HAIBO ZHOU

Knowledge, Entrepreneurship and Performance

Evidence from Country-level and Firm-level Studies
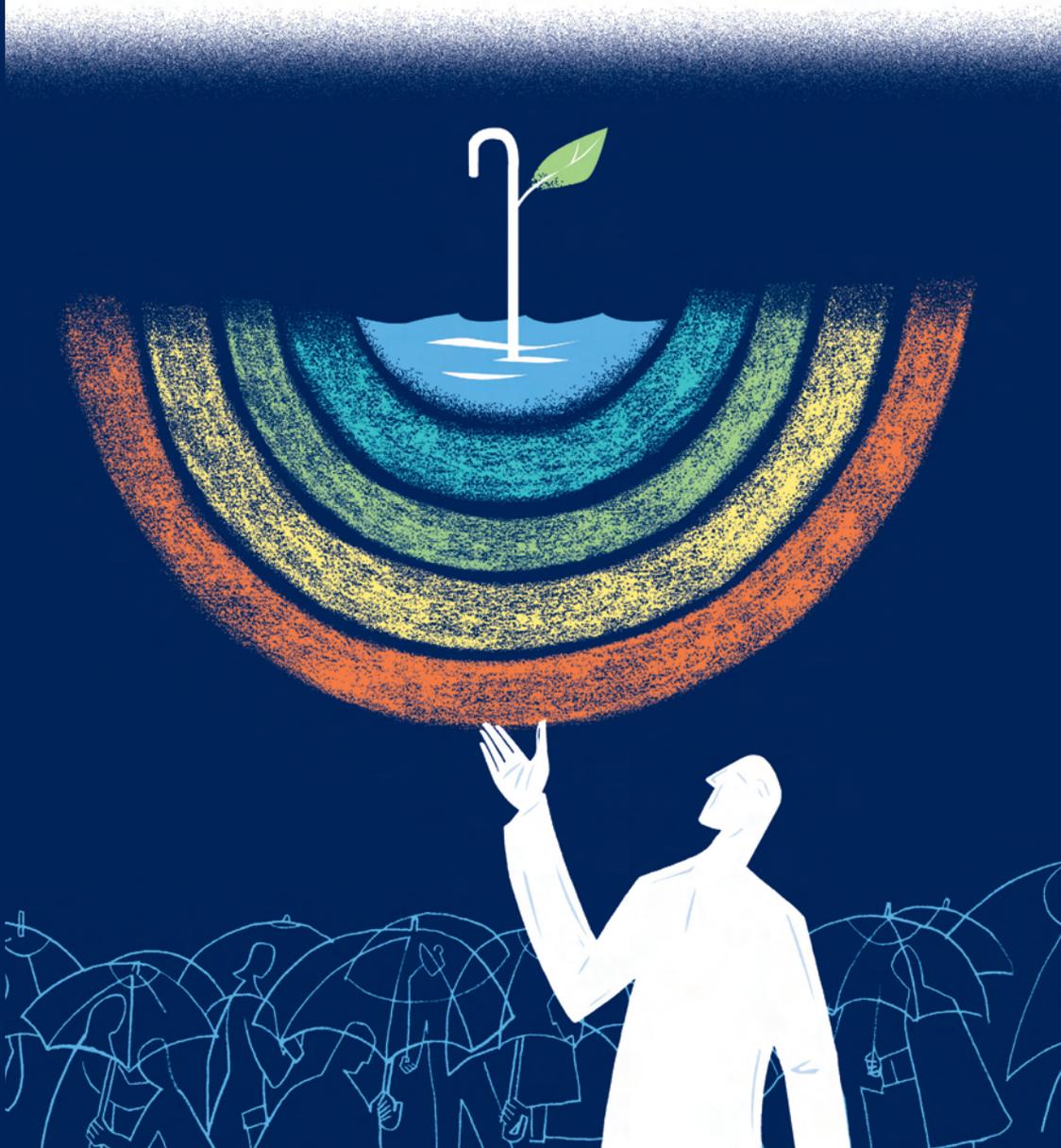
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Kennis, ondernemerschap en prestatie
Bewijs op land- en bedrijfsniveau

Proefschrift

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aan de Erasmus Universiteit Rotterdam
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For my beloved parents, Zhou Derong & Zhang Mingfang

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Part I: Table of Content

Part II: List of Tables

Part III: List of Figures

Part IV: Appendices

CHAPTER I

Knolwedge, entrepreneurship and performance: introduction, conclusions and implications

1.1. Introduction

Increased globalization driven by technological changes, in particular by the advent of ICT and the telecommunication revolutions, has altered the economic meaning of national borders and distances (Audretsch, 2007a). Western countries are shifting their comparative advantage from large-scale mass production to knowledge-based economic activities (Audretsch and Thurik, 2004). Knowledge, which is characterized as intrinsically uncertain, asymmetric and subjective, makes knowledge-based economic activities difficult to imitate by competitors (Audretsch et al., 2006). Furthermore, knowledge creates entrepreneurial opportunities for small and young firms, which in turn fuels the transformation of the economy from a *managed economy* to an *entrepreneurial economy* (Audretsch and Thurik, 2001, 2004). Economists, scholars and policy-makers have realized that the traditional resources of a *managed economy*, that is, capital and labor, are not the only inputs to economic competence and growth; knowledge and entrepreneurship are recognized as new twin driving forces for economic growth in an *entrepreneurial economy* (Audretsch and Thurik, 2001, 2004). These twin forces and their consequences with regard to economic performance are the preliminary focus of this book.

1.1.1. Theoretical background

Knowledge and entrepreneurship, as production factors contributing to economic growth, have been receiving increasing attention in the theoretical and empirical literature (Cohen and Klepper, 1992; Glaeser et al., 1992; OECD, 1996; Feldman and Audretsch, 1999; Audretsch and Thurik, 2001; Audretsch and Keilbach, 2003). Both *endogenous growth theory* and the R&D approach point out that knowledge is a major driver of economic growth (Mansfield, 1965; Romer, 1986; Lucas, 1988; Coe and Helpman, 1995; Griliches, 1998, 2000; Jacobs et al., 2002). Endogenous growth theory (Romer, 1986, 1990; Lucas, 1988) postulates that

aggregated knowledge capital, including knowledge and human capital, responds to market opportunities. Investment in knowledge is not only about new knowledge creation through R&D efforts, but also about the knowledge that largely and continuously spills over to other agents in the economy. Here knowledge spillover is assumed to be exogenous, neither bounded geographically nor by cost (Lucas, 1988; Romer, 1986, 1990). However, counter to this assumption, empirical evidence suggests that knowledge and ideas do not spill over automatically. Rather, knowledge spillover is bounded by geography and involves transaction costs (Glaeser et al., 1992; Jaffe et al., 1993; Anselin et al., 1997; Cohen et al., 2000; Keller, 2001; Bottazzi and Peri, 2003). This important finding has given rise to the development of the *knowledge spillover theory* and the concept of the *knowledge filter*, which is the barrier between new knowledge creation and the commercialization of that knowledge (Acs et al., 2005; Audretsch, 2007a). According to this theory, the bigger the knowledge filter, the less knowledge would spill over for commercialization (Acs et al., 2005). Knowledge spillover theory seeks to explain the ways in which knowledge spillover occurs and how it works in practice. Empirical evidence shows that knowledge spills over through various conduits such as: scientific literature and patents (Jaffe et al., 1993; Deng, 2007), human capital mobility (Moen, 2005), and through the inter-firm networks (Audretsch and Feldman, 1996; Powell et al., 1996). However, these theories explain less about *how* knowledge manifests itself into actual growth.

Independently of the investigation on the role of knowledge, a different strand of literature has developed that emphasizes the role of entrepreneurship in economic growth. *Entrepreneurship* refers to the creation of new economic activity including new venture creation and new economic activity of established firms (Gartner, 1988; Audrestch and Keilbach, 2003; Davidsson et al., 2006). Knowledge spillover theory recognizes new ventures as a driving force that can penetrate knowledge filters (Kirzner, 1997). This theory introduces entrepreneurship as an independent production factor like human, physical and knowledge capital into the production function (Audretsch and Keilbach, 2004). Various studies indicate that entrepreneurship is an important contributor to economic growth, for example due to its effect on innovation (Schumpeter, 1934; Ortega-Argilés, Vivarelli and Voigt, 2009), and on job creation (Glaeser et al., 1992; Carree and Klomp, 1996; Feldman and Audretsch, 1999). In a geographical context, entrepreneurship increases competition and enhances diversity that in turn generates growth of local economy (Jacobs, 1969; Cohen and Klepper, 1992; Glaeser et al., 1992; Audretsch, 1995; Audretsch and Feldman, 1996). Nonetheless, explanations for *why*

2

entrepreneurship leads to economic growth still remain relatively vague (Carree and Thurik, 2003; Van Praag and Versloot, 2007; Braunerhjelm, 2008).

1.1.2. The interrelations between knowledge and entrepreneurship

To understand how and why knowledge and entrepreneurship lead to actual growth, it is necessary to explain the interrelations between them. It has been observed that neither knowledge nor entrepreneurship alone is sufficient to drive economic growth. Investments in new knowledge are only a necessary condition: new knowledge needs to be exploited and put into commercial use such that it can lead to a higher level of competitiveness and economic growth (Acs et al., 2005; Mueller, 2006; Audretsch, 2007a). Empirical evidence demonstrates that entrepreneurial activities not only stimulate the knowledge transfer between different economic agents, clusters or industries (Jaffe et al., 1993; Bottazzi and Peri, 2003; Link and Scott, 2005; Mueller, 2006), but also catalyze the transformation of new knowledge into economic knowledge that constitutes a commercial opportunity (Kirzner, 1997; Parker, 2004). The acknowledgement of the importance of entrepreneurship has led to theoretical developments and empirical investigations into the interrelations between knowledge and entrepreneurship as well as their effects on economic performance at different levels of analysis.

At the country level, the *knowledge spillover theory of entrepreneurship* is developed to constitute a link between knowledge and entrepreneurship, starting from the viewpoint that the interrelations between them have an important effect on economic growth (Audretsch and Lehmann, 2005; Audretsch and Keilbach, 2007, 2008; Acs et al., 2009). This theory assumes that knowledge spillovers serve as a source of entrepreneurial opportunities on the one hand (Azoulay and Shane, 2001; Archibald, et al, 2002; Audretsch and Keilbach, 2003). On the other hand, it assumes that commercializing the opportunities created by knowledge spillovers via entrepreneurial activities results in a higher economic growth (Lucas, 1988; Romer, 1990; Glaeser et al., 1992), and this relationship is moderated by geographical proximity (Jaffe et al., 1993; Bottazzi and Peri, 2003). Consistent with this theory, empirical studies suggest that investments in new knowledge lead to higher startup rates (Audrestch, 1995; Caves, 1998). Furthermore, opportunities for entrepreneurship become superior when the ability to access knowledge spillovers from geographically proximate sources such as universities, large high-tech firms or other research-intensive institutions is greater (Audretsch et al., 2005; Mueller, 2006)

At the firm level, the interrelations between knowledge and entrepreneurship are grounded in the context of small and medium-sized enterprises (SMEs). SMEs, as a dimension of entrepreneurship, are found to make important contributions to innovation (Thompson and Leyden, 1983; Acs and Audretsch, 1993) and employment growth (OECD, 2002; De Kok et al., 2006b). The success of SMEs may have a significant impact on the economic growth of a nation. Hence, it is essential to understand how SMEs foster innovation and growth within their organization context, and in particular, the role of knowledge in this process. Knowledge, which is embedded in individuals and organizations, has been considered as an important asset of firms in the dominant management and organization theories such as the resource-based view, the knowledge-based view and the dynamic capabilities perspective (Barney, 1991; Teece and Pisano, 1994; Teece et al., 1997). Knowledge is a key ingredient of a firm's innovative capacity. Appropriate management of knowledge (including the management of human resources) can help improve a firm's overall capability to innovate (Guest, 1997; Trott, 1998; Andriessen, 2005). The management of knowledge has been proven to be a key source of competitive advantage for the success of firms (Winter, 1987; Prahalad and Hamel, 1990; Hedlund and Nonaka, 1993; Nonaka and Takeuchi, 1995; Grant, 1996; Prusak, 1996; Spender and Grant, 1996; Davenport and Prusak, 1998). Due to the limited resources compared to their larger counterparts, SMEs are found to be more likely to depend on the quality of the knowledge assets (including human resources) that are applied in their business processes. Knowledge and human resources thus play a more crucial role in determining the competitiveness and success of SMEs (Dollinger, 1984, 1985; Brush, 1992; Brush and Vanderwerf, 1992).

1.1.3. Motivation and approach

Although the interrelations between knowledge and entrepreneurship have been gaining increasing attention from scholars, empirical evidence on specific externalities at different levels of analysis is still lacking. For instance, the knowledge spillover theory of entrepreneurship only assumes that the links between knowledge and entrepreneurship have an impact on economic growth, the question of *how* exactly entrepreneurship turns knowledge into economic growth is left unanswered (Chapter 2). At the firm level, although research and policy interest for SMEs is manifest, most of the dominant management and organization theories regarding the role of knowledge assets (including organization knowledge and human resources) are still centered on large organizations. Most of the empirical literature in the context of SMEs relies on either qualitative case studies or very small samples (Wong and Radcliffe, 2000; Sparrow, 2001; Uhlaner and van Santen, 2005; Desouza and Awazu, 2006)

(Chapters 3 through 5). Even though certain aspects of SMEs, i.e. determinants of growth, have been studied in various disciplines, knowledge of firm growth is still limited (Davidsson and Wiklund, 2000; Wiklund et al., 2007) and the existing literature is highly fragmented (Chapter 6). This is unsatisfactory because to design an effective growth policy, policy-makers need to understand the exact mechanisms through which knowledge and entrepreneurship leads to economic growth. In a similar vein, in order to be successful, owner-managers of SMEs need to understand how to make use of specific resources to sustain their competitive advantage.

The present book consists of five separate studies that attempt to make empirical contributions to 'fill' the aforementioned research gaps. The objective of this book is to provide more insights into the processes of *how* entrepreneurship interrelates to knowledge and *why* they lead to economic growth. To serve this objective, both country-level and firm-level analyses are used. In order to bridge the links between knowledge and entrepreneurship, and economic growth, *innovation and firm growth* are introduced as the two indicators of performance (i.e., outcome variables). Both indicators are correlated with the concepts of knowledge and entrepreneurship. Knowledge is considered a key ingredient for technological change and innovation (Schumpeter, 1934, 1942). The growth of SMEs is regarded as an important job generator (Carree and Klomp, 1996). Both innovation and job creation in turn are linked to economic growth.

Each chapter of this book builds on one of five separate studies and can be read independently. The common denominators throughout these chapters are knowledge and entrepreneurship. The remainder of this chapter is organized as follows. Section 1.2 elaborates the research framework and research questions. Section 1.3 discusses the definition and measurement issues of the key concepts: knowledge, entrepreneurship and performance. Section 1.4 gives an overview of each chapter and its main results. Section 1.5 draws conclusions and implications. Section 1.6 lists the status of the chapters.

1.2. Research framework and Research questions

This section presents an integrated framework that links the different chapters in this book (See Figure 1.1). Research questions that are addressed by each of the chapters are discussed below.

