)				
3E	Professionalism (1)	.34	.00	.35	.26
3D	Result orientation (2)	.31	.01	.33	
	Excluded				
3A	Loose control			.22	
3B	People orientation			-.16	
3C	Openness			.06	
3F	Spread of information			-.16	

Source: EIM.

Only the determinants professionalism and result orientation are significant in the stepwise regression. Thereby we found support for hypotheses 3E and 3D. Service businesses with more result orientation and a more professional culture will have more innovative ability.

The other four determinants are not significantly contributing to innovative ability. Therefore, hypotheses 3A, 3B, 3C and 3F must be rejected. The openness (3C) has a significant correlation with innovative ability (see table 4) but is not included in the stepwise regression. This may be the result of the shared explained variance of openness (direct effect) with the two significant determinants, or the indirect effect of openness on innovative ability via the determinants professionalism or result orientation.

Unique variance per determinant

In Table 9, the explained variance per determinant and the shared variance are presented. Professionalism and result orientation contribute almost equally to the explained variance. Approximately 25% of the explained variance is shared.

Table 9 Results commonality analysis of the 'culture' category

	Explained variance
Professionalism	.10
Result orientation	.09
Shared variance	.07
Total variance	.26

Source: EIM.

Summarizing, it appears that both result orientation and professionalism are important when one tries to improve the innovative ability of service businesses.

Structure

As discussed in section 2.5, this category consists of seven determinants:

- De-standardization
- Vertical integration
- Multifunctional teams
- Task assignment and expansion
- Job rotation
- Autonomy
- Reward structure.

In the stepwise regression, only two determinants proved to be significant (see Table 10).

Table 10 Results stepwise regression of the 'structure' category

Hyp.	Variable	Beta	Sign.	Partial corr.	R^2
	Included (step)				
4C	Multifunctional teams (1)	.57	.00	.58	.38
4F	Autonomy (2)	.31	.00	.36	
	Excluded				
4A	De-standardization			.08	
4B	Vertical integration			.03	
4D	Task assignment and expansion			.13	
4E	Job rotation			.18	
4G	Reward structure			.03	

Source: EIM.

The analysis gives support for hypotheses 4C and 4F. Service businesses that organize their work in multifunctional teams will have more innovative ability. The same holds for service businesses with a large extent of employee autonomy. With these two determinants, we are able to explain 38% of the total variance of innovative ability. The beta of multifunctional teams is considerably greater than the beta of autonomy, meaning that an increase of one standard deviation of multifunctional teams will have a much larger impact on innovative ability than a similar increase in autonomy.

We do not find support for hypotheses 4A, 4B, 4D, 4E and 4G. Job rotation (4E) has the highest partial correlation of the remaining determinants but the partial correlation is not significant at the 5% level. Given that job rotation is significantly correlated with innovative ability (see Table 4), this implies that the direct effect of job rotation on innovative ability is largely shared with the two significant determinants, or that there is an indirect effect on innovative ability via these two determinants.

Unique variance per determinant

In Table 11, the results of the commonality analysis are presented. Multifunctional teams explain almost 85% of the total explained variance. Autonomy explains the remaining 15%. The shared variance is negative. This cannot be interpreted. Given the small figure, we may assume that we may ignore the shared variance[1].

Table 11 Results commonality analysis of the 'structure' category

	Explained variance
Multifunctional teams	.32
Autonomy	.09
Shared variance	-.04
Total variance	.38

Source: EIM.

Summarizing, it appears that organizing the work in multifunctional teams is the most important prerequisite for service businesses attempting to improve innovative ability.

Availability of means

This category is measured by four determinants:
- Freedom to experiment
- Financial resources
- Education and training
- Use of creativity techniques.

In section 2.6, four expected relations are discussed. The four determinants all are expected to have a positive correlation with innovative ability. Of these four determinants, only the use of creativity techniques proved to be significantly related with innovative ability (see Table 12). Based on the analysis, we may conclude that hypothesis 5D is supported.

[1] In commonality analysis, the figures may be interpreted as percentage of explained variance. Therefore, they cannot be negative. Probably, the negative sign is caused by inaccurate calculation of the computer programme. It concerns small values (see also Lammers *et al.* (1980), footnote 2). Another explanation is provided by Kerlinger and Pedhauzer (1973). According to them, it is of no use to interpret the negative sign.

Table 12 Results stepwise regression of the 'availability of means' category

Hyp.	Variable	Beta	Sign.	Partial corr.	R^2
	Included (step)				
5D	Use of creativity techniques (1)	.46	.00	.46	.21
	Excluded				
5A	Freedom to experiment			.20	
5B	Financial resources			.17	
5C	Education and training			-.20	

Source: EIM.

The remaining hypotheses (5A, 5B and 5C) are rejected. Note that the freedom to experiment (5A) and financial resources (5B) have a significant correlation with innovative ability (see Table 4), but their partial correlations in the stepwise regression are not significant. This implies that the direct effect of these two determinants is largely shared with the use of creativity techniques. It is also possible that there is an indirect effect of the freedom to experiment and/or financial resources on innovative ability via the use of creative techniques.