A country-level framework of this book is built upon the knowledge spillover theory of entrepreneurship which suggests that entrepreneurship increases the level of economic output

by serving as a mechanism that facilitates the commercialization of knowledge. In Chapter 2, a direct link between entrepreneurship and innovation is made. Entrepreneurship is hypothesized to moderate the relationship between knowledge and innovation performance which in turn leads to economic growth. The chapter aims to contribute empirical evidence to the following research question:

RQ1: How does entrepreneurship facilitate the process of turning knowledge into innovative products? (Chapter2)

To understand the phenomenon addressed in the country-level framework, it is important to investigate how entrepreneurial firms transform their knowledge to yield innovation at firm-level analysis. Therefore, Chapters 3 through 5 investigate how SMEs foster innovation within their firms through managing knowledge assets. Two aspects of knowledge assets, that is, knowledge processes and human resources are adopted by these chapters. By answering the following questions, Chapters 3 through 5 aim to contribute to the limited quantitative knowledge of the specifics of knowledge processes in SMEs and how these processes lead to innovation, as well as to the understanding of how flexible labor patterns stimulate innovation performance by their influence on human resources, which is still under-researched in the literature on the determinants of innovation.

RQ2: How do the organization contexts of SMEs explain the characteristics of knowledge processes in SMEs? (Chapter 3)

RQ3: How do SMEs foster innovation through managing their knowledge processes? (Chapter 4)

RQ4: How do SMEs stimulate their innovation performance through flexible labor contracts? (Chapter 5)

In addition, the growth of SMEs per se is an important driver of economic growth. Building upon the existing literature on the determinants of firm growth, an exhaustive analysis is provided in Chapter 6 to identify the most important determinants that matter to the growth of SMEs.

RQ5: What are the important determinants of SME growth? (Chapter 6)

All research questions aim to meet the objective of this book, that is, to offer a better understanding of the interrelations between knowledge and entrepreneurship, and their consequences with regard to economic growth.

Figure 1.1. Research framework of the book


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┌──────────────────────────────────────────────────────────────────────┐
│ Country-level analysis                                                  │
│                                                                         │
│  ┌──────────────┐         ┌──────────────┐        ┌──────────────┐     │
│  │  Knowledge   │────────▶│  Innovation  │- - - -▶│   Economic   │     │
│  └──────────────┘    ▲    └──────────────┘        │    growth    │     │
│                      │                            └──────────────┘     │
│                  RQ 1 │                                                  │
│              ┌──────────────┐                                           │
│              │Entrepreneurship│                                         │
│              └──────────────┘                                           │
└──────────────────────────────────────────────────────────────────────┘
        Aggregate
┌──────────────────────────────────────────────────────────────────────┐
│ Firm-level analysis (SMEs)                                              │
│                                                                         │
│ ┌───────────┐ RQ 2 ┌──────────────┐                                     │
│ │Organization│────▶│  Knowledge   │  RQ 3                               │
│ │ contexts   │     │ management   │─────┐                               │
│ └───────────┘     └──────────────┘     ▼                               │
│                                   ┌──────────────┐                      │
│                                   │  Innovation  │- - - -               │
│                   ┌──────────────┐┘              │       │              │
│                   │Flexible labor│──────┘└───────┘       │              │
│                   │  patterns    │  RQ 4                 │              │
│                   └──────────────┘                       │              │
│                                                                         │
│  ┌──────────────┐ RQ 5 ┌──────────────┐                                 │
│  │ Determinants │─────▶│ Firm growth  │- - - - - - - - -                │
│  └──────────────┘     └──────────────┘                                  │
└──────────────────────────────────────────────────────────────────────┘
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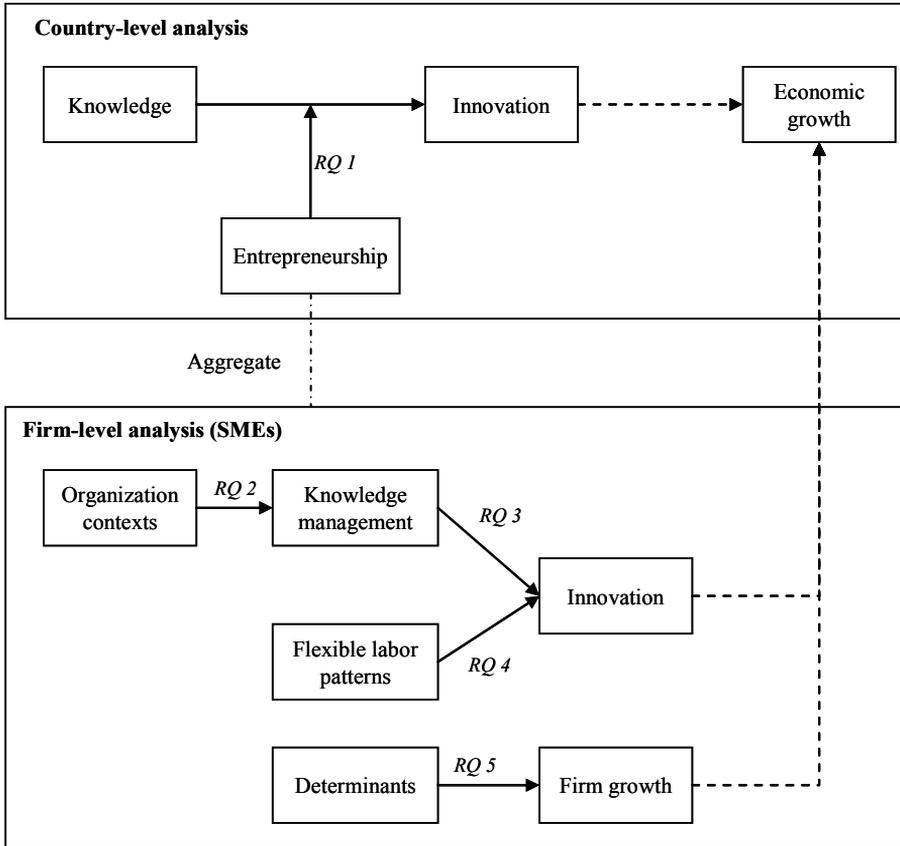
------: Assumptions not tested in the framework of the present book

1.3. Definition and Measurement Issues

As mentioned in the previous section, two basic units of analysis are considered for the studies in this book: the country-level (Chapter 2) and the firm-level (Chapters 3 through 6). Measurements of the key concept vary according to the unit of analysis and the context of each study.

1.3.1.   Knowledge

In order to operationalize knowledge for empirical studies, this book adopts the definition of knowledge from the economic literature. From a macroeconomic perspective, aggregate knowledge capital refers to scientific knowledge (including technology) and human capital (Lucas, 1988; Romer, 1986, 1990). The microeconomic perspective distinguishes knowledge from data and information. Knowledge is specifically about how to use information in its context through different perspectives associated with personal expertise (Bhatt, 2001). Knowledge is considered a firm's specific asset which causes a fundamental heterogeneity in their productive potential (Nelson and Winter, 1982; Grant and Baden-Fuller, 1995; Spender, 1996; Grant, 1996; Priem and Butler, 2001). It is thus embedded in individuals, and organization routines and practices (Nelson and Winter, 1982).

Knowledge can be explicit or it can be tacit (Polanyi, 1966; Nonaka, 1994). Explicit knowledge can be codified into data and information and be distributed through knowledge repositories such as the scientific literature, patents and databases. Explicit knowledge has the character of public goods that can be easily transferred (Nonaka, 1994). Tacit knowledge is embedded within individuals and/or collective experiences, skills and know-how (Lyles and Schwenk, 1992). Such knowledge is often poorly-documented, idiosyncratic and is difficult to formalize, communicate and articulate through a formal systematic solution (Polanyi, 1966; Nonaka and Takeuchi, 1995). The distinction between explicit and tacit knowledge is important as it determines the strategies, routines and policies used by a firm to organize its knowledge processes (Nonaka and Takeuchi, 1995; Inkpen and Dinur, 1998).

In country-level analyses, knowledge is commonly measured by aggregated information on R&D activities or patents. These proxies are commonly used as they are publicly available and comparable across countries and times. In a country-level study of this book (Chapter 2), patents are adopted as a proxy for aggregated knowledge stock. Analyzing knowledge at the firm-level is often concerned with *how* firms build and sustain competitive success through managing, exploiting, developing and reconfiguring their knowledge assets (including knowledge embedded in human resources within the firm) (Barney, 1991; Teece and Pisano, 1994; Teece et al., 1997). Therefore, proxies of knowledge at the firm-level include both tactical measurements such as overall quality of organization knowledge or individual knowledge (Chapters 5 and 6), and dynamic proxies such as organization routines, processes and capabilities. The dynamic proxies used in this book are: knowledge management practices

(Chapters 3 and 4), flexible labor relations (Chapter 5), training (Chapters 5 and 6) and organization learning (Chapter 6).

1.3.2. Entrepreneurship

As defined in the introduction section, entrepreneurship refers to the creation of new economic activity including the aspects of new venture creation activity and new economic activity of established firms (Gartner, 1988; Audretsch and Keilbach, 2003; Davidsson et al., 2006). As this book emphasizes the consequences of interrelations between knowledge and entrepreneurship with regard to economic performance, it adopts the aspect of new economic activity created by established firm.

Due to the heterogeneous nature of entrepreneurship, there is no unique variable that adequately measures entrepreneurial activity. At the country-level, commonly used measures are self-employment rates, business ownership rates, and number of new firm start-ups (Parker, 2004). A country-level study of this book (Chapter 2) adopts business ownership rate as a proxy for entrepreneurship. The business ownership rate is calculated as the share of business owners in the total labor force. Business owners are defined as individuals who are self-employed as their main occupation. Therefore, this measure includes all unincorporated self-employed persons and owner-managers of incorporated businesses (OMIBs) (Van Stel, 2005). Although it has been argued that business ownership is not identical to entrepreneurship, Carree et al. (2002) acknowledge that the business ownership level is a fair reflection of the level of entrepreneurship in a particular country.

Corresponding to business ownership rates in the country-level studies, firm-level studies in this book (Chapters 3 through 6) focus on the population of small- and medium-sized enterprises (SMEs). Though not synonymous with the self-employed dimension of entrepreneurship, SMEs are also considered a main source of employment growth in a nation (OECD, 2002; De Kok et al., 2006b) and make impressive contributions to innovation (Thompson and Leyden, 1983; Acs and Audretsch,1993; OECD, 2002), which is similar to entrepreneurial activities. In this book, the EU criterion of less than 250 employees is adopted to define SMEs (CEC, 1996; DTI, 1999).

1.3.3. Performance

As mentioned in section 1.1, *innovation* and *firm growth* are the two indicators of performance in this book.

Innovation: Innovation is a single force driving economies through a process of creative destruction. This process occurs whenever innovation is successfully introduced to the market (Schumpeter, 1942). According to Schumpeter, innovation is regarded as a new or significantly improved product (goods or services). This type of innovation, which is categorized as product innovation, is adopted by the studies of this book (Chapters 2, 4 and 5). Innovation relates to two interrelated processes: the production of knowledge and the exploitation of knowledge. The studies of this book focus on the exploitation phase of innovation that is referred to as innovation performance. The critical dimension of innovation performance is the variation in newness or novelty, from 'new to the firm' which is referred to as imitation performance, to 'new to the market' which is referred to as 'true' innovation performance. There are also various ways to measure innovation performance (for an overview, see Hauser and Zettelmayer, 1997). This book uses two specific measures: share of turnover attributable to new products (Chapters 2 and 5) and the extent to which a firm develops and/or introduces new products or services (Chapter 4).

Firm growth: Growth is a multidimensional phenomenon, different forms of growth may have distinct determinants and effects (Delmar et al., 2003). This book emphasizes the form of growth which generates new economic value and contributes directly to economic growth, referred to as organic growth. Organic growth can be defined as business expansion through increasing output and sales. From this point of view growth can be measured by change in several attributes such as turnover/sales, employment, assets, market share and profits. Among these measures, sales and employment which reflect both short-term and long-term changes in the firm are broadly used indicators of growth in previous studies (Davidsson, 1991; Delmar, 1997; Ardishvili et al., 1998; Weinzimmer et al., 1998; Wiklund, 1998). In a firm-level study on growth (Chapter 6), relative growth in employment is used as an indicator of firm growth.

To conclude this section, Table 1.1 gives an overview of all definitions and measures that are used in this book.

Table 1.2. Summary of definition and measurements of key concepts

Unit of analysis	Concepts	Definitions	Measurements/Proxies
Country-level analysis (Chapter 2)	Knowledge	Aggregated knowledge capital	Patent
	Entrepreneurship	Creation of new economic activity of established firm	Business ownership rate
	Innovation	New or significantly improved product (goods or services)	Share of turnover attributable to new or significantly improved products (country average)
Firm-level analysis (Chapter 3 to 6)	Knowledge	A firm's specific asset causing a fundamental heterogeneity in productive potential. Embedded in individuals expertise, organization routines and practices	Overall quality of individual or organization knowledge (Chapters 5 and 6)
			Knowledge management practices (Chapters 3 and 4)
			Flexible labor relations (Chapter 5)
			Training (Chapters 5 and 6)
			Organization learning (Chapter 6)
	Entrepreneurship	Firms with less than 250 employees	Population of small and medium size enterprise (SMEs) (Chapters 3 to 6)
	Innovation	New or significantly improved product (goods or services)	Share of turnover attributable to new or significantly improved products (Chapter 5)
			The extent to which a firm develops and/or introduces new products or services (Chapter 4)
	Firm growth	Business expansion through increasing output and sales	Relative growth in employment (Chapter 6)

1.4. Overview of Chapters and Main Results

The present book deals with the interrelations between knowledge and entrepreneurship as well as the consequences for performance. While Chapter 1 provides a general introduction,

main findings and implications, the empirical part of this book is structured in three parts. The first part (Chapter 2) identifies the moderating role of entrepreneurship in turning knowledge into innovation which may lead to economic growth. This chapter is based on a country-level analysis. A natural follow-up of this chapter is the second part of this book: it investigates how SMEs manage their knowledge assets (including organization knowledge and human resources) to stimulate innovation performance. Chapters 3 through 5 address these issues from a firm-level perspective. In the last part of this book (Chapter 6), special attention is paid to understand the determinants of SME growth. The rest of this section provides an overview on each of the chapters including their main results. Key features of the chapters are summarized in Table 1.2.

Chapter 2 analyzes the relationship between new knowledge and innovation performance and, in particular, the role of entrepreneurship with regard to the mechanism that translates knowledge into innovative products. The chapter uses a longitudinal country-level dataset constructed from CIS, Compendia and OECD Economic Outlook, covering 21 countries over the period of 1998 to 2006. Empirical results show that a high rate of entrepreneurship increases the chances that knowledge turns into innovative products (but not for imitative products). The findings highlight the importance of entrepreneurs in the process of commercialization of new knowledge. They are clearly in line with a Schumpeterian view of entrepreneurship, that is, the entrepreneur is an agent who can cope with a high degree of uncertainty, thereby inducing technological change and progress (Schumpeter, 1934). This chapter contributes to the understanding of how entrepreneurship facilitates the process of turning knowledge into innovative products (*RQ1 is answered*), and identifies the role of innovation in the knowledge spillover theory of entrepreneurship.

Chapter 3 examines empirically a preliminary model that addresses the prevalence of different KM practices as well as certain organization contexts such as size, family orientation and strategy that might explain the variation of KM practices among SMEs. Using a sample of about 500 SMEs located in the Netherlands, results show that SMEs rely on a more people-centered KM approach. Socialization dominates internal knowledge transferring, sharing and exploitation practices. These findings are consistent with previous qualitative studies. Furthermore, empirical results indicate that certain organization contexts of SME explain the variation of KM practices among SMEs. For instance, larger SMEs are more likely to use formalized KM practice and family-oriented SMEs are less likely (than nonfamily firms) to use formal KM practices. The arguments from the resource-based view and agency theory are

found to be particularly relevant in explaining the choice of using formal and informal KM practices in an SME context. SMEs pursuing formalized strategies, including innovation orientation, sales-focused market orientation, or competitor orientation strategy, are found to be more likely to engage in a wider range of KM practices. These findings support the conclusion that strategy is an antecedent for various KM practices from a strategy implementation perspective of the contingency model. The findings of this chapter make an empirical contribution to the understanding of the specifics of KM issues in SMEs (*RQ2 is answered*).

Chapter 4 advances a knowledge-based dynamic capabilities framework to predict innovation in SMEs. Adopting a dynamic capabilities perspective, this chapter presumes that a firm can develop absorptive capacity and transformative capacity (i.e. its *realized* knowledge capacities) by actively implementing external knowledge acquisition and internal knowledge sharing practices (i.e. its *potential* knowledge capacities). These knowledge capacities form part of the firm's knowledge-based dynamic capabilities, which enhance the firm's innovation orientation and performance in turn. This assumption is empirically examined based on a sample of 649 SMEs located in the Netherlands. Empirical results most clearly support the conclusion that only external knowledge acquisition contributes positively to innovation performance of a SME and presumably via the enhancement of absorptive capacity. Furthermore, this relationship is fully mediated by innovation orientation. Similar predictions for internal knowledge sharing practices however are not supported. These findings appear consistent with other research views that external knowledge acquisition practices (but not necessarily internal sharing practices) are an essential determinant especially in new product innovation for SMEs (Kazanjian et al., 2001). Furthermore, the finding of the mediating role of innovation orientation provides support for a combined emergent and deliberate view of innovation strategy. The finding of this chapter implies a different means for SMEs to foster their innovation within firms (*RQ3 is answered*).

Taking a different aspect of knowledge assets, Chapter 5 examines the nexus between flexible labor and innovation performance. Two types of flexible labor patterns, that is, numerical flexibility and functional flexibility, are adopted for empirical analyses. Based on the counterarguments between main stream economists and Schumpeterian economists, a non-linear relationship between numerical flexibility and innovation performance is assumed. Functional flexibility is hypothesized to have a positive impact on innovation performance. This chapter uses a longitudinal firm-level data (1992-2000) with broad industry coverage in

the Netherlands. The sample of this chapter includes 1032 commercial organizations and a sub-sample of 929 commercial SMEs. Fairly consistent results are found in both samples. Empirical results indicate that numerical flexibility, that is firms with high shares of workers on fixed-term contracts, has significantly higher sales of *imitative* new products but performs significantly worse on sales of *innovative* new products ("first on the market"). High functional flexibility in "insider-outsider" labor markets, that is the percentage of employees that changed their function and/or department within the firm, enhances a firm's new product sales. The indicators for the quality of human capital: training efforts and highly educated personnel are also found to be positively conducive to a firm's innovation performance. The findings of this chapter support the importance of qualified human capital to the innovation process and emphasizes that a firm can stimulate its innovation performance by utilizing the various means of flexible labor which is suggested by the previous studies (Laursen and Foss, 2003; Michie and Sheehan, 2003; Arvanitis 2005; Verburg and Den Hartog, 2005). (*RQ4 is answered*).

Chapter 6 deals with the determinants of SME growth. Based on an extensive review on the determinants of firm growth, this chapter classifies these determinants into three dimensions: individual, organizational and environmental determinants (Baum et al., 2001). Using a sample of 523 SMEs located in the Netherlands, empirical results show that environmental determinants do not affect firm growth. Individual ones do: entrepreneurs with growth motivation and having technical knowledge background are more likely to grow their firms while entrepreneurs characterized by a strong need of achievement are less likely to grow. Organizational determinants have the largest influence on firm growth: the older the firm, the less likely it is to grow. Availability of financial capital is found to be crucial for firm growth. Finally, a firm's growth orientation, which could be a new dimension for entrepreneurial orientation, is found to have a positive impact. This chapter identifies seven most important determinants – growth motivation, specific skills, need for achievement, firm age, financial performance, extra finance, and growth orientation – for the growth of SMEs (*RQ5 is answered*) and makes an empirical contribution to the existing growth literature.

Table 1.2. Key features of Chapter 2-6

	Research questions	Data sample	Data source	Time span	Method
Chapter 2	How does entrepreneurship facilitate the process of turning knowledge into innovative products?	Macro, 21 countries	Community Innovation Survey: CIS2, CIS3, CIS4, and CIS2006 OECD Economic Outlook Database 2009 EIM: COMPENDIA (version of 2007)	1996-2006 corresponding to four waves of CIS survey	Pooled OLS regression Fixed-effects (panel) Random effects (panel)
Chapter 3	How do the organization contexts of SME explain the characteristics of knowledge processes in SMEs?	Micro, 496 SMEs from the Netherlands	EIM: SME-panel	2006	Factor analysis Seemingly unrelated regression
Chapter 4	How do SMEs foster innovation through managing their knowledge processes?	Micro, 649 SMEs from the Netherlands	EIM: SME-panel	2006-2007	Factor analysis Multivariate OLS regression Structural equation model
Chapter 5	How do SMEs stimulate innovation performance through flexible labor contracts?	Micro 1032 firms from the Netherlands 929 SMEs from the Netherlands	Organization for Strategic Labor Market Research (OSA)	1992-2000	Pooled OLS regression Tobit model Heckman model Heck-tobit model Ordered logistic regression
Chapter 6	What are the important determinants of SME growth?	Micro, 523 SMEs from the Netherlands	EIM: Growth of entrepreneurial firms	2005	Factor analysis Multivariate OLS regression

1.5. Conclusions and Implications

This book consists of five distinct chapters investigating research themes that are of interest to economists, policy-makers and owner-managers of SMEs, such as how entrepreneurship facilitates the process of turning knowledge into innovative products, how SMEs foster innovation performance through managing their knowledge assets, and what determines the growth of SMEs. The findings of the chapters provide a closer insight into the processes of how entrepreneurship interrelates to knowledge and why they contribute to economic growth. Based on the main findings of the individual chapters presented in the previous section, the present section draws some conclusions and provides some implications for current and future research, policy-makers and owner-managers of SMEs.

1.5.1. Conclusions of the book

First of all, entrepreneurship serves as a moderator between new knowledge and innovation performance. A higher rate of entrepreneurship facilitates the process of turning knowledge into innovative products which in turn might lead to economic growth. This book shows that countries with a high rate of entrepreneurship perform better in terms of innovation performance but not necessarily imitation performance. The outcome of innovation performance is often highly uncertain and requires entrepreneurs who are considered to have an above-average level of willingness to take risks (Kihlstrom and Laffont, 1979; Brockhaus, 1980), a tolerance for ambiguity (Timmons, 1976; Schere, 1982), a great need for achievement (McClelland, 1961), and a preference for autonomy (Benz and Frey, 2008). Being a risk-taker and having a tolerance for ambiguity are crucial in managing the process of commercializing new knowledge. Thus, this book reveals how exactly entrepreneurship turns knowledge into economic growth, which is left unanswered by the existing theories. Knowledge and entrepreneurial activity may ultimately lead to economic growth, but not without first producing innovative products.

Second, knowledge assets, including both organization knowledge and human resources, serve as an important source of an SME's competitive advantage. The aggregated effects of SMEs in innovation may lead to economic growth. Though it has been argued that SMEs may face resource constraints due to their smaller size (Nooteboom, 2001; Wong and Aspinwall, 2004; Dosouza and Awazu, 2006), this book identifies a number of ways in which SMEs manage their knowledge processes. Generally speaking, SMEs use more people-centered informal KM practices that emphasize individual involvement and socialization. However, counter to prior assumptions and findings, the use of formal KM approaches to acquire and

store knowledge is fairly widespread. This suggests that many SMEs reach out for information beyond their boundaries, including other organizations and individuals. Thus the barriers toward dissemination of knowledge may not be as great as it is sometimes assumed. Furthermore, it is observed that external knowledge acquisition contributes positively to innovation orientation of a SME and presumably via the enhancement of absorptive capacity. This in turn enhances innovation performance of a SME. This finding helps to explain why indeed SMEs have historically been responsible for a fairly high rate of innovation relative to larger firms and reveals the process of how SMEs foster innovation performance through managing their knowledge processes.

Third, compared to larger firms, SMEs rely heavily on individual know-how, in particular, that of entrepreneurs and managers in the firm (Wiklund and Shepherd, 2003). Knowledge diffusion takes place via individual mobility. Human resources are essential for a firm's innovation performance. This book identifies how a firm can stimulate human resources for its innovation performance by means of flexible labor. Flexible labor reflects the individual mobility through external labor market as well as through reallocation in the internal market. The empirical finding of this book underlines the importance of "insider-outsider" labor markets for keeping knowledge in the firm and investing in the loyalty and commitment of employees while allowing for flexibility. Furthermore, this book suggests that temporary contracts might have advantages for imitative firms, but definitely are not an option preferred by market leaders who seem to have a greater need than market followers for continuity in learning and in preventing knowledge from leaking to competitors.

Fourth, both knowledge and entrepreneurship are identified as most important determinants for the growth of SMEs. Next to the availability of financial capital, the entrepreneur's specific skills, in particular with the technical background, have a significant impact on firm growth. From a learning perspective, entrepreneurs with a technical background can learn managerial skills via daily operations. This supports the view that technical competency is an important expertise which facilitates the implementation of the entrepreneur's vision and strategy (Baum, Locke, & Smith, 2001). Furthermore, it is observed that a firm-level entrepreneurial attitude consisting of entrepreneurial orientation and growth orientation from entrepreneurial management is the key to actual growth. This finding empirically supports Stevenson's conceptualized entrepreneurial management: the existence and nature of management teams affect the likelihood of a positive outcome (Stevenson and Jarillo, 1990; Terrence et al., 2001). This also indicates that entrepreneurial behaviour is not

solely based on personalities. There is a propensity for teaching entrepreneurial behaviour (Stevenson and Jarillo, 1986; 1990).

To conclude, the findings of this book empirically support that knowledge and entrepreneurship are the sources of competitive advantage both at the country-level and at the firm-level.

1.5.2.   Contributions and Implications

The main contribution of this book is to combine different fields of research for each of the five studies: Chapter 2 extends the knowledge spillover theory of entrepreneurship and links it to innovation and innovation performance, while Chapters 3 and 4 integrate existing organization and managerial theories, such as the resource-based view, agency theory, contingency theory of strategy, dynamic capabilities perspective, and the emergent-deliberate view of strategy into the context of SMEs. In a similar vein, Chapter 5 constitutes a link between the labor economics and innovation literature, while Chapter 6 integrates many known determinants of firm growth from different perspectives and disciplines for an exhaustive analysis. All five chapters attempt to create new insights that can be advanced further. Below a number of implications are presented for current and future research, policy-makers and owner-managers of SMEs.

Implications for current and future research

Next to providing empirical evidence to the existing literature on knowledge and entrepreneurship, the chapters of this book make scientific contributions to the understanding of economic and managerial theories.

First, this book identifies the role of innovation, which is a missing link in the knowledge spillover theory of entrepreneurship. The extension of the knowledge spillover theory of entrepreneurship to the field of innovation is the first step to understand the process of why and under which conditions entrepreneurship leads to economic growth. More research could be conducted on this basis to determine how to identify, attract, and support those entrepreneurs who transform knowledge into innovative products and thereby increase the competitiveness of their particular region.

Second, this book provides insights specifically from an SME perspective regarding the resource-based view, agency theory and contingency theory of strategy. The resource-based view and agency theory are found to be particularly relevant in explaining the choice of using formal and informal KM practices in an SME context. The strategy implementation perspective

of contingency models of strategy underlines that firms with a competitive strategy engage in a wider range of KM practices than those with a simple survival strategy. This reveals that strategy is associated with management practices to improve the effectiveness of executing this strategy. This finding contributes to the understanding of strategy as an antecedent for organization practices, especially within SMEs.

Third, this book advances a knowledge-based dynamic capabilities framework to predict innovation within SMEs. A firm's knowledge-based dynamic capabilities, which treat KM practices as aspects of potential (vs. realized) knowledge capacities, underline the rationale that KM practices develop and renew the realized knowledge capacities, which in turn predict a firm's innovation orientation and performance. This rationale is in line with the dynamic capabilities perspective, which emphasizes that a firm's abilities to renew and to develop its organizational capabilities are essential for building and sustaining competitive advantage (Kogut and Zander, 1993; Nonaka and Takeuchi, 1995; Grant, 1996; Spender, 1996; Teece et al., 1997; Eisenhardt and Martin, 2000). The proposed framework questions the capital approach of measuring realized knowledge capacity (capital itself is a resource, not a capacity per se) and it calls for future research on designing direct measures of realized knowledge capacities.

Fourth, the finding of the mediating role of innovation orientation between external knowledge acquisition and innovation performance provides support for a combined emergent and deliberate view of innovation strategy. On the one hand, external exposure to ideas appears to enhance learning and interest in strategic renewal and innovation (i.e. emergent view). On the other hand, a heightened innovation orientation is clearly related to greater innovation performance during a subsequent period, supporting a deliberate view of strategy as planned and based on behavioral intentions. This combined emergent-deliberate view is in keeping with a view of strategy proposed by Mintzberg et al (1998). This finding also leads to future research on an emergent-deliberate view of strategy by involving a time-series basis.

Last, the analysis on the determinants of firm growth provides an extensive overview of many known determinants from different perspectives and disciplines. The identified seven most important determinants can serve as a first step to develop a more systematic analysis for future research on determinants of firm growth.

Implications for policy-makers

A few policy implications can be derived from the individual chapters: *First*, the moderating role of entrepreneurship between knowledge and innovation performance indicates that it is not sufficient to promote the production of new knowledge (e.g., by means of R&D subsidies or university education); it is equally necessary to have entrepreneurs who turn this new knowledge into innovative products (subsequently leading to economic growth). If there are only a few entrepreneurs in a knowledge-intensive region, the Swedish or the European paradox (Ejermo and Kander, 2006; Audretsch, 2007a) can emerge. To prevent this situation from arising, policy-makers may want to promote entrepreneurship in their own country or region through subsidized loans to high-tech entrepreneurs, regulatory exemptions for innovative new start-ups, or tax benefits. Furthermore, the government should support those entrepreneurs who really take the risk of transforming new knowledge into innovative products and focus less on those entrepreneurs who merely start another shop around the corner. An alternative strategy for policy-makers would be to promote (entrepreneurship) education to increase the number of qualified and risk-taking entrepreneurs which would be a more long-term approach.