Unique variance per determinant

Because the use of creativity techniques is the only significant determinant, this determinant also accounts for all the explained variance in the 'availability of means' category.

Network activities

Network activities entail the external orientation and contacts of an enterprise. We examined the effect of:

- External orientation
- Customer orientation
- Co-operation with other enterprises
- Transfer of (technical) knowledge.

In section 2.7, the expected relations with innovative ability are hypothesized. In Table 13, the results of the stepwise regression are presented.

Table 13 Results stepwise regression of the 'network activities' category

Hyp.	Variable	Beta	Sign.	Partial corr.	R^2
	Included (step)				
6A	External orientation (1)	.32	.01	.34	.20
6D	Transfer of (technical) knowledge (2)	.29	.02	.30	
	Excluded				
6B	Customer orientation			-.02	
6C	Co-operation with other enterprises			.06	

Source: EIM.

The determinants external orientation and transfer of technical knowledge explain 20% of the variance in innovative ability. Hypotheses 6A and 6D are supported. On first sight, both determinants are almost of equal importance.

Hypotheses 6B and 6C concerning customer orientation and co-operation with other enterprises are not supported. However, customer orientation (6B) has a significant bivariate correlation with innovative ability (see Table 4), but this determinant is not included in the stepwise regression. This implies that the direct effect is shared with the other, significant determinants or that there is an indirect effect of customer orientation on innovative ability via these determinants.

Unique variance per determinant

If we have a closer look at the two significant determinants, it proves that external orientation has a somewhat higher unique contribution to the total variance explained than transfer of technical knowledge (see Table 14). The shared variance is relatively small.

Table 14 Results commonality analysis of the 'network activities' category

	Explained variance
External orientation	.10
Transfer of (technical) knowledge	.08
Shared variance	.02
Total variance	.20

Source: EIM.

Summarizing, it appears that service businesses attempting to improve their innovative ability by means of network activities, should work on their external orientation (contacts with suppliers, competitors, etc.) and transfer technical knowledge in exchange for money.

Firm characteristics

In Table 15, the results are presented of the stepwise regression with the determinants of the firm characteristics: technological competence, firm size, high diversification scheme, exporting activities, location of the business in urban areas, and high complexity of product design.

Table 15 Results stepwise regression of the 'firm characteristics' category

Hyp.	Variable	Beta	Sign.	Partial corr.	R^2
	Included (step)				
	-				
	Excluded				
7A	Technological competence			-.03	
7B	Firm size			.00	
7C	High diversification scheme			.12	
7D	Exporting activities			.20	
7E	Location of the business in urban areas			.19	
7F	High complexity of product design			-.13	

Source: EIM.

In the stepwise regression procedure, determinants with a significant partial correlation are entered in the regression. None of the determinants appears to be significantly correlated with innovative ability (see also Table 4). We conclude that the innovative ability of service businesses cannot be explained by the firm characteristics themselves. Therefore, we have to reject the hypotheses 7A-F.

Unique variance per determinant

We cannot explain any variance in the innovative ability of service businesses by looking at firm characteristics. Therefore, each of the determinants narrated in Table 15 is unsuitable for the commonality analysis.

Market characteristics

In section 2.10, we identified six determinants of the market that may affect corporate innovative ability:

- High degree of demand-pull
- High intensity of non-price competition
- Short length of product life cycle
- Low price elasticity
- More heterogeneous demand
- High uncertainty of demand.

The stepwise regression resulted in three determinants that significantly contribute to the explanation of the variance of innovative ability (see Table 16).

Table 16 Results stepwise regression of the 'market characteristics' category

Hyp.	Variable	Beta	Sign.	Partial corr.	R^2
	Included (step)				
8B	High intensity of non-price competition (1)	.50	.00	.55	.49
8F	High uncertainty of demand (2)	.40	.00	.47	
8D	Low price elasticity (3)	-.33	.00	-.40	
	Excluded				
8C	Short length of product life cycle			-.04	
8E	More heterogeneous demand			.12	
8A	High degree of demand-pull			-.19	

Source: EIM.

The total variance explained by market characteristics is 0.49. Hypotheses 8B and 8F are supported. Service businesses that operate in markets with a high intensity of non-price competition (i.e. compete more on quality and service) will have more innovative ability. The same applies for service businesses that operate in markets where demand is highly uncertain.

Hypothesis 8D states that service businesses that offer services with a low price elasticity will have more innovative ability. However, the beta is negative, indicating that there is a negative correlation between low price elasticity and innovative ability. To put it in other words, a high price elasticity seems to contribute to more innovative ability. Therefore, our findings do not support hypothesis 8D. We shall discuss the implications of this finding in chapter 5. Finally, the hypotheses 8A, 8C and 8E are rejected.

Unique variance per determinant

In Table 17, the unique variance of each determinant is presented. The unique variance of the three determinants is relatively high compared to the shared variance. The shared variance of the determinants high intensity of non-price competition and high uncertainty of demand is relatively large, especially compared to the unique contribution of the high uncertainty of demand. Also the shared variance between determinants 1 and 3 is striking, i.e. it is negative. As said before, a negative contribution cannot be interpreted.

Table 17 Results commonality analysis of the 'market characteristics' category

	Explained variance
1) High intensity of non-price competition	.22
2) High uncertainty of demand	.10
3) Low price elasticity	.14
Shared 1 and 2	.11
Shared 1 and 3	-.07
Shared 2 and 3	.00
Shared 1, 2 and 3	-.01
Total variance	.49

Source: EIM.

Summarizing, it seems that the intensity of non-price competition is the most relevant market characteristic when one tries to explain the innovative ability of service businesses.

4.4 The effect of individual determinants on innovative ability

Procedure

In this section, we shall work on with the 13 determinants that proved significant in the previous analysis. Assuming that our model holds, these determinants are the most important antecedents of innovative ability. The effects of these determinants are, however, analyzed in isolation of the determinants of the other (theory-based) categories. In this step, the determinants of the different categories are combined in one regression. Via stepwise regression, we shall select the significant determinants of the different categories that have a direct and unique contribution in explaining the variance of innovative ability[1]. Following this procedure, we shall find the determinants that are most important for the innovative ability of service businesses with 10 to 100 employees.

For the determinants that will have a significant correlation with innovative ability, we shall perform a commonality analysis. This will enable us to indicate the degree as to which an entrepreneur himself may influence innovative ability.

Following the procedure outlined above, we assume that the model of de Jong and Brouwer (1999) is valid. To examine the robustness of our findings, we shall perform a stepwise regression with all 38 determinants together.

[1] The 'firm characteristics' category had no significant determinants and will, therefore, be omitted.

Results

The results of the stepwise regression are presented in Table 18. Overall, four determinants prove to be significant at the 5% level: willingness to take risks (1A), high uncertainty of demand (8F), high intensity of non-price competition (8B) and result orientation (3D).

Table 18 Results stepwise regression determinants of innovative ability

Hyp.	Variable	Beta	Sign.	Partial corr.	R^2
	Included (step)				
1A	Willingness to take risks (1)	.57	.00	.71	.77
8F	High uncertainty of demand (2)	.29	.00	.49	
8B	High intensity of non-price competition (3)	.23	.00	.40	
3D	Result orientation (4)	.15	.04	.26	
	Excluded				
2A	Innovation in the mission statement			-.09	
2B	Innovation objectives in the strategy			-.11	
3E	Professionalism			.01	
4C	Multifunctional teams			.12	
4F	Autonomy			-.03	
5D	Use of creativity techniques			-.01	
6A	External orientation			.11	
6D	Transfer of (technical) knowledge			-.04	
8D	Low price elasticity			-.20	

Source: EIM.

The total explained variance of innovative ability is 77%. Two determinants have an internal focus, i.e. willingness to take risks and result orientation. These determinants may be managed by an entrepreneur himself. The other significant determinants have an external focus, i.e. high uncertainty of demand and high intensity of non-price competition.

The willingness to take risks has by far the highest beta (0.57), implying that this determinant is the most important antecedent of innovative ability (see also table 19). Of the excluded determinants, low price elasticity has the highest (negative) partial correlation with the unexplained variance of the fourth stepwise regression. However, the partial correlation is not significant at the .05 level; this determinant is, therefore, not included.

Unique variance per determinant

In Table 19, the unique explained variance of each significant determinant and the shared variance is presented.

Table 19 Results commonality analysis determinants of innovative ability

R^2	Value
1) Willingness to take risks	.26
2) High uncertainty of demand	.08
3) High intensity of non-price competition	.02
4) Result orientation	.02
Shared 1 and 2	.10
Shared 1 and 3	.04
Shared 1 and 4	.14
Shared 2 and 3	.02
Shared 2 and 4	-.01
Shared 3 and 4	.00
Shared 1, 2 and 3	.05
Shared 1, 2 and 4	-.00
Shared 1, 3 and 4	.02
Shared 2, 3 and 4	-.00
Shared 1, 2, 3 and 4	.01
Total variance	.74*

* Owing to differences in the number of observations used in both analyses, the R^2 of the stepwise regression is somewhat higher than the R^2 of the commonality analysis.

Source: EIM.

As could be expected based on the relative value of beta, the determinant willingness to take risks has the highest unique contribution to the total explained variance. Also the shared variance of the willingness to take risks with other determinants is considerable.

The unique contribution of the determinants high intensity of non-price competition and result orientation is relatively low. Result orientation has a high shared explained variance with willingness to take risks.

Robustness of our findings

In the preceding analysis, we assumed that the model of de Jong and Brouwer (1999) is valid. To examine the robustness of our findings, we shall perform a stepwise regression with all 38 determinants together. If we find the same determinants to be most important for innovative ability, it is straightforward that the model does not affect our findings.