Second, the mixed results on the relationship between numerical flexibility and innovation performance warn against the unconditional plea by mainstream economists for the deregulation of labor markets, that is, to reduce unemployment by making European labor markets more flexible (see e.g. the OECD's Job Study, 1994). The finding of this book indicates that the "rigidity" of insider-outsider labor markets also has advantages, as it allows for "functional" flexibility. The often criticized protection of "insiders" can be interpreted as an investment in the loyalty and commitment of workers. Moreover, functional flexibility on internal labor markets has advantages for the continuity of (organizational) learning, and strengthens the historical memory of firms. Neoclassical economists should note that numerical flexibility such as using employees based on temporary contracts can have advantages for imitative firms, but definitely are not an option for market leaders. In order to reach the goal of being the most competitive and dynamic economy in the world, policy-makers of European countries may need to rethink about the deregulation of labor markets which might decrease the amount of market leaders who contribute to 'true' innovation.

Third, this book suggests that SMEs may innovate in different ways than their large counterparts. Instead of building new knowledge and creating innovation opportunity in-house, SMEs often seek opportunities and acquire new external knowledge through social ties and

interaction with external resources. A favorable external communication system can make SMEs more innovative, perhaps by improving their ability to identify new opportunities from the external environment. Therefore, policy-makers who want to stimulate SMEs' innovation performance may want to assist SME directors in making better use of their external environment by learning how to network more effectively.

Implications for owner-managers of SMEs

This book provides a general understanding of the characteristics of KM in SMEs to the owner-managers of SMEs. SMEs rely more upon people-centered informal KM approaches than on formal KM approaches. They significantly rely on individual social interactions to transfer, share and exploit knowledge. The importance of people-centered knowledge processes suggests that owner-managers of SMEs should be aware of a need to develop competencies of their employees by nurturing their knowledge base as well as by retaining key (e.g. knowledgeable) employees through the right incentives. To do so, owner-managers of SMEs can utilize flexible labor patterns and adjust their employment relations through functional flexibility. Functional flexibility provides opportunities for long-term careers in the same firm. Relying on training, functional flexibility can increase the multiple competencies of workers, as well as the loyalty and commitment of employees. This is likely to reduce positive externalities through the exit of trained people or through disloyal behavior (e.g., the leaking of trade secrets to competitors). By doing so, SMEs can prevent the knowledge leakage through the loss of key employees and the spillover via external connections.

Furthermore, knowledge in family oriented SMEs is found to be less externalized and codified. Acquiring external knowledge, codifying and storing knowledge brings large benefits for a firm's long-term competitiveness. Thus it may be helpful to stimulate owner-managers of family oriented SMEs in particular, to be more open to outside influences and be aware of the benefit of codifying and storing knowledge to foster innovation and change.

1.6. Status of Chapters

Chapter 2: What turns knowledge into innovative products? The role of entrepreneurship and knowledge spillover

- *Working paper :*
  - ERIM report series, no. ERS-2009-049-ORG
- *Presentations*:
  - IECER Conference, Regensburg, Germany, March 2010
  - Babson Conference, Lousanne, Switzerland, June 2010
  - Academy of Management Conference, Montreal, Canada, August 2010
- *Co-authors:* Joern Block and Roy Thurik

Chapter 3: Knowledge management and its relationship with organizational context: An empirical exploration on Dutch SMEs

- *Working papers:*
  - Version named 'Knowledge Management in the SME and its Relationship to Strategy, Family Orientation and Organization Learning' appeared in ERIM report series, no.2009-026-ORG.
  - Early version named 'Family Orientation, Strategy and Organizational Learning as Predictors of Knowledge Management in Dutch SMEs' appeared in EIM Scales series, no. H200703
- *Presentation*:
  - Strategic Management Society Conference, Cologne, October, 2008
  - Top 5 finalists of Best Conference Paper for Practical Implications
- *Co- author:* Lorraine Uhlaner

Chapter 4: Predicting innovation in SMEs: A knowledge-based dynamic capabilities perspective

- *Working papers:*
  - Version named 'Knowledge Management as a Strategic Tool to Foster Innovativeness of SMEs' appeared in ERIM report series, no.2009-025-ORG.

- Early version named 'Knowledge Management, Innovation Orientation and Innovation Performance' appeared in EIM Scales series, no. H200718
- *Presentations*:
  - Academy of Management Annual Conference, Anaheim, US, August, 2008
  - Strategic Management Society Conference, Cologne, Germany, October, 2008
- *Co- author:* Lorraine Uhlaner

Chapter 5: Flexible labor and innovation performance: Evidence from longitudinal firm-level data
- *Working paper:*
  - ERIM report series, no.2010-007-ORG.
- Early *version as book chapter*: The Impact of Labour Flexibility and HRM on Innovation. In Innovation in Business and Enterprise: Technologies and Frameworks, L.Hakim., J.Chen (eds.). IGI Global, Hershey (forthcoming)
- *Early version as conference proceeding*: The proceeding of The 5th International Symposium on Management of Technology (ISMOT'07), pg. 433-436
- *Presentation:*
  - International Schumpeter Society Conference, Aalborg, Denmark, 2010.
- *Co-author:* Ronald Dekker and Alfred Kleinknecht

Chapter 6: Determinants and dimensions of firm growth: Evidence from Dutch SMEs
- *Working paper:*
  - EIM Scales series, no. H200903
- *Co-author:* Gerrit de Wit

CHAPTER II

What turns knowledge into innovative products?
The role of entrepreneurship and knowledge spillovers

Abstract: The knowledge spillover theory of entrepreneurship seeks to explain the sources of entrepreneurship and its consequences with regard to economic performance. This chapter extends the theory and links it to innovation performance. We propose that a high rate of entrepreneurship facilitates the process of turning knowledge into innovative products, while it has no effect on the relationship between knowledge and imitative products. We use European country-level data to test our propositions. Our results show that a high rate of entrepreneurship increases the chances that knowledge will turn into innovative products. The findings highlight the importance of entrepreneurs in the process of the commercialization of knowledge. Implications for innovation policy are discussed.

2.1. Introduction

Endogenous growth theory assumes that an economy automatically benefits from its investments in new knowledge (Lucas, 1988; Romer, 1990). The idea is that knowledge behaves like a public good that an entire economy can use. This use leads to economic growth. Also, in the empirical world of the R&D capital approach (Mansfield, 1965; Griliches, 1998, 2000), the development of total factor productivity (TFP) is simply explained using an R&D stock variable.[1] Although there is, of course, a great deal of evidence that knowledge (R&D stock) leads to growth (TFP growth), some countries seem to benefit more from investments in new knowledge than others do. The US, for example, is considered to be much stronger than Europe in the commercialization of new knowledge. This effect is sometimes referred to as the Swedish paradox (Ejermo and Kander, 2006) or the European paradox (Audretsch, 2007a). Investments in new knowledge are only a necessary condition; new knowledge still needs to be exploited and put to commercial use so that it can translate into a higher level of competitiveness and subsequent economic growth. The barrier between knowledge and its commercialization is termed the knowledge filter (Acs et al., 2005; Mueller, 2006; Audretsch, 2007a).

This chapter analyzes the relationship between new knowledge and innovation performance and, in particular, the role of entrepreneurship with regard to the mechanism that translates knowledge into innovative products. We use and extend the knowledge spillover theory of entrepreneurship (Audretsch and Lehmann, 2005; Audretsch and Keilbach, 2007, 2008; Acs et al., 2009) and link it to the field of innovation. So far, the theory has largely not addressed questions of innovation and innovation performance. Its main concern has been the role of entrepreneurship in turning knowledge into economic growth. The question of *how* exactly entrepreneurship turns knowledge into economic growth is left unanswered. This is unsatisfactory because to design an effective growth policy, policy-makers need to understand the exact mechanisms through which entrepreneurship leads to economic growth. Our extension of the knowledge spillover theory to the field of innovation is a first step in this direction.

Prior research presents entrepreneurship as an additional production factor termed entrepreneurship capital (Audretsch, 2007a). However, in this sense, it does not contribute to our understanding of how the transformation of knowledge into economic growth works. The

main question is *why* entrepreneurship leads to growth. Also, literature surveys of the influence of entrepreneurship on economic growth (Carree and Thurik, 2003; Van Praag and Versloot, 2007; Braunerhjelm, 2008) are relatively vague about this: entrepreneurship is expected to lead to diversity, innovation, competition, employment, learning, etc., at which point growth occurs[2]. In the present chapter, we address this question by focusing on innovation and innovation performance as outcome variables (not economic growth). Hence, we make a first attempt to integrate the knowledge spillover theory into the innovation literature.

Our focus, and hence our unit of observation, is at the country level and not that of the individual firm. We test our proposed extensions of the knowledge spillover theory of entrepreneurship using a panel dataset that covers the innovation activity of 21 European countries in four waves corresponding to the period from 1996 to 2006. The results are clear: entrepreneurship is found to be an important driver that turns knowledge into innovative products, while it has no impact on imitative products. This is precisely what our extension of the knowledge spillover theory of entrepreneurship predicts. Entrepreneurs as individuals are risk-takers; they play an important role when risk is involved. This is the case with innovative products but less so with imitative products. With this result, the chapter contributes to our understanding of why and under which conditions entrepreneurship leads to economic growth.

The remainder of this chapter is organized as follows. Section 2.2 introduces the knowledge spillover theory of entrepreneurship. Section 2.3 extends the knowledge spillover theory of entrepreneurship, linking it to innovation performance. Section 2.4 describes our data and the empirical model. Section 2.5 reports our regression results, which are then discussed in Section 2.6.

2.2. Related literature

2.2.1. Knowledge spillovers and geographical boundaries

The production of knowledge can lead to spillovers: individuals or organizations other than the creators of knowledge may benefit from the knowledge that the creator has produced. Thus, by investing in knowledge, a firm not only increases its own level of knowledge but also

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1   The R&D capital approach also takes international effects into account such as those of foreign R&D, import shares, openness and catch-up mechanisms. See Erken et al. (2009).

2   In their overview of the results Van Praag and Versloot (2007) cite several studies where entrepreneurs do not contribute to several measures of innovative performance.

makes a contribution to the aggregate stock of knowledge (Romer, 1986; Lucas, 1993; Griliches, 1998). For example, if a firm produces new knowledge and is granted a patent, the information included in the patent becomes accessible to the general public and to competitors. A competitor may use the information from the patent for its own research and invest in related knowledge, which might then lead to new patents or innovative products: knowledge may spill over from one firm to another. There exists extensive research on knowledge spillovers in multiple contexts, such as technology transfer (e.g., Mueller, 2006), innovation networks (e.g., Breschi and Lissoni, 2001), technology clusters (e.g., Link and Scott, 2005), and the evolution of industries (e.g., Iammarino and McCann, 2006). One of the recurring findings is that geographical proximity matters if knowledge spillovers are to occur. Although it is possible that knowledge spills over to firms or individuals far away from the creator of knowledge, it has been shown that these spillovers are more likely to occur on a local level (Jaffe et al., 1993; Bottazzi and Peri, 2003).

2.2.2. The knowledge spillover theory of entrepreneurship

Entrepreneurship is identified by its role in opportunity recognition, discovery, and creation (Shane and Venkataraman, 2000). Little is known, however, about the source of opportunities. The knowledge spillover theory of entrepreneurship (Audretsch and Lehmann, 2005; Audretsch and Keilbach, 2007, 2008; Acs et al., 2009) helps to close this gap. Knowledge spillovers are suggested as a possible source of entrepreneurial opportunities. This has also been termed endogenous entrepreneurship[3]. Due to the non-rival nature of knowledge as an asset, it may spill over such that the producers of knowledge are not able to appropriate the entire value of their knowledge for themselves. These spillovers serve as a source of opportunities for other firms and for individuals who want to start their own business. The knowledge spillover theory of entrepreneurship states that entrepreneurial activity is greater in the presence of higher investments in knowledge. This argument is supported by Audretsch and Lehmann (2005), among others, who show that regions with greater investments in new knowledge also have higher start-up rates. Another facet of the theory refers to entrepreneurial performance. Based on the assumption that knowledge spillovers increase economic performance (Lucas, 1988; Romer, 1990; Glaeser et al., 1992) and that this relationship is moderated by geographical proximity (Jaffe et al., 1993; Bottazzi and Peri, 2003), it is

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[3]   The theory starts from the assumption that given constant individual characteristics entrepreneurial decisions are driven by the context, in particular by the knowledge intensity of the context. Hence, entrepreneurship is not just exogenously driven by individual characteristics, behaviours and traits but also by the endogenous response to opportunities created by the context (Audretsch, 2007a).

suggested that opportunities for entrepreneurship are superior when the ability to access knowledge spillovers from geographically proximate sources is greater. This can be the case if the entrepreneur is located in close proximity to universities, large high-tech firms or other research-intensive institutions that produce knowledge (Audretsch et al., 2005; Mueller, 2006).

2.3. Entrepreneurship as a factor that turns knowledge into innovation

The purpose of this chapter is to extend the knowledge spillover theory of entrepreneurship and link it to innovation and innovation performance. As summarized in the preceding section, most existing work about the knowledge spillover theory of entrepreneurship is about the sources of entrepreneurship and its consequences with regard to economic performance. The link between entrepreneurship and innovation is made only indirectly; for example, it is suggested that entrepreneurship increases the level of economic output by serving as a mechanism that facilitates the commercialization of knowledge. No explicit link has been made between entrepreneurship and innovation. The purpose of this chapter is to close this gap. In the following, we argue that entrepreneurship is more likely to influence the process that leads knowledge to be converted into innovative products as opposed to imitative products.

Innovation relates to two interrelated processes: the production of knowledge[4] and the exploitation of knowledge. We focus on the exploitation phase and particularly on the mechanism that turns knowledge into innovative products. The commercialization of knowledge, in particular new knowledge, includes efforts such as financing product development or market research. The outcome of this process is often highly uncertain and requires a risk-taking attitude from those actors who manage the process. Having an entrepreneurial attitude comes into play at this stage. Entrepreneurs are considered different from other individuals; for example, they are considered to have an above-average level of willingness to take risks (Kihlstrom and Laffont, 1979; Brockhaus, 1980), a tolerance for ambiguity (Timmons, 1976; Schere, 1982), a great need for achievement (McClelland, 1961), and a preference for autonomy (Benz and Frey, 2008). In particular, being a risk-taker and

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[4] The production of knowledge part is emphasized by Baumol (2002) who represents the Schumpeterian (1934) view that an environment where most of the breakthrough innovation occurs in small firms while most of the improvement on those innovations and wide-scale dissemination occurs in large firms, is an efficient one. See Ortega-Argilés, Vivarelli and Voigt (2009) for a survey of the various roles of small firms in the process of technological change.

having a tolerance for ambiguity are crucial in managing the process of commercializing new knowledge. A high rate of entrepreneurship and exposure to an entrepreneurial climate facilitate the process of turning knowledge into innovative products. This leads us to propose the following hypothesis:

Entrepreneurship moderates the relationship between knowledge and innovation performance.

2.4. Data and empirical model

2.4.1. Data sources

Our study combines data from the Community Innovation Survey (CIS) [5], the COMPENDIA database[6], and the OECD Economic Outlook Database[7].

The CIS is commissioned by the European Commission and records the innovation activity of firms in the EU member states, in EU candidate countries, and in Iceland and Norway. The first CIS took place in 1993, using a pilot version (CIS1). Since then, four additional surveys have been carried out: CIS2 (years 1996-1998), CIS3 (years 1998-2000), CIS4 (years 2002-2004), and CIS2006 (years 2004-2006). The survey unit of the CIS is the enterprise, and the target population is the total population of enterprises in the particular country. Because sampling rates may differ across countries, the CIS uses a stratified sampling procedure and weighting procedures to ensure that the samples are representative of the total population of enterprises in each country. The results of the firm-level CIS are aggregated and transmitted to Eurostat on a compulsory basis. CIS data are accepted in the research community and have been widely used in innovation research (Arundel, 2001; Mairesse and Mohen, 2002, 2004; Hoelzl, 2009).

COMPENDIA (COMParative ENtrepreneurship Data for International Analysis) is developed and maintained by EIM Business and Policy Research (a Panteia company) in the Netherlands. The database summarizes and harmonizes information about the number of

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[5]   Extended information is available at
http://epp.eurostat.ec.europa.eu/portal/page/portal/science_technology_innovation/data/database
(accessed September 7th, 2009).

[6]   For extended information, please refer to http://data.ondernemerschap.nl (accessed September 7th, 2009).

[7]   For extended information, please refer to http://stats.oecd.org/wbos/index.aspx?r=582080 (accessed September 7th, 2009).

business owners and the size of the labor force from the following resources: the OECD databases, the ILO Yearbook of Labour Statistics and the European Observatory for SMEs. The quotient of these two variables is called the business ownership rate (Van Stel, 2005). Business ownership includes all unincorporated self-employed persons and owner-managers of incorporated businesses (OMIBs) (Van Stel, 2005). Although it has been argued that business ownership is not synonymous with entrepreneurship, Carree et al. (2002) acknowledge that business ownership level is a fair reflection of the level of entrepreneurship in a particular country. The main advantage of this harmonized dataset is that it makes entrepreneurship activity comparable across countries and over time. The latest version of the COMPENDIA consists of 23 OECD countries over the period of 1972-2007.

The OECD Economic Outlook Database indicates historical trends and future projections for a wide range of macro indicators that illustrate the demographic, social, economic and environmental developments of a country. These include gross domestic product, rate of unemployment or deflators and prices. The dataset encompasses longitudinal information on macro indicators from the 30 OECD member countries and 6 selected non-OECD countries. We rely on this database to build our country-specific control variables.

Our final assembled dataset covers aggregated information on innovation activity from manufacturing firms (NACE 15-37)[8], business ownership rates, and macro indicators of 21 European countries[9] in four waves corresponding to the period from 1996 to 2006. We restrict our sample to the manufacturing sector to ensure that our results are not driven by differences in industry structure between countries. Because not all countries are included in each wave, our final dataset takes the form of an unbalanced panel dataset.

2.4.2. Dependent variable
Innovation performance: the measurement of innovation and innovation performance embraces various dimensions and varies according to firms and their life-cycle phases. Innovation and its performance can be measured in many ways, such as with the turnover of new products, increases in productivity or decreases in production cost as a result of introducing new processes, and customer satisfaction with new products or services (for an

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[8]   For the NACE codes, see http://stats.oecd.org/glossary/detail.asp?ID=1713 (accessed September 7th, 2009).
[9]   The countries are Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, and the United Kingdom.

overview, see Hauser and Zettelmayer, 1997). The CIS measures new product performance in two ways: (1) with shares of turnover attributable to new or significantly improved products that are *new to the firm* (we have termed this imitation performance) and (2) with shares of turnover attributable to new or significantly improved products that are *new to the market* (we have termed this innovation performance). We argue that entrepreneurship and an entrepreneurial attitude matter particularly with regard to innovation performance, and less so with imitation performance.

2.4.3. Independent variables

Rate of knowledge-intensive firms: As discussed above, the production of new knowledge is a crucial factor leading to innovation. We measure a country's level of knowledge as the share of firms that have applied for at least one patent in the survey year. We consider this measure a good proxy for knowledge in the context of this study: patents are property rights granted by a patent authority such as the European Patent Office (EPO). For a patent to be granted, the invention must be non-trivial and of potential commercial value. Patents have been used in a number of studies as a proxy for knowledge and knowledge spillover (Jaffe et al., 1993, 2000; Acs et al., 2002; Furman et al., 2002). The data were obtained from the CIS.

Entrepreneurship rate: Due to the heterogeneous context of entrepreneurship, no unique variable exists that measures entrepreneurship or entrepreneurial climate. Commonly used measures are self-employment rates, business ownership rates, and numbers of new firm start-ups (Parker, 2004, pp. 5-8). We use the business ownership rate to measure entrepreneurship. Our results, however, also hold when we use the rate of self-employment as a proxy for entrepreneurship. The business ownership rate is calculated as the share of business owners in the total labor force. Business owners are defined as individuals whose main occupation is self-employment. This also includes owner-managers of incorporated businesses. The data were obtained from COMPENDIA.

Control variables: To control for macro-economic influences, two macro-economic variables are included in the regression models: *GDP* and *GDP per capita*. The variables are taken from the OECD Economic Outlook Database. To achieve comparability over time, the values of *GDP* and *GDP per capita* were adjusted to prices from 1995. Both variables are represented as logged values and refer to the country's size or level of wealth.

2.4.4. Empirical model

The following two pooled OLS equations are used for the empirical analysis:

$$I_{i,t} = \alpha + \beta_1(K_{i,t}) + \beta_2(E_{i,t}) + \beta_3(K_{it}E_{it}) + \beta_4\ (Controls_{i,t}) + \beta_5(Years_t) + \varepsilon_{i,t}\ ,$$

where *I* is either *Innovperf* (innovation performance measured according to the share of turnover attributable to new or significantly improved products that are *new to the market*;) or *Imitaperf* (imitation performance measured according to the share of turnover attributable to new or significantly improved products that are *new to the firm*); *K* denotes the rate of knowledge-intensive firms measured by the share of firms that applied for at least one patent in the last three years; *E* denotes the business ownership rate as a proxy for the entrepreneurship rate; *Controls* denotes the control variables, which are the natural logarithm of *GDP* and the natural logarithm of *GDP per capita*; *Years* corresponds to year dummies for the years 1998, 2000, 2004, and 2006 and *i* and *t* are country and year indices, respectively. Appendix 2.1 describes the construction of the variables in more detail. To conduct a robustness check, we also estimate random-effects and fixed-effects regressions (Wooldridge, 2002) using the same variables.

2.5. Results

2.5.1. Descriptive statistics

Some descriptive statistics for the variables are presented in Table 2.1. The mean percentage of turnover with innovative products is 8% (with variation from 1% to 24%). The mean percentage of turnover with imitative products is 13% (with variation from 4% to 41%). The mean rate of entrepreneurship is 11% (with variation from 5% to 21%), and the mean proportion of firms that applied for a patent is 10% (ranging from 2% to 27%).

Table 2.1. Descriptive statistics

Variables	Mean	Median	Std. dev.	Min.	Max.
Innovation performance (in %)	8.12	7.30	3.96	1.00	23.90
Imitation performance (in %)	12.84	10.40	7.71	3.70	41.10
Ln(GDP)	12.47	12.25	1.17	8. 97	14.55
GDP (in million US $)	486,722	208,854	565,727	7,867	2,076,601
Ln(GDP per capita)	10.03	10.08	0.31	9.30	10.96
GDP per capita (in US $)	23,734	23,820	7,985	10,985	57,282
Entrepreneurship rate (in %)	10.78	9.80	3.90	5.20	21.00
Rate of knowledge-intensive firms (in %)	10.14	9.70	6.38	1.60	27.20

Notes: N=57 observations from 21 countries
Data sources: CIS, COMPENDIA, and OECD Economic Outlook Database

Table 2.2 shows a correlation table. Innovation and imitation performance are <u>not</u> correlated (r=0.05, p>0.1), which indicates that they relate to different characteristics of new products (and countries). Except for the correlation between *knowledge* and the natural logarithm of *GDP per capita*, all correlations are below 0.5. With innovation and imitation performance as the dependent variables, the variance inflation factors (VIFs) do not exceed 3. In conclusion, multicollinearity is unlikely to be an issue. Still, we use step-wise regressions to learn about the interrelationships among the independent variables.

Table 2.2. Correlations and variance inflation factors

	Variables	1	2	3	4	5	VIFs
1	Innovation performance						
2	Imitation performance	0.05					
3	Enterepreneurship rate	0.01	-0.20				1.69
4	Rate of knowledge-intensive firms	0.02	0.51*	-0.48*			2.97
5	ln (GDP per captia)	-0.26*	0.09	-0.34*	0.56*		1.83
6	ln (GDP)	0.10	0.32*	0.24*	0.27*	-0.15	1.59

* p<0.10, two-tailed tests
Notes: N=57 observation from 21 countries; VIF=variance inflation factor
Year dummies are included in the calculation of the VIFs.
The VIF values are all below 3 in the regression on imitation performance.
Data sources: CIS, COMPENDIA, and OECD Economic Outlook Database

2.5.2.   Pooled OLS regressions of innovation performance

Table 2.3 shows the results of pooled OLS regressions regarding innovation performance (standard errors are clustered). The empirical analysis is conducted in four steps. Model I is a baseline model in which we only include the macro-economic control variables and the year dummies. The baseline model already explains 13% of the variation in *innovation performance* (our dependent variable). In Model II, we add the knowledge variable to the baseline model and test for the effect of *knowledge* on *innovation performance*. As expected, a positive relationship is found in that a higher share of knowledge-intensive firms leads to higher innovation performance ($\beta=0.27$, $p<0.1$). The explanatory power of the model increases by 9%. The result confirms that the stock of knowledge is an important determinant of innovation performance. In Model III, we include the entrepreneurship variable in the model. The rate of entrepreneurship itself seems not to have an impact on innovation performance ($\beta=0.09$, $p=0.67$). The effect of the knowledge variable hardly increases from $\beta=0.27$ ($p<0.10$) in Model II to $\beta=0.31$ ($p<0.05$) in Model III. In Model IV, we test for the moderation effect of entrepreneurship: the interaction term shows a positive effect ($\beta=0.07$, $p<0.05$). Explanatory power increases by 7% points: from $R^2=22\%$ in Model III to $R^2=29\%$ in Model IV. A higher rate of entrepreneurship seems to increase the rate by which knowledge leads to innovative products. This result indicates that a higher rate of entrepreneurship facilitates the process of the commercialization of knowledge. Entrepreneurship is found to moderate the relationship between knowledge and innovation performance. To determine whether the OLS model produces consistent results, we performed a Breusch-Pagan test for random effects (Breusch and Pagan, 1980). The test shows significant results for Models I-II and insignificant results for Models III-IV. Thus, we can conclude that OLS coefficients are consistent in Models III-IV and inconsistent in Models I-II.

Table 2.3. Pooled OLS regressions on innovation performance

Independent variables	Model I Coeff. (SE)	Model II Coeff. (SE)	Model III Coeff. (SE)	Model IV Coeff. (SE)
Macro-economic variables				
ln(GDP)	0.28 (0.49)	-0.21 (0.67)	-0.34 (0.61)	-0.70 (0.66)
ln(GDP per capita)	-3.17 (1.57)†	-6.54 (2.29)**	-6.69 (2.19)**	-7.38 (2.25)**
Rate of knowledge-intensive firms		0.27 (0.14)†	0.31 (0.12)*	-0.33 (0.24)
Entrepreneurship rate			0.09 (0.20)	-0.38 (0.19) †
Rate of knowledge-intensive firms X entrepreneurship rate				0.07 (0.03) **
Year dummies (reference year: 1998)				
Year 2000	1.94 (1.45)	2.94 (1.76)	3.01 (1.78)	3.25 (1.70)†
Year 2004	1.70 (1.08)	2.81 (1.50)†	2.91 (1.39)*	3.13 (1.29)*
Year 2006	2.64 (0.79)**	3.98 (1.33)**	4.16 (1.12)**	3.13 (1.29)*
Constant	34.83† (17.98)	71.11* (27.33)	72.77* (26.97)	88.43** (26.70)
F-value	5.31 **	4.67 **	4.60 **	6.53 **
p-value Breusch-Pagan test for random effects	0.01	0.05	0.10	0.14
R^2	0.13	0.22	0.22	0.29
R^2 (without year dummies)	0.07	0.11	0.11	0.17
Adjusted R^2	0.04	0.12	0.11	0.18
N observations (countries)	57 (21)	57 (21)	57 (21)	57 (21)

SE=robust and clustered standard errors; Coeff.=regression coefficient

Data sources: CIS, COMPENDIA, and OECD Economic Outlook Database

†: at 0.1 significance level; *: at 0.05 significance level; **: at 0.01 significance level; two-tailed tests

We also calculated the effect of a time trend variable with year 1998=1, year 2000=2, year 2004=3, and year 2006=4. The coefficients (SE) are as follows: Model I: β=0.759 (0.31)*; Model II: β=1.13 (0.42) *; Model III: β=1.18 (0.33) **; Model IV: β=1.22 (0.32) **.

2.5.3. Pooled OLS regressions of imitation performance

As a further test of the role of entrepreneurship, we investigate whether entrepreneurship in fact does *not* moderate the relationship between knowledge and imitative products. Table 2.4 shows the results of the regressions regarding imitation performance. Knowledge clearly leads to more imitative products. A higher rate of knowledge-intensive firms increases turnover with imitative products ($\beta=0.51$, $p<0.05$, Model II). Table 5, however, also shows that entrepreneurship does <u>not</u> have an effect with regard to imitation performance. Neither the entrepreneurship variable included directly ($\beta=-0.29$, $p=0.13$, Model III) nor the interaction term ($\beta=-0.02$, $p=0.65$, Model IV) show significant results. Hence, a higher rate of entrepreneurship does not lead to more imitative products. This result re-confirms our proposition that entrepreneurship moderates the relationship between knowledge and innovation performance but does <u>not</u> have an impact on the relationship between knowledge and imitation performance. The results should be interpreted with caution because the Breusch-Pagan test for random effects (Breusch and Pagan, 1980) yields significant results. OLS coefficients may be inconsistent, which is why we also estimate random- and fixed effects regressions (see robustness checks below).