The results of the stepwise regression are presented in Table 20. It appears that five determinants prove to be significant at the 5% level. Just like in Table 18, the willingness to take risks (1A), high uncertainty of demand (8F), high intensity of non-price competition (8B) and result orientation (3D) are included in the regression equation in the same order. Besides, the amount of education and training (5C) contributes negatively when one takes into account the other four significant determinants. Since the results almost com-

pletely overlap, we conclude that the model of de Jong and Brouwer (1999) does not have a negative influence on our findings.

Table 20 Results stepwise regression with all 38 determinants

Hyp.	Variable	Beta	Sign.	Partial corr.	R^2
	Included (step)				
1A	Willingness to take risks (1)	.58	.00	.78	.79
8F	High uncertainty of demand (2)	.29	.00	.49	
8B	High intensity of non-price competition (3)	.21	.00	.39	
3D	Result orientation (4)	.18	.01	.26	
5C	Education and training (5)	-.15	.02	-.30	
	Excluded				
1B	Entrepreneur's commitment			-.01	
1C	Presence of internal capabilities			-.19	
2A	Innovation in the mission statement			.01	
2B	Innovation objectives in the strategy			-.05	
3A	Loose control			.03	
3B	People orientation			-.12	
3C	Openness			.06	
3E	Professionalism			.14	
3F	Spread of information			.04	
4A	De-standardization			-.11	
4B	Vertical integration			.04	
4C	Multifunctional teams			.15	
4D	Task assignment and expansion			.16	
4E	Job rotation			.23	
4F	Autonomy			.03	
4G	Reward structure			-.14	
5A	Freedom to experiment			-.02	
5B	Financial resources			-.05	
5D	Use of creativity techniques			.09	
6A	External orientation			.11	
6B	Customer orientation			-.10	
6C	Co-operation with other enterprises			.16	
6D	Transfer of (technical) knowledge			-.03	
7A	Technological competence			-.11	
7B	Firm size			.09	
7C	High diversification scheme			-.08	
7D	Exporting activities			-.04	
7E	Location of the business in urban areas			.02	
7F	High complexity of product design			-.04	
8A	High degree of demand-pull			-.22	
8C	Short length of product life cycle			-.01	
8D	Low price elasticity			-.21	
8E	More heterogeneous demand			.03	

5 Conclusions, limitations and future research

5.1 Conclusions and discussion

Contribution of this study

In the underlying study, we examined the relative contribution of different antecedents of innovative ability. In de Jong and Brouwer (1999), these determinants are discussed in a conceptual way. These determinants were selected based on a broad review of the literature of two different research orientations, i.e. the general-economic tradition and the organizational tradition. The effect of these determinants on innovative ability is often studied in isolation. In the underlying study, we integrated these two research traditions and empirically tested the determinants.

The contribution of the underlying study is twofold. We focus on the service sector. Most traditional innovation studies concentrate on manufacturing businesses. Our findings are relevant for service businesses with 10 to 100 employees delivering business-to-business, financial or personal services. We identify the most important determinants for innovative ability, and are able to provide an indication about the extent as to which an entrepreneur in the service sector himself may actually influence innovative ability.

Conclusions and management implications

We tested the effect of 38 determinants on the innovative ability of service businesses. These determinants were divided over eight categories. The results show that most categories are suitable to explain part of the innovative ability of service businesses (Table 21).

Table 21 Conclusion about our hypotheses

Category	Hypothesis	Determinant	Conclusion
People	1A	Willingness to take risks	Supported
	1B	Entrepreneur's commitment	Not supported
	1C	Presence of internal capabilities	Not supported
Strategy	2A	Innovation in the mission statement	Supported
	2B	Innovation objectives in the strategy	Supported
Culture	3A	Loose control	Not supported
	3B	People orientation	Not supported
	3C	Openness	Not supported
	3D	Result orientation	Supported
	3E	Professionalism	Supported
	3F	Spread of information	Not supported
Structure	4A	De-standardization	Not supported
	4B	Vertical integration	Not supported
	4C	Multifunctional teams	Supported
	4D	Task assignment and expansion	Not supported
	4E	Job rotation	Not supported
	4F	Autonomy	Supported
	4G	Reward structure	Not supported
Availability of means	5A	Freedom to experiment	Not supported
	5B	Financial resources	Not supported
	5C	Education and training	Not supported
	5D	Use of creativity techniques	Supported
Network activities	6A	External orientation	Supported
	6B	Customer orientation	Not supported
	6C	Co-operation with other enterprises	Not supported
	6D	Transfer of (technical) knowledge	Supported
Enterprise	7A	Technological competence	Not supported
	7B	Firm size	Not supported
	7C	High diversification scheme	Not supported
	7D	Exporting activities	Not supported
	7E	Location of the business in urban areas	Not supported
	7F	High complexity of product design	Not supported
Market	8A	High degree of demand-pull	Not supported
	8B	High intensity of non-price competition	Supported
	8C	Short length of product life cycle	Not supported
	8D	Low price elasticity	Supported
	8E	More heterogeneous demand	Not supported
	8F	High uncertainty of demand	Supported

Our analyses showed that 13 determinants are of particular importance. Below, we discuss this in detail for every category along with the management implications. One should take into account that we define an enterprise's in-

novative ability as the employees' abilities to generate ideas and to work with these ideas to develop new or improved products, services, technologies, work processes or markets.

People characteristics

The *willingness of a service business's employees to take risks* are very closely related to innovative ability. Employees who are willing to take risks accept ambiguities and uncertainties in their work. This enhances their ability to generate ideas and to work with these ideas.

Service businesses that strive to improve their innovative ability should pay considerable attention to their recruitment efforts, particularly the willingness of potential employees to take risks. This comes to the foreground in behavioural characteristics such as flexibility, adaptability, willingness to co-operate, creativity, etc.

Strategy

A mission statement provides direction for the activities that an enterprise will develop in the future. It appears that service businesses that have the notion of *innovation in their mission statement* and that communicate this in a forceful way to their employees, have more innovative ability. Besides, it appears that the *innovation objectives* play a significant role as well, especially when innovation is made the responsibility of the entire organization by translating it into objectives for each employee.

The management implications are straightforward: the entrepreneur should incorporate the notion of innovation in his mission statement, communicate this in a forceful way to his employees, and translate the enterprise's innovation objectives to individual objectives for each employee. This prevents that innovation will be considered as an ad hoc process.

Culture

It appears that the *result orientation* of an organizational culture partially explains the innovative ability of a service business. A results-orientated culture emphasizes the results of the work process. How these results are realized is of less importance. The amount of *professionalism* appears to be relevant as well. In a professional culture, employees are more aimed at their job and will be more open to information from outside the enterprise. Both determinants are incentives to creativity.

Service businesses that attempt to improve their innovative ability might improve the result orientation and professionalism by giving their employees a greater freedom of action: to do their work the way they want to. There should be few rules and procedures for carrying out the work. People should be held responsible for their results only.

Structure

Organizing the work in *multifunctional teams* is very important for service businesses attempting to improve innovative ability. Besides, we conclude that service businesses with *autonomous employees* will have more innovative ability.

To improve innovative ability, small service businesses should organize the work in multifunctional teams. The interdisciplinary backgrounds of team members causes that people may look at problems from different angles. To enhance the autonomy of employees, they should be given greater freedom of action and be held responsible for the results of their work only. This was already discussed above (see result orientation).

Availability of means

We conclude that enterprises using brainstorm techniques will have more innovative ability. *Creativity techniques* contribute directly with the capacity of employees to generate solutions and ideas by enlarging the capacity to abandon programmed ways of thinking. To improve innovative ability, a service business could start using these techniques.

Network activities

Service businesses attempting to improve innovative ability by means of network activities should focus on their *external orientation* (contacts with suppliers, competitors, etc.), and *transfer (technical) knowledge* in exchange of money.

When employees maintain frequent, intensive contacts with the environment, this provides additional information that stimulates idea generation. Developing and implementing external orientation in each job constitutes a major step in creating and maintaining an innovative organization. The enterprise should also be open for knowledge that is developed outside the enterprise. By acquiring (technical) knowledge from external parties in exchange for money, a cross-fertilization of ideas is realized.

Firm characteristics

It is striking that we cannot explain any variance in the innovative ability of service businesses by looking at the firm characteristics. There are no significant effects of technological competence, firm size, high diversification schemes, etc. This might be caused by our definition of the dependent variable in our analysis, which is an input variable of innovation (the ability of employees to generate and work with ideas). In most studies on firm characteristics, the innovative *results* are used as dependent variable instead of the innovative ability. See, for instance, Brouwer (1997).

Market characteristics

Service businesses that operate in markets with a *high intensity of non-price competition* will have more innovative ability. We conclude that in a situation of non-price competition, enterprises use to differentiate their products from their competitors as much as possible by quality and service and will pay more attention to their innovative ability.

Service businesses that operate in markets where *demand is highly uncertain* seem to have more innovative ability as well. In this situation, an enterprise will initiate more activities to discover the characteristics of demand and to satisfy the needs of customers. By these activities, new ideas may emerge.

A striking result is that we found a negative correlation between *low price elasticity* and innovative ability. To put it in other words, high price elasticity seems to contribute to more innovative ability. This might be caused by a strong focus on product differentiation: to be able to have more freedom in its pricing policy, an enterprise may attempt to offer differentiated services. In this situation, high price elasticity indeed contributes to more innovative ability. In a market with low price elasticity, an enterprise grows (in terms of turnover) by raising its price. This will result in a minor decrease of the volume sold. The total turnover may increase. In a market with high price elasticity, the effect of a price increase has larger impact on the volume sold. In such a market, it may prove more profitable to grow by means of new innovations. Apparently, in a market characterized by low price elasticity, there is much less inter-firm competition in order to be first in the market with a new innovation.

This finding is in contradiction with Le Bas and Cabagnols (1999). The result may, once again, be caused by differences in the definitions of innovative ability. Le Bas and Cabagnols (1999) focus on successful product innovations.