Table 2.4. Pooled OLS regressions on imitation performance

Independent variables	Model I Coeff. (SE)	Model II Coeff. (SE)	Model III Coeff. (SE)	Model IV Coeff. (SE)
Macro-economic variables				
ln(GDP)	1.91 (1.29)	0.98 (0.94)	1.40 (1.20)	1.52 (1.42)
ln(GDP per capita)	2.50 (2.12)	-3.89 (2.34)	-3.41 (2.04)	-3.19 (2.10)
Rate of knowledge-intensive firms		0.51 (0.18)[*]	0.39 (0.13)[**]	0.59 (0.48)
Entrepreneurship rate			-0.29 (0.19)	-0.14 (0.23)
Rate of knowledge-intensive firms X entrepreneurship rate				-0.02 (0.05)
Year dummies (reference year: 1998)				
Year 2000	-0.95 (1.92)	0.96 (2.02)	0.73 (1.86)	0.65 (1.90)
Year 2004	-9.53 (2.04)[**]	-7.44 (1.71)[**]	-7.78 (1.71)[**]	-7.85 (1.75)[**]
Year 2006	-10.43 (2.28)[**]	-7.88 (2.14)[**]	-8.48 (1.91)[**]	-8.53 (1.95)[**]
Constant	-30.58 (32.95)	38.23 (24.64)	32.81 (23.74)	27.82 (29.92)
F-value	6.51 [**]	6.93 [**]	6.13 [**]	6.84 [**]
p-value Breusch-Pagan test for random effects	0.01	0.11	0.05	0.04
R²	0.50	0.59	0.60	0.61
R² (without year dummies)	0.15	0.33	0.33	0.33
Adjusted R²	0.45	0.54	0.55	0.54
N observations (countries)[a]	57 (21)	57 (21)	57 (21)	57 (21)

SE=robust and clustered standard errors; Coeff.=regression coefficient

Data sources: CIS, COMPENDIA, and OECD Economic Outlook Database

[†]: at 0.1 significance level; [*]: at 0.05 significance level; [**]: at 0.01 significance level; two-tailed tests

We also calculated the effect of a time trend variable with year 1998=1, year 2000=2, year 2004=3, and year 2006=4. The coefficients (SE) are as follows: Model I: β=-4.07 (0.77)**; Model II: β=-3.37 (0.66)**; Model III: β=-3.57 (0.66) **; Model IV: β=-3.71 (0.71) **.

2.5.4. Further results from the regressions

Our analysis yields several other interesting findings. First, there seems to be a positive time trend with regard to innovation performance (β=1.18, p<0.01, Table 2.3, Model III) and a negative time trend with regard to imitation performance (β=-3.57, p<0.01, Table 2.4, Model

III). The ratio of innovative versus imitative products has increased over time in the 21 European countries. This phenomenon is one of the many indicators of the switch from the 'managed' to the 'entrepreneurial' economy (Audretsch and Thurik, 2001). Second, the regressions for imitation performance have higher R^2 values than the regressions for innovation performance (R^2=61% vs. 29% in Model IV). This substantial difference is due to the effect of the year dummies: inclusion of year dummies alone already explains 42% of the variation in imitation performance, while it only explains 5% of the variation in innovation performance. The autonomous decline in imitative performance seems to override the autonomous increase in innovative importance. This phenomenon is one of the many indicators of the decline in competitiveness of European countries. Finally, the finding that knowledge plays a role with both innovation (ß=0.27, p<0.1, Table 2.3, Model II) and imitation performance (ß=0.51, p<0.05, Table 2.4, Model II) is in line with what we expected. Investments in knowledge increase a country's level of absorptive capacity (Cohen and Levinthal, 1989, 1990), which has an effect on both imitation and innovation performance.

2.5.5. Robustness checks

To check the robustness of our results, we estimate random- and fixed-effects models (see Tables 2.5 and 2.6). Both models confirm our main finding that entrepreneurship moderates the relationship between knowledge and innovation performance (Table 2.5: Model II: β=0.07, p=0.03; Model IV: β=0.12, p=0.01) but also indicate that it does *not* have an impact on the relationship between knowledge and imitation performance (Table 2.6: Model II: β=-0.04, p=0.46). A Hausman specification test is used to compare the coefficients of the random- and fixed-effects regressions (Hausman, 1978). In all estimations, the test shows an insignificant result (p>0.10); the random-effects coefficients can be used because they do not differ in a systematic way from the fixed-effects coefficients. The fact that our results also hold for a fixed effects specification is reconfirming. We can conclude that our main findings hold irrespective of country-specific variables such as openness to trade or geographic location.

As further robustness checks, we estimate seemingly unrelated regression models (SUR) and two-stage simultaneous equation models in which the entrepreneurship variable is treated as endogenous. The moderation effect of entrepreneurship on the relationship between knowledge and innovation performance is similar to the effects in the other models. The estimation results are available from the authors upon request.

Table 2.5. Random and fixed-effects regressions on *innovation performance*

Independent variables	Random-effects regressions		Fixed-effects regressions	
	Model I	Model II	Model III	Model IV
	Coeff. (SE)	Coeff. (SE)	Coeff. (SE)	Coeff. (SE)
Macro-economic variables				
ln(GDP)	-0.02 (0.60)	-0.40 (0.67)	-23.30 (36.00)	-9.26 (37.28)
ln(GDP per capita)	-5.78 (2.26) **	-6.32 (2.16) **	31.30 (49.04)	21.22 (50.93)
Rate of knowledge-intensive firm	0.22 (0.10) *	-0.42 (0.30)	0.06 (0.10)	-0.91(0.34) *
Entrepreneurship rate	-0.00 (0.21)	-0.46 (0.27) †	-0.19 (0.36)	-0.99 (0.63)
Rate of knowledge-intensive firms X entrepreneurship rate		0.07 (0.03) *		0.12 (0.04) *
Year dummies (reference year: 1998)				
Year 2000	3.09 (1.65) †	3.16 (1.57) *	2.73 (1.77)	2.04 (1.65)
Year 2004	2.69 (1.11) *	2.82 (0.99) **	1.84 (2.01)	0.69 (1.61)
Year 2006	4.06 (1.00) **	4.18 (0.94) **	2.92 (2.09)	1.39 (1.79)
Constant	61.64 (26.65) *	75.97 (26.13) **	-15.57 (89.36)	-81.48 (80.17)
Wald chi²	26.83 **	34.89 **		
Hausman specification test [1]	p>0.10	p>0.10	p>0.10	p>0.10
F-value			2.04†	3.63**
Rho	0.22	0.20	0.99	0.97
R² within; between; overall	0.15; 0.30; 0.21	0.20; 0.36; 0.29	0.21; 0.11; 0.03	0.28; 0.12; 0.03
N observations (countries)	57 (21)	57 (21)	57 (21)	57 (21)
Obs. per group (min, avg, max)	1; 2.7; 4	1; 2.7; 4	1; 2.7; 4	1, 2.7, 4

SE=robust standard errors; Coeff.=regression coefficient

Data sources: CIS, COMPENDIA, and OECD Economic Outlook Database

† : at 0.1 significance level; *: at 0.05 significance level; **: at 0.01 significance level; two-tailed tests

[1] Model I is tested against Model III and Model II is tested against Model IV.

Table 2.6. Random and fixed-effects regressions on *imitation performance*

	Random-effects regressions		Fixed-effects regressions	
	Model I	**Model II**	**Model III**	**Model IV**
Independent variables	Coeff. (SE)	Coeff. (SE)	Coeff. (SE)	Coeff. (SE)
Macro-economic variables				
ln(GDP)	1.60 (0.99)	1.87 (1.14)	-27.12 (75.15)	-48.92 (69.13)
ln(GDP per capita)	-3.07 (2.64)	-2.67 (2.79)	32.17 (91.98)	47.84 (84.95)
Rate of knowledge-intensive firms	0.34 (0.19) [†]	0.68 (0.52)	0.12 (0.19)	1.63 (0.76) [*]
Entrepreneurship rate	-0.36 (0.23)	-0.13 (0.42)	-2.05 (0.92) [*]	-0.81 (1.13)
Rate of knowledge-intensive firms X entrepreneurship rate		-0.04 (0.06)		-0.18 (0.09) [†]
Year dummies (reference year: 1998)				
Year 2000	0.63 (2.44)	0.54 (2.42)	-0.27 (2.70)	0.80 (2.26)
Year 2004	-8.07 (1.88) [**]	-8.25 (1.89) [**]	-8.84 (3.69) [*]	-7.06 (2.81) [*]
Year 2006	-8.65 (2.21) [**]	-8.79 (2.19) [**]	-8.88 (4.44) [†]	-6.51 (3.25) [†]
Constant	28.39 (30.79)	19.26 (35.75)	54.19 (240.37)	156.61 (196.99)
Wald chi²	55.76 [**]	56.74 [**]		
Hausman specification test [1]	p>0.10	p>0.10	p>0.10	p>0.10
F-value			8.03 [**]	10.78 [**]
Rho	0.14	0.20	0.98	1.00
R² within; between; overall	0.57; 0.68; 0.60	0.59; 0.67; 0.60	0.62; 0.11; 0.01	0.65; 0.17; 0.04
N observations (countries)	57 (21)	57 (21)	57 (21)	57 (21)
Obs. per group (min., avg., max.)	1; 2.7; 4	1; 2.7; 4	1; 2.7; 4	1, 2.7, 4

SE=robust standard errors; Coeff.=regression coefficient

Data sources: CIS, COMPENDIA, and OECD Economic Outlook Database

[†]: at 0.1 significance level; *: at 0.05 significance level; **: at 0.01 significance level; two-tailed tests

[1] Model I is tested against Model III and Model II is tested against Model IV.

2.6. Discussion

2.6.1. Innovation in the knowledge spillover theory of entrepreneurship

Both the endogenous growth theory and the R&D capital approach point to knowledge as a major driver of economic growth. Less is known about *how* this source of economic growth has its effect on growth. This means that it is difficult for policy-makers to identify policy instruments that promote growth. Glaeser et al. (1992) have established that knowledge and ideas do not spill over automatically: in the context of cities, it takes competition and diversity to generate growth (see also Audretsch, 1995; Audretsch and Feldman, 1996). The important finding that knowledge does not automatically spill over has given rise to the development of the concept of the knowledge filter, i.e., the impediments that keep knowledge from spilling over from where it is created to where it can be commercialized (Acs et al., 2005; Audretsch, 2007a). Independently of the investigation of the role of knowledge, a different strand of literature has developed that emphasizes the role of entrepreneurship in economic growth. See Audretsch and Thurik (2001) and surveys such as Carree and Thurik (2003) and Van Praag and Versloot (2007). This development has culminated in the view that the older 'managed' economy has been replaced by a newer 'entrepreneurial' economy (Audretsch and Thurik, 2001; Audretsch, 2007b). The view that entrepreneurship is an independent production factor like human, physical and knowledge capital has led to the introduction of entrepreneurship capital into the production function (Audretsch and Keilbach, 2004) and to various studies showing that entrepreneurship indeed influences economic growth (Erken et al., 2009). Although there are many indications in the knowledge literature that the (spatial) organization of business plays a role (Audretsch and Feldman, 1996) and in the entrepreneurship literature that knowledge and its diffusion play a role (Audretsch and Thurik, 2001), it took the knowledge spillover theory of entrepreneurship to bring this all together (Audretsch and Lehmann, 2005; Audretsch and Keilbach, 2007, 2008; Acs et al., 2009). This theory is sometimes presented as the missing link (Acs et al., 2005). However, within this missing link, there is another missing link: the role of innovation. Knowledge and entrepreneurial activity may ultimately lead to economic growth, but not without first producing innovative products. The latter missing link is addressed in the present chapter using a panel dataset for the aggregate innovation activity of 21 European countries collected in four time waves. Our results clearly show that entrepreneurship moderates the relationship between knowledge and innovation but has <u>no</u> impact on the relationship between knowledge and imitation. In other words, our results show that countries with a high rate of entrepreneurship perform better in terms of innovation performance.

Figure 2.1 illustrates our extension of the knowledge spillover theory to the area of innovation. The production of knowledge increases the aggregate stock of knowledge (arrow 1). Existing or new firms can draw from this aggregate stock and develop both imitative (arrow 2) and innovative products (arrow 3).[10] Entrepreneurship moderates the relationship between the aggregate stock of knowledge and the number of innovative products (innovation performance) (arrow 4), but it has *no* impact on the relationship between the aggregate stock of knowledge and the number of imitative products (imitation performance).[11] Both imitative products and innovative products may lead to economic growth. The mechanisms involved, however, are different and may depend on the country's level of development (Vandenbussche et al., 2006). We will not go deeper into this discussion because it is beyond the scope of our chapter.

Figure 2.1. The moderating role of entrepreneurship in the relationship between knowledge and innovation
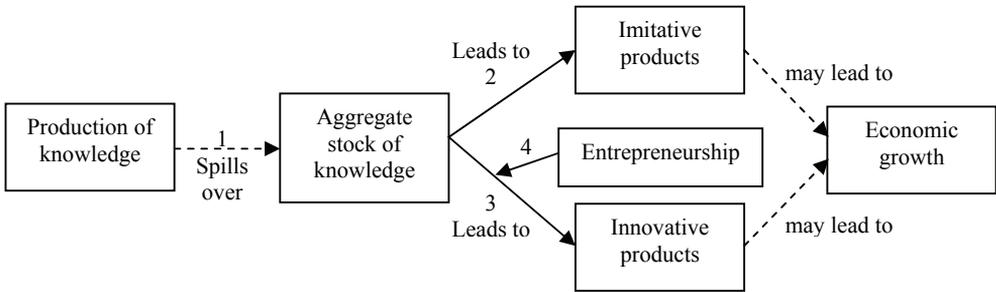
------ not tested in our study

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[10]   Consider the following illustrating example: firm A discloses new knowledge (e.g., through filing a patent). Firm B applies this new knowledge to create a product that is similar to the product idea of firm A (which then leads to an imitative product). Firm C, however, uses this new knowledge to create a product that is new to both firm A and firm B (which then leads to an innovative product).

[11]   A different mechanism is suggested by Audretsch, Boente and Keilbach (2008) where innovation efforts are assumed to generate technical knowledge and entrepreneurship capital while the latter two are assumed to lead to economic growth.

2.6.2. Explanations for the moderating role of entrepreneurship

Our findings regarding the role of entrepreneurship are clearly in line with a Schumpeterian view of entrepreneurship. In his early works, Schumpeter argued that entrepreneurs are not necessarily inventors or knowledge creators (Schumpeter, 1934). Rather, their role is to transform knowledge into products. Being innovators, they are responsible for the introduction of new products, the creation of new production methods, and the opening of new markets, etc.. Schumpeter saw the entrepreneur as an agent who can cope with uncertainty, thereby inducing technological change and progress. Our findings regarding the role of entrepreneurship support this view: entrepreneurship moderates the relationship between knowledge and innovation performance but has no impact on the relationship between knowledge and imitation performance. The former relationship is characterized by a high degree of uncertainty, whereas the latter is not necessarily so.

Because entrepreneurship is often related to small firms, our findings are also in line with the view that small firms face relatively lower costs of experimentation than do large firms. The formers' potential losses from innovation are bounded at a low level (Jovanovic, 1982). In addition, small firms may have an advantage with regard to rewarding their employees for high-value innovation (Wiggins, 1995).

2.6.3. Implications for innovation policy

Our main finding that entrepreneurship moderates the relationship between knowledge and innovation performance has important policy implications. From an innovation policy perspective, it is not sufficient to promote the production of new knowledge (e.g., by means of R&D subsidies or university education); it is equally necessary to have entrepreneurs who turn this new knowledge into innovative products (subsequently leading to economic growth). If there are only a few entrepreneurs in a knowledge-intensive region, the Swedish or the European paradox (Ejermo and Kander, 2006; Audretsch, 2007a) can emerge, meaning that many commercial opportunities will remain under-exploited while at most there will be a possibility of them being exploited outside the region. In any case, the profits will not flow back to the region in which the knowledge was produced. To prevent this situation from arising, policy-makers may want to promote entrepreneurship in their own country or region. This could be achieved through subsidized loans to high-tech entrepreneurs, regulatory exemptions for innovative new start-ups, or tax benefits. However, we believe that simply encouraging more people to become entrepreneurs is not an effective policy. The government should support those entrepreneurs who really take the risk of transforming new knowledge

into innovative products and focus less on those entrepreneurs who merely start another shop around the corner[12]. Many start-ups do not fall into the first category but, rather, belong to the latter group (Koellinger, 2008). An alternative strategy for policy-makers would be to promote (entrepreneurship) education to increase the number of qualified and risk-taking entrepreneurs; this would be a more long-term approach.

2.7. Concluding Remarks

More research is needed to determine how to identify, attract, and support those entrepreneurs who transform knowledge into innovative products and thereby increase the competiveness of their particular region. Some questions worth investigating include the following: what types of entrepreneurs turn knowledge into new products (young versus experienced entrepreneurs)? How should these entrepreneurs be funded (equity versus debt)? What is the role of technology clusters and government-sponsored technology parks with regard to the relationship between entrepreneurship and innovation performance?

The stagnation of the competitiveness of the European economies is often attributed to their inability to transform new knowledge into commercially viable products. It has been a persistent notion of policy-makers that entrepreneurs play a larger role in this transformation than do large corporations. A wave of policies focusing on the promotion of entrepreneurship has followed. The present analysis shows that this notion is justified.

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[12] See also Shane (2009) who discusses at length why simply encouraging more people to become entrepreneurs is a bad public policy.

Appendix 2.1. Description of variables

Variable	Description	Data source
Innovation performance (in %)	CIS question: "What is the percentage of total turnover from goods and service innovations introduced during the last three years that were new to the market?" The question was included in CIS2 (1996-1998), CIS3 (1998-2000), CIS4 (2002-2004), and CIS2006 (2004-2006).	Community Innovation Survey: CIS2, CIS3, CIS4, and CIS2006 (only answers from manufacturing firms)
Imitation performance (in %)	CIS question: "What is the percentage of total turnover from goods and service innovations introduced during the last three years that were new to the firm?" The question was included in CIS2 (1996-1998), CIS3 (1998-2000), CIS4 (2002-2004), and CIS2006 (2004-2006).	Community Innovation Survey: CIS2, CIS3, CIS4, and CIS2006 (only answers from manufacturing firms)
Ln (GDP)	Natural logarithm of Gross Domestic Product in million US $; in purchasing power parities adjusted to prices from 1995	OECD Economic Outlook Database 2009
Ln (GDP per capita)	Natural logarithm of Gross Domestic Product divided by total population; US dollars; in purchasing power parities adjusted to prices from 1995	OECD Economic Outlook Database 2009
Entrepreneurship rate (in %)	The number of business owners (excluding the agricultural sector) as a percent of the total labor force.	COMPENDIA (version of 2007)
Rate of knowledge-intensive firms (in %)	CIS question: "During the last three years, did your enterprise apply for a patent?" The question was included in CIS2 (1996-1998), CIS3 (1998-2000), CIS4 (2002-2004), and CIS2006 (2004-2006). The variable is calculated as the number of firms that answered 'yes' as a percentage of the total number of firms.	Community Innovation Survey: CIS2, CIS3, CIS4, and CIS2006 (only answers from manufacturing firms)

CHAPTER III

Knowledge management and its relationship with organizational context: an empirical exploration on Dutch SMEs

Abstract: Based on an empirical study of 496 Dutch SMEs, this chapter shows that certain knowledge management (KM) practices are prevalent among SMEs. Formal KM approaches are used for acquiring knowledge through external connections and for storing internal knowledge. Informal KM approaches through socialization are adopted by SMEs for internal knowledge transferring, sharing and exploitation. This study implies that despite their resource constraints, SMEs find their own ways, i.e. relying on a more people-centered KM approach, to build their competitive advantages on knowledge. Furthermore, the chapter tests a predictive model of KM practices based on selected organization contexts. Empirical results indicate that larger SMEs are more likely to use formalized KM practices and that family-oriented firms are less likely (than nonfamily firms) to use formal KM practices. Results also show that SMEs pursuing formalized strategies, including an innovation orientation, a sales-focused market orientation, and a competitor orientation strategy, are more likely to engage in a wider range of KM practices. Our empirical findings support the contingency models of strategy from a strategy implementation perspective. The choice of strategy directs deliberate selection of management practices to improve the effectiveness of executing that strategy. Our study contributes with unique empirical evidence in an SME context to other management theories, including the resource-based view and agency theory.

3.1. Introduction

From a dynamic capabilities view, a firm's competitive success arises from the continuous development and reconfiguration of firm specific assets such as knowledge (Teece and Pisano, 1994; Teece et al., 1997). The management of knowledge has been proven as a key source of competitive advantage for the success of firms (Winter, 1987; Prahalad and Hamel, 1990; Hedlund and Nonaka, 1993; Nonaka and Takeuchi, 1995; Grant, 1996; Prusak, 1996; Spender and Grant, 1996; Davenport and Prusak, 1998). For instance, knowledge management (KM) has been examined in past research as a possible determinant of a firm's innovation capability (Corso et al., 2001). A report by Business Intelligence (quoted in Numri, 1998) claims that successful KM programs can produce up to tenfold returns, thus indicating that KM might have a positive effect on firm performance.

To date, some of the most extensive research on knowledge transfer and sharing has been centered on the nature of networks among (larger) firms and between such firms and public institutions. On the contrary, research over the past thirty years repeatedly shows patterns that a disproportionate amount of innovation (including patents, inventions and discoveries) comes from small to medium-sized enterprises (SMEs) (Thompson and Leyden, 1983; Acs and Audretsch, 1993). Although research and policy interest in KM is beginning to grow for SMEs (e.g. Wong and Radcliffe, 2000; Sparrow, 2001), previous studies typically rely upon either qualitative methods and/or fairly small samples (Uit Beijerse, 1999; Koskinen and Vanharanta, 2000; Wong and Radcliffe, 2000; Sparrow, 2001; Sabatier et al., 2005; Dosouza and Awazu, 2006; Uhlaner and van Santen, 2007). There is relatively little empirical evidence that provides a general understanding of the characteristics of KM issues in SMEs. This is the primary focus of the present study. More specifically, based on a random sample of 496 Dutch SMEs, we investigate empirically the prevalence of different KM practices among SMEs as well as the relationships between certain aspects of organization context and the variation of KM practices used by SMEs.

The definition of KM in the present study is based on research by Choo and Bontis (2002), Takeuchi and Nonaka (2004), Uit Beijerse (1999) and von Krogh et al. (2000). Common to their definitions is the identification of three KM processes to unlock tacit knowledge. KM encompasses the entire knowledge acquisition and utilization process, beginning with locating and capturing knowledge, followed by transferring and sharing knowledge, and eventually enabling that knowledge within the firm in turn (Choo and Bontis, 2002; Takeuchi and Nonaka, 2004). Accordingly, *KM practices* refer to those organizational

routines by which a firm can acquire, share, transfer, store and/or exploit knowledge to fulfill these KM processes.

Organization contexts include firm size, family orientation and certain aspects of organization strategy (including innovation orientation, sales-focused market orientation, competitor orientation, service orientation, cost optimization and strategy formalization). These contextual variables are controlled for by firm age, ownership structure and industrial sectors. The rationale of organization contexts in explaining the variation of KM practices is based on a blend of theoretical approaches. For instance, the resource-based view focuses on the scale effect of size to explain variation in use of KM practices. Agency theory and the resource-based view provide alternative explanations for differences in KM practices between family-oriented and non family-oriented firms. Finally, contingency theory and other research from the strategic management literature explain the role of strategy in predicting the variation of KM practices. In previous studies, some of these variables have been identified as having an influence on KM practices in the context of larger firms (Mohan-Neill, 1995; Sparrow, 2000; Nooteboom, 2001; Yli-Renko et al., 2001).

This chapter makes an empirical contribution to the limited quantitative studies on KM in SMEs in the following ways. *First,* we investigate the prevalence of different KM practices in a large sample consisting of 496 Dutch SMEs. Using frequency analysis on the KM practices applied by these Dutch SMEs, we provide a general understanding of the characteristics of KM practices in SMEs. *Second*, we develop and perform a preliminary test of a predictive model of KM practices in SMEs based on certain aspects of organization contexts. *Third,* contingency models of strategy support the assumption that effective implementation of certain strategic choices requires administrative decisions about various management practices such as management systems, choice of key management personnel and HRM practices (Naylor et al., 1980; Ginsberg and Venkatraman, 1985; Schuler and Jackson, 1987; Jackson et al., 1989; Schuler, 1991). This study contributes an empirical understanding to this less explored field by treating strategy as an antecedent for various KM practices.

The remainder of this chapter is organized as follows: In section 3.2, we explain KM studying more detail. In section 3.3, we describe the relationships between organization context and KM practices. Section 3.4 presents the research methodology regarding sampling, measures and model tests to be used in the data analysis. Empirical results are presented in section 3.5. Section 3.6 covers discussion of results, implications, conclusions, and directions for future research.

3.2. Knowledge management and its overall degree of formalization

As defined in the introduction, our definition of KM is comprised of three KM phases to unlock tacit knowledge (Uit Beijerse, 1999; von Krogh et al., 2000; Choo and Bontis; 2002, Takeuchi and Nonaka, 2004). These phases include: 1) capturing and locating knowledge; 2) transferring and sharing knowledge; and 3) enabling knowledge.

KM practices for capturing and locating knowledge include *knowledge acquisition practices* and *knowledge storage practices*. These practices are mainly concerned with unlocking tacit knowledge into explicit knowledge – a process referred to in the KM literature as externalization (Nonaka, 1994; Nonaka and Takeuchi, 1995; Nonaka and Tomaya, 2003). *Knowledge acquisition* can occur both internally through, for instance, research and development activities, and externally through hiring new employees (Holsapple and Jones, 2004), connecting with experts in other organizations, and by participating in presentations or seminars (Uit Beijerse, 2000; Nooteboom, 2001). Recent studies indicate that external connections are an important way for SMEs to capture needed knowledge, because such approaches are often much less expensive than building an internally created knowledge base via research and development investments (Wong and Aspinwall, 2004; Desouza and Awazu, 2006). *Knowledge storage practices* are another means for capturing and locating knowledge. For example, data warehousing is mainly concerned with maintaining repositories of books and manuals, knowledge management systems (KMS), enterprise resource planning (ERP) and filing-systems (both computerized and non-computerized) where knowledge can be systematically captured (von Krogh et al., 2000).

Knowledge transferring and sharing practices in the second phase emphasize the dissemination of both explicit and tacit knowledge throughout the organization, and can involve a combination of ICT and non-ICT solutions (Uhlaner and van Santen, 2007). Non-ICT solutions are thought to be particularly important for SMEs for a variety of reasons. On the one hand, SMEs generally lack financial resources or technological sophistication. On the other hand, tacit knowledge, which is not easily codified and thus cannot be transferred (Davenport and Prusak, 1998), is perhaps most effectively shared directly between individuals through discussion among colleagues or direct observation (von Krogh et al., 2000). Desouza and Awazu (2006) find that internal knowledge transfer (either from owner to employee or between employees) occur via formal and informal social mechanisms. They further suggest that socialization, which is primarily a process between individuals to transfer tacit knowledge

from one person to the other (Nonaka, 1994; Nonaka and Takeuchi, 1995; Nonaka and Tomaya, 2003), is a dominant peculiarity of KM in SMEs (Desouza and Awazu, 2006). Furthermore, as the major source of knowledge in SMEs, owner-managers often also play an important role in explaining which KM practices are being used and to what extent organizational knowledge ought to be transferred and shared (Wong and Aspinwall, 2004).

Knowledge exploitation practices in the enabling phase integrate new knowledge with existing knowledge to improve a firm's business performance. The effectiveness of exploiting knowledge builds upon organization-wide knowledge accessibility and dissemination through formal and informal conversations (von Krogh et al., 2000). Wiklund and Shepherd (2003) suggest that SMEs highly rely on individual know-how, especially that of entrepreneurs and managers in the firm. Effective enabling practices promote lateral communication and dialogue through which employees can share new ideas and/or reflect on each other's viewpoint (von Krogh et al., 2000).

Regardless of the type of KM practice, the formalization of KM practices is another aspect that is researched in the context of SMEs (Uhlaner and van Santen, 2007). While some researchers suggest that SMEs are less likely to use formal KM practices such as technology-based knowledge repositories due to the resource constraints and simpler organizational structure (e.g. Wong and Aspinwall, 2004), others argue that formal systems and routines are as important for a firm as are informal social activities (e.g. Gray and Gonsalves, 2002). A resource-based view (Barney, 1991) in particular, implies that a firm needs to hold and manage knowledge in the form of established procedures, patents, training patterns or organization routines in order to sustain its competitive advantage.

As proposed by De Kok and Uhlaner (2001), there is no universally accepted definition to distinguish the overall degree of formalization. In their study of HRM practices, they point out that formalization has been variously referred to as: 1) the degree to which a procedure is regularly applied within the organization; 2) the extent to which a rule or procedure is written down; and/or 3) the degree to which the employer (vs. the employee) takes the initiative to assure that an activity take place. We adopt the view in the present study that formalization must meet any of the aforementioned three criteria.

3.3. Organization context and KM practices

In the present study, the scope of organization contexts is limited to firm size, family orientation and certain aspects of strategy. The rationales on the relationship between these organization contexts and KM practices are grounded in the resource-based view, agency theory, and contingency theory. We elaborate further on the rationales and implied hypotheses in the remainder of this section.

3.3.1. Firm size

Firm size is often used as a general indicator for the level of specific resources available. Small firms are more likely to operate in an informal and flexible manner than their larger counterparts (Marlow and Patton, 1993; Storey, 1994; Hendrickson and Psarouthakis, 1998). The rationale of this scale effect is supported by the resource-based view in the following ways: *first*, smaller size reduces the complexity of a firm's organizational structure. The flat and simple organizational structure associated with smallness makes formal approaches less necessary (Mintzberg, 1983; Wong and Aspinwall, 2004); *second*, due to the lack of size and financial scope, smaller firms do not have enough resources for development costs. Furthermore, in spite of a possible need for such investment, they cannot benefit from economies of scale to cover development costs (Nooteboom, 1993; Desouza and Awazu, 2006). Hence, they are less likely to invest in formal organization routines; *third*, smaller size also reflects the limitation of knowledge resources. Penrose (1995) argues that a firm's knowledge will accumulate corresponding to growth in firm size. Larger firms are likely to formalize KM practices in order to take advantage of more obvious opportunities for specialization of knowledge. Based on all these reasons, we thus could argue that availability of resources, which is strongly correlated with size, affects the variation of KM practices adopted by SMEs. This leads to our hypothesis 1 as follows:

Hypothesis 1: The larger the SMEs, the more likely that formalized KM practices will be used.

3.3.2. Family orientation

The earliest and still more broadly adopted structural definition of family orientation was developed by London Business School (Stoy Hayward, 1989). According to this definition, a firm is classified as a family business if more than 50% of shares are owned by one family, or at least 50% of the management team are from one family, or/and a significant number of members of the board are from a single family. However, this definition is problematic for SME research since most small firms fit the definition of the family firm

according to this definition (Klein, 2000; Uhlaner, 2005). Thus, more recent research has attempted to develop definitions which better differentiate extent of family orientation amongst small firms (Astrachan et al., 2002). The current study uses a multifaceted approach which combines different dimensions into one scale, inspired by the approach to family orientation scale development suggested by Uhlaner (2005) and which captures a number of the common elements for family business measurement (Stoy Hayward, 1989; Klein, 2000; Astrachan et al., 2002).