Most important determinants

In chapter 1, we stated that the objective of our empirical test was twofold: to make a statement about which determinants must be handled first when trying to improve the innovative ability of a small service business, and to give an indication about the extent as to which an entrepreneur himself may actually influence innovative ability (because the model consists of categories that are manageable and exogenous categories that cannot be managed by an entrepreneur).

The following determinants seem to be most important and should be handled first: willingness to take risks, result orientation, high intensity of non-price competition and high uncertainty of demand. With these four determinants, we are able to explain 77% of the variance in innovative ability of service businesses.

Besides, it appears that the willingness to take risks is by far the most important determinant of innovative ability. It seems that an entrepreneur himself may to a large extent influence the innovative ability of a service business. However, we should not forget that market characteristics do play a significant role as well. In markets with a high intensity of non-price competition and an uncertain demand, it will be easier for an entrepreneur to realize his innovation objectives.

For Dutch policy makers, our findings are relevant as well, for instance to the Syntens organization. Syntens is supported by the Netherlands Ministry of Economic Affairs to advise SMEs about product innovations, work processes, enterprise renewal (business reengineering) and new markets. When initiating activities to improve the numbers of innovations by Dutch enterprises, one could think of activities to inform entrepreneurs about the 13 determinants that are of particular importance. Besides, the market characteristics that are significant (high intensity of non-price competition, demand is highly uncertain) may be used to trace the sectors in which innovation is less easy to achieve (and where policy could be targeted).

Finally, we conclude that both the general-economic tradition and the organizational tradition make a valuable contribution in the explanation of the innovative ability of service businesses (with 10 to 100 employees).

5.2 Limitations and future research

In this section, we shall discuss the limitations of our study. We shall also formulate some suggestions for further research:

- The response rate of the questionnaire was relatively low. This was probably due to the high burden we asked from the enterprises. Besides the entrepreneur or manager, also 10 or more employees had to complete the questionnaire. It is unclear what the effect is of the low response rate. In future research, the questionnaire may be shortened based on this study. This might lower the burden and thereby produce a better response rate.
- We restricted the study to service businesses. This implies that the results cannot be generalized to other sectors such as manufacturing. It may be expected that in other sectors, other determinants might prove more important than the present determinants. Further research is encouraged to test this tool in other sectors as well. Also a test in another national setting may further develop our understanding of corporate innovative ability.
- When testing our hypotheses, we assumed that the model of de Jong and Brouwer (1999) is true. Although we examined the robustness of our findings by performing a stepwise regression with all 38 determinants, future research should focus on the question whether the (theory-based) model of de Jong and Brouwer (1999) holds.

- In our sample, we only incorporated enterprises of at least 10 employees. If we want to know more about the innovative ability of the smallest enterprises, these should be incorporated in the sample. This is especially relevant for the Netherlands because more than 90% of the enterprises employ less than 10 staff. It may be expected that the importance of the different determinants chances. Characteristics of the entrepreneur might become more important than structure, for instance.
- Not all the determinants of the study of de Jong and Brouwer (1999) were used in this study. Some determinants were not relevant for the service industry setting. Also the category of innovation infrastructure was not used. Comparative research between sectors may provide information as to whether this category has explanatory power for explaining innovative ability.
- We did not examine the process by which creative ideas are evaluated and how projects/ideas are selected for further development. Most enterprises only have limited resources for further development of ideas. In other words, ideas have to compete for attention and resources. The question is whether or not the most promising ideas survive. This selection process is a next step in the innovation process, which needs more attention and further research.
- Related with the previous point, we did not focus on the innovative results of service businesses. Further research is encouraged to examine the correlation between the antecedents of innovative ability and the innovative results like profit, growth, etc.

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Appendix 1: Sampling frame

We collected our data from services businesses in the SME Policy Panel. In this panel, enterprises delivering business-to-business, financial and personal services are represented. In Table 22, the sampling frame is shown. It states the sector codes from the Business Classification as used by the Netherlands Chambers of Commerce.

Table 22 Sample frame

Sector	Code
Financial services	651 652 660 671 672
Business-to-business services	701 703 711 712 713 714 721 722 723 724 725 726 741 742 743 744 745 746 747 748
Personal services	921 922 924 927 930

Source: Kamer van Koophandel en Fabrieken (1997).

As discussed, we approached only enterprises with 10 to 100 employees for our study. Eventually, we invited 477 enterprises to join our research. We refer to the following publication for additional details about the sectors stated above: Kamer van Koophandel en Fabrieken (1997), *Bedrijfsindeling Kamers van Koophandel en Fabrieken 1995*, Vereniging van Kamers van Koophandel: Woerden.

Appendix 2: Correlation matrix

In Table 23, we show the matrix of bivariate correlations. The abbreviations in the first column and row correspond with the measurement scales in Table 3 (IV stands for innovative ability).