Agency theory and the resource-based view explain the variation of KM practices between family and non-family firms. According to agency theory, when owners (principals) and managers (agents) are part of the same family, coordination between the two through, for instance, monitoring and contracting should be more efficient and simpler (Steier, 2003). Thus formal approaches are not necessary within family-oriented firms. The resource-based view provides an alternative explanation, based on the assumption that differences in firm-specific resources, such as physical, knowledge, organizational and human resources, cause a fundamental heterogeneity in their productive potential (Priem and Butler, 2001). Family-oriented firms often have their limitations in specific resources due to their comparatively smaller size and reduced complexity compared to non family-oriented firms (Daily and Dollinger, 1993; Cromie et al., 1995). This makes family-oriented firms less likely to use a formal approach.

Although which theory best explains the results to date is somewhat open to interpretation, the finding of less formality in family firms is consistently supported by empirical research to date. For instance, studies by Reid and Adams (2001) and De Kok et al. (2006) both report that family-oriented firms are less likely to use formal HRM practices. Other research in the context of accounting practices shows that even when controlling for size and other organization context variables, family-oriented firms are less systematic in their use of accounting procedures and policies (Jorissen et al., 2002). Taking views from both the underlying theories and empirical findings together, one would expect less formal KM practices used in the family-oriented firm. Hypothesis 2 is thus formulated as follows:

Hypothesis 2: The more family oriented the firm, the less likely that the firm will be engaged in formal KM practices.

3.3.3. Strategy

In the present study, certain aspects of strategy include *strategy formalization* and five types of strategy: *innovation orientation*, *sales-focused market orientation, competitor orientation*, *service orientation* and *cost optimization*. These aspects are selected furthermore because they are often found to be relevant in the SME population of firms.

Strategy formalization refers to whether or not a firm uses a formal approach to define its strategy. It often implies a formal directive of owner-manager's goals, objectives and targets which is also titled as a firm's mission or strategy statement.

Innovation orientation refers to a strategy where a firm focuses on offering new and unique products or services to gain and sustain competitive advantage. *Sales-focused market orientation* and *competitor orientation* in this chapter are the two dimensions of what Kohli and Jaworski (1990) refer to as "market orientation strategy": the organization-wide generation of market intelligence pertaining to current and future customer needs, dissemination of intelligence across departments, and organization-wide responsiveness. Firms pursuing sales-focused market orientation strategy focus on capturing new and maintaining existing markets, and trying to understand future customer needs. Those pursuing competitor orientation strategy emphasize the investigation of competitors' moves. Innovation orientation, as well as market orientation's external focus on customer needs and competitor capabilities, can be viewed as a variant of Porter's strategic concept of "differentiation" (Porter, 1980).

Service orientation emphasizes the motivation of firms for providing an excellent service to customers. Although service orientation does not quite fit any of Porter's generic strategies (Porter, 1980), it is commonly referred to in both the SME and marketing literatures as one of the key success factors especially for SMEs (Hendrickson and Psarouthakis, 1998). *Cost optimization* implies that a firm tries to retain its competitive advantage by optimizing its overall cost competitiveness in the market. It must be noted that this does not hold exactly the same meaning as Porter's "cost leadership" though the two are probably correlated (Porter, 1980, 1985).

These different strategies are distinct as they create a unique position of a firm in the value system, and require a distinct set of organization configurations, employee behaviors, skills, managerial mindset and activities for successful execution (Porter, 1980).

From a strategy formulation perspective, on the one hand, strategy can be conceptualized as a response to organizational and environmental factors as well as to the level

of a firm's performance. On the other hand, from a strategy implementation perspective, different types of strategy are considered as having different influences on administrative decisions (Ginsberg and Venkatraman, 1985). For the purpose of this study, we adopt a strategy implementation perspective. We thus use strategy to predict variation in use of KM practices. Though specific research on strategy explaining the variation of KM practices is lacking, researchers have examined similar relationships in other aspects of the organization context. For instance, several studies support that there is a variation of HRM policy and practices among firms due to the types of strategy they pursue. A firm with a survival strategy such as cost minimization is more likely to use narrow policies compared to the firm pursuing a competitive strategy, which dictates demands for skilled employees and a long-term perspective of HRM to develop human resources (Schuler and Jackson, 1987; Lengnick-Hall and Lengnick-Hall, 1988;). In a similar vein, we could assume that the extent to which an SME manages its knowledge resources is dependent on its distinct strategy.

Through formalizing a strategy, employees of a firm can be well informed about the priorities of the firm. Furthermore, this formal strategy can also serve as a guideline for the owner-managers to allocate key resources (e.g. knowledge and human capital) and define priorities in order to respond to the emerging opportunities and changing environment. Having formally defined a strategy, a firm is clearer about its knowledge gaps and can identify what knowledge will be truly valuable for its success (Halawi et al., 2006). This can make implementation of KM more effective. KM has consistently proven to be a key source of a firm's competitive advantage (Winter, 1987; Prahalad and Hamel, 1990; Hedlund and Nonaka, 1993; Nonaka and Takeuchi, 1995; Grant, 1996; Prusak, 1996; Spender and Grant, 1996; Davenport and Prusak, 1998). However, KM can only create significant value when it is linked to a firm's overall strategy (Halawi et al., 2006). This leads to hypothesis 3.

Hypothesis 3: Firms following a formal approach to define their strategy are more likely to engage in both formal and informal KM practices.

Furthermore, firms with an *innovation orientation* are more likely to engage in KM practices because knowledge is a key ingredient for innovation. The success of such firms is based on the unique new products and services that they could offer to competitive markets. Therefore, such firms need to actively engage in acquiring, creating, storing, internally sharing and exploiting their unique knowledge, and prevent the leakage of such knowledge to their competitors.

Sales-focused market-oriented firms require well-developed knowledge acquisition and a repository of knowledge about existing as well as of related markets. They need to know how to develop and maintain strong relationship with key customers. By doing so, they can profitably develop tailored products and services based on the needs of their customers as well as swiftly respond to an emerging related market which has the greatest opportunity for profitable sales growth. In this sense, specific knowledge of the market and specific knowledge of customers is crucial for such firms. It is thus important to systematically acquire, update, store and integrate such knowledge through KM practices.

Competitor-oriented firms are keen to develop their market sensing and customer linking capabilities in order to sustain or gain market share (Day, 1994). Such firms must continuously study their competitors, and continuously update their knowledge about their competitors. Only then they can react in an effective way and retain their competitive advantage. Specific knowledge of the market and competitors is important for such firms. This should be acquired, stored, shared and transferred within the firm through well developed KM practices.

Service-oriented firms may or may not engage in systematic KM practices. On the one hand, firms believing in service excellence will be more likely to pursue knowledge activities – especially acquiring feedback from customers, and to share and integrate such feedback internally to improve and provide customized services. On the other hand, firms may be less likely to pursue knowledge activities when they only provide average or undifferentiated service to customers.

Finally, we assume that a *cost optimization* strategy is least likely to pursue KM practices, as many small firms can often compete on low cost simply due to the fact that they are smaller than many of their competitors and thus carry less overhead. Naturally true cost leadership may require a more sophisticated set of strategies but we are assuming this will not be the case for most SMEs. Given above discussion, we formulate our hypotheses on the five strategies and KM practices as follows:

Hypothesis 4: Firms putting greater emphasis on innovation orientation strategy are more likely to engage in both formal and informal KM practices.

Hypothesis 5: Firms putting more emphasis on sale-focused market orientation strategy are more likely to engage in both formal and informal KM practices.

Hypothesis 6: Firms putting more emphasis on competitor orientation strategy are more likely to engage in both formal and informal KM practices.

Hypothesis 7: Firms putting more emphasis on service orientation strategy are more likely to engage in both formal and informal KM practices.

Hypothesis 8: Firms putting more emphasis on cost optimization strategy are less likely to engage in both formal and informal KM practices.

3.4. Methodology

3.4.1. Sample and data collection

This chapter uses a sub-sample of firm-level data from the 'SME Business Policy Panel' that has been tracked longitudinally by EIM Business Policy and Research since 1998. The total panel consists of about 2000 SMEs and is stratified according to sectors (manufacturing, construction, retail and wholesale, and service), according to BIK (Dutch Industrial Classification Chambers of Commerce) codes and size classes (0-9, 10-49 and 50-99 employees in FTEs).

For this particular study, we collected information about key variables via telephone (computer-aided) interviews in 2006. Statements describing KM practices are formulated based on previous exploratory studies (uit Beijerse, 2000, van Santen, 2002; Wong and Aspinwall, 2004) and these items are measured on a five-point disagree/agree scale.

We also adopted a key informant approach for this study (Kumar et al., 1997) by interviewing the owner-manager of an SME in each case. Though this approach might lead to single-response bias (Golden, 1992), our approach also benefits from direct measure of the perceptions of the owner-managers. Owner-managers are found to play a vital role in recognizing the value and the opportunity of knowledge and manage such knowledge effectively in turn (Alvarez and Busenitz, 2001).

The target group of this particular study includes only independent firms with at least four employees from all sectors defined in the panel: manufacturing, construction, retail and wholesale, and service. This resulted in a sample of 496 firms available for empirical analysis. Within the sample, about 50% of respondent firms are less than 17 years old; and about 45% of our sample is in the service sector. Regarding size, about 53% of respondent firms have 4-9 employees, about 36% have 10-49 employees and the remaining 11% have between 50-99

employees. Thus, the sample is somewhat dominated by relatively young and small firms in the service sector.

3.4.2. Variables

Scale construction. To construct multi-item variables, we used a combination of techniques, including factor analysis (using principal components extraction and varimax rotation), testing for reliability using the Cronbach-alpha reliability coefficient, correlation between variables and a check for face validity. Variables based on items with scales of the same length were created by taking the mean of different items. Variables that required a combination of items with scales of different lengths made use of the protocol referred to as categorical principal components analysis (CATPCA) and was executed using the Statistical Package for the Social Sciences (SPSS). Appendix 3.1 provides a more extensive description of each variable in the present study.

KM practices. Statements describing KM practices in the present study include both formal and informal KM practices for the three KM phases. The questionnaire used for the original study covers 20 KM practices. However, after conducting factor analysis on all 20 practices, only two factors drawn from 12 practices are retained as they have acceptable or higher Cronbach-alpha coefficient (Nunnally, 1967) and could have been anticipated on the basis of the theoretical dimensions. The first factor combines nine practices assessing the degree to which a KM practice is regularly applied and/or formally organized within the organization (Cronbach's $\alpha= 0.79$). The second factor (Cronbach's $\alpha= 0.57$) combines three KM practices that emphasize individual involvement and efforts, in particular, employees' initiatives to assure that an activity takes places (see Appendix 3.1). Based on the criteria of formalization, we identify the two factors as representing formal and informal KM practices, respectively.

Strategy. Items measuring strategy include: innovation orientation, sales-focused market orientation, competitor orientation, service orientation, cost optimization and strategy formalization. Using factor analysis, we identify a four-item factor for innovation orientation strategy, including items on attitudes towards innovation of products, services or production processes and expected investments in innovations (Cronbach's alpha= 0.58), a two-item factor for sales-focused market orientation strategy including items on attitudes towards market activities regarding sales performance (Cronbach's alpha= 0.59) and a two-item factor for competitor orientation including items on attitudes towards competitors (Cronbach's alpha= 0.83). All three factors have acceptable or higher Cronbach-alpha coefficients. Single item

variables were used for service orientation, cost optimization, and strategy formalization (See Appendix 3.1).

Family orientation: Items measuring family orientation captures a number of common elements for family business measurement (Stoy Hayward, 1989; Klein, 2000; Astrachan et al., 2002). Factor analysis suggests a four-item factor for family orientation to the present study (Cronbach's alpha= 0.74), including items on family relations such as whether owners or managers are family members and family influence, as, for instance, the extent to which family members determine strategy.

Firm size: The natural logarithm of the number of full-time employees in 2006 is used as a proxy of firm size.

Control variables: Firm age, industrial sectors (manufacturing, construction, retail and wholesale, and service) and ownership structure are included as control variables. Firm age is measured by years since the establishment of a firm. Firm age is found to be positively correlated to formalized KM practices in the previous studies (Mohan-Neill, 1995; Penrose, 1995; Hendrickson and Psarouthakis, 1998; Sparrow, 2000).

Ownership structure is comprised of three aspects including number of owners, number of managers, and combined director-ownership. Ownership structure reflects the complexity of an organization that is correlated with firm size. Smaller firms generally have flatter simple structures which could ease the coordination of work using direct supervision. Knowledge transfer can be done via personal communication between owner and employees, and among employees. This makes formal KM practices less necessary (Mintzberg, 1983). Furthermore, when the director and owner are one and the same, monitoring is not needed since principal (owner) and agent (director) are one and the same.

Common method bias tests. Although reliabilities of scales in some cases are somewhat lower than desired, results from the common method bias test support the conclusion that each scale measures a separate construct (Podsakoff and Organ, 1986; Tippins and Sohi, 2003). More specifically, results were checked via an orthogonally rotated Principal Components Analysis (PCA) including individual items for KM practices, innovation orientation, sales-focused market orientation, competitor orientation and family orientation. Based on Harman's single-factor test, results show that items for each KM factor (formal and informal KM practices), innovation orientation, sales-focused market orientation, competitor orientation and family orientation all load on separate factors (See Table 3.1). In further support of the lack of

common method bias, in the un-rotated solution, the largest factor explains only 24% of total variance. Furthermore, component loadings range from 0.40 to 0.87, with an average statement loading on the intended construct of 0.72. Of the 120 potential cross-loadings, only one loading is above 0.30. Altogether, these findings provide reasonable confidence that the common method bias is not a major problem in the current study. However, given the limits of the methodology we cannot rule out such bias altogether (Podsakoff et al., 2003).

3.4.3. Data analysis

Two data analysis methods are applied in this study: 1) We conduct a simple frequency analysis to investigate the prevalence of each KM practice among Dutch SMEs. Frequencies are based on the number of respondents reporting that a particular KM practice is '4 = applicable to a great degree' or '5 = totally applicable' as a share of total respondents in our sample; 2) In order to examine the relationship between organization contexts and KM practices, we applied seemingly unrelated regression (SUR) model proposed by Zellner (1962). We estimate a set of two KM equations with cross-equation parameter restrictions and correlated error terms. Such equations can also be estimated with the help of Ordinary Least Squares (OLS). However, when the error terms of these equations are significantly correlated, the OLS coefficients of each equation are inefficient. In our two equations case, our dependent variables are formal KM practices, and informal KM practices. We assume that these two KM variables are very likely to correlate. Therefore, SUR should be a more appropriate method for estimating our model.

$$KM_1 = \alpha + \beta_1 (Size) + \beta_2 (FO) + \beta_3 (Strategy) + \beta_4 (Control) + \varepsilon_1 \quad (1)$$

$$KM_2 = \alpha + \beta_1 (Size) + \beta_2 (FO) + \beta_3 (Strategy) + \beta_4 (Control) + \varepsilon_2 \quad (2)$$

Where KM_1 and KM_2 denote formal and informal KM practices variables respectively; Size represents firm size; FO denotes the family orientation variable