Table 23 Correlation matrix

	1A	1B	1C	2A	2B	3A	3B	3C	3D	3E
1A	1.00									
1B	0.47	1.00								
1C	-0.16	0.14	1.00							
2A	0.55	0.45	-0.11	1.00						
2B	0.50	0.72	0.15	0.28	1.00					
3A	0.08	-0.43	-0.16	-0.17	-0.41	1.00				
3B	0.17	0.55	0.24	0.35	0.46	-0.68	1.00			
3C	0.23	0.65	0.03	0.34	0.41	-0.51	0.62	1.00		
3D	0.49	0.55	0.05	0.27	0.67	-0.28	0.39	0.28	1.00	
3E	0.44	0.39	0.10	0.67	0.42	-0.32	0.46	0.33	0.28	1.00
3F	0.19	0.56	0.21	0.27	0.67	-0.68	0.65	0.40	0.42	0.48
4A	-0.13	-0.18	0.01	-0.16	-0.23	0.13	-0.23	-0.35	-0.19	-0.29
4B	0.03	0.34	0.14	0.24	0.40	-0.61	0.55	0.40	0.20	0.29
4C	0.43	0.24	0.02	0.44	0.17	0.03	0.27	0.27	0.08	0.40
4D	-0.12	0.20	0.04	0.08	0.01	-0.41	0.29	0.34	-0.04	0.15
4E	0.36	0.18	-0.17	0.35	0.27	-0.16	0.26	0.29	0.17	0.55
4F	0.39	0.46	0.10	0.23	0.40	-0.16	0.20	0.28	0.45	0.22
4G	0.46	0.35	-0.04	0.41	0.44	-0.14	0.22	0.18	0.24	0.55
5A	0.56	0.41	0.24	0.32	0.48	-0.19	0.48	0.14	0.45	0.51
5B	0.52	0.50	0.05	0.53	0.52	-0.17	0.44	0.45	0.35	0.46
5C	0.03	0.35	0.12	0.29	0.27	-0.27	0.48	0.32	0.11	0.40
5D	0.51	0.41	0.17	0.46	0.52	-0.27	0.41	0.27	0.41	0.58
6A	0.44	0.32	0.02	0.20	0.38	0.06	0.03	0.07	0.53	0.20
6B	0.41	0.31	0.15	0.14	0.21	0.00	0.09	0.16	0.44	0.07
6C	0.14	-0.04	-0.45	0.16	-0.09	0.22	-0.24	-0.03	0.09	-0.16
6D	0.28	0.16	-0.06	0.29	0.07	0.11	0.06	0.08	-0.01	0.12
7A	0.04	0.20	0.26	0.28	0.23	-0.26	0.41	0.28	0.01	0.37
7B	0.04	-0.10	-0.27	0.05	-0.19	0.22	-0.23	0.04	-0.18	-0.02
7C	0.26	0.15	-0.09	0.36	0.02	0.05	0.13	0.19	0.10	0.20
7D	0.20	0.09	-0.20	0.13	0.15	0.03	0.05	0.13	0.01	0.13
7E	0.19	0.03	0.05	-0.08	-0.06	0.28	-0.13	-0.09	0.07	-0.14
7F	-0.18	0.02	0.22	-0.28	-0.06	-0.03	-0.12	-0.11	0.02	-0.14
8A	0.05	0.20	0.19	0.01	0.13	0.06	0.08	0.08	-0.03	-0.03
8B	0.26	0.03	0.12	0.12	0.13	0.04	0.10	-0.14	0.10	0.14
8C	0.06	0.05	0.11	0.28	-0.07	0.17	-0.09	0.13	-0.09	0.07
8D	-0.22	-0.17	0.24	-0.05	-0.14	-0.06	-0.05	-0.09	-0.13	-0.09
8E	0.11	0.06	0.31	0.08	0.10	-0.24	0.23	0.07	0.14	0.16
8F	0.26	0.09	0.03	0.18	0.13	-0.10	0.06	0.19	-0.01	0.17
IA	0.79	0.38	-0.17	0.46	0.42	-0.02	0.16	0.24	0.40	0.42

Table 23 Correlation matrix (continued)

	3F	4A	4B	4C	4D	4E	4F	4G	5A	5B
3F	1.00									
4A	-0.21	1.00								
4B	0.51	0.04	1.00							
4C	0.14	-0.25	0.02	1.00						
4D	0.14	0.05	0.24	-0.23	1.00					
4E	0.24	-0.40	0.15	0.24	0.03	1.00				
4F	0.33	0.00	0.25	-0.12	0.23	0.12	1.00			
4G	0.39	-0.24	0.15	0.26	-0.24	0.47	0.14	1.00		
5A	0.45	-0.05	0.13	0.21	0.06	0.18	0.33	0.37	1.00	
5B	0.38	-0.14	0.36	0.30	0.04	0.32	0.37	0.53	0.57	1.00
5C	0.48	-0.22	0.24	0.14	0.07	0.28	0.19	0.31	0.32	0.39
5D	0.44	-0.25	0.25	0.35	-0.15	0.37	0.12	0.41	0.58	0.45
6A	0.22	-0.28	0.03	0.32	-0.48	0.08	0.20	0.39	0.37	0.31
6B	0.09	-0.04	0.07	0.22	-0.35	-0.13	0.15	0.22	0.30	0.19
6C	-0.30	-0.01	-0.20	0.15	-0.31	-0.04	-0.04	-0.06	-0.23	-0.12
6D	-0.16	-0.01	0.17	0.36	-0.14	0.05	-0.05	0.16	0.00	0.17
7A	0.25	-0.20	0.36	0.03	0.15	0.23	0.06	0.24	0.23	0.32
7B	-0.28	-0.37	-0.41	0.00	0.00	0.07	-0.04	-0.03	-0.19	-0.23
7C	0.04	-0.09	-0.01	0.38	-0.03	0.30	0.14	0.15	0.16	0.34
7D	-0.06	-0.11	0.14	0.26	0.08	0.07	0.00	0.12	0.05	0.20
7E	-0.29	0.36	0.03	-0.07	-0.18	-0.17	0.10	0.04	0.12	0.07
7F	0.03	0.27	-0.06	-0.20	0.01	-0.32	-0.05	-0.20	-0.05	-0.29
8A	0.00	0.07	0.02	0.06	-0.02	-0.35	0.08	0.02	0.12	0.02
8B	-0.06	0.38	0.20	0.20	-0.03	-0.14	0.00	-0.04	0.35	0.13
8C	-0.18	-0.23	-0.05	0.46	-0.28	0.02	-0.23	0.10	-0.20	0.11
8D	-0.05	0.10	0.06	0.10	-0.12	-0.34	-0.11	-0.09	-0.12	-0.17
8E	0.18	-0.13	0.24	0.32	0.06	0.07	0.05	-0.02	0.15	0.16
8F	0.02	-0.16	0.22	0.33	0.01	0.20	0.08	-0.01	0.12	0.22
IA	0.18	-0.08	0.11	0.53	0.04	0.31	0.24	0.21	0.41	0.34

Table 23 Correlation matrix (continued)

	5C	5D	6A	6B	6C	6D	7A	7B	7C	7D
5C	1.00									
5D	0.24	1.00								
6A	0.01	0.34	1.00							
6B	-0.15	0.24	0.77	1.00						
6C	-0.22	-0.13	0.21	0.20	1.00					
6D	-0.02	0.24	0.09	0.08	0.34	1.00				
7A	0.23	0.32	-0.06	-0.12	-0.37	0.11	1.00			
7B	-0.06	-0.02	-0.13	-0.26	0.17	0.06	-0.02	1.00		
7C	0.31	0.18	0.20	0.05	0.13	0.16	0.07	0.02	1.00	
7D	0.00	0.07	0.08	-0.05	0.13	0.31	0.12	0.11	0.17	1.00
7E	-0.10	0.02	0.12	0.26	0.20	0.17	-0.14	0.05	-0.09	-0.10
7F	-0.14	-0.05	0.01	0.10	-0.19	-0.12	-0.13	-0.01	-0.15	-0.07
8A	-0.01	-0.08	0.04	0.18	-0.02	0.02	0.08	-0.09	0.00	0.19
8B	-0.11	0.42	-0.08	0.06	-0.04	0.43	0.12	-0.07	0.04	0.20
8C	0.00	0.11	0.30	0.30	0.31	0.42	0.04	-0.01	0.22	0.04
8D	-0.08	0.03	-0.05	0.05	-0.21	0.14	0.05	0.00	-0.03	-0.03
8E	0.04	0.27	0.17	0.13	-0.23	0.08	0.19	-0.09	0.24	-0.08
8F	-0.01	0.17	0.23	0.19	0.19	0.33	0.16	-0.05	0.30	0.17
IA	-0.06	0.46	0.35	0.30	0.22	0.32	-0.01	0.04	0.15	0.21

Table 23 Correlation matrix (continued)

	7E	7F	8A	8B	8C	8D	8E	8F	IA
7E	1.00								
7F	0.00	1.00							
8A	0.03	0.11	1.00						
8B	0.20	0.30	0.26	1.00					
8C	0.08	-0.13	-0.06	-0.05	1.00				
8D	-0.01	-0.05	0.06	0.28	0.17	1.00			
8E	0.00	0.14	-0.16	0.28	0.19	0.29	1.00		
8F	-0.05	-0.20	-0.05	0.22	0.39	0.19	0.35	1.00	
IA	0.15	-0.15	-0.08	0.40	0.11	-0.11	0.24	0.49	1.00

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9409/E Entry and exit in Dutch manufacturing industries; Aad Kleijweg and Marcel Lever

9410/I Labour productivity in Europe: differences in firm-size, countries and industries; Garmt Dijksterhuis

9411/N Verslag van de derde mondiale workshop Small Business Economics; Tinbergen Instituut, Rotterdam, 26-27 augustus 1994; M.A. Carree en M.H.C. Lever

9412/E Internal and external forces in sectoral wage formation: evidence from the Netherlands; Johan J. Graafland and Marcel H.C. Lever

9413/A Selectie van leveranciers: een kwestie van produkt, profijt en partnerschap?; F. Pleijster

9414/I Grafische weergave van tabellen; Garmt Dijksterhuis

9501/N Over de toepassing van de financieringstheorie in het midden- en kleinbedrijf; Erik M. Vermeulen

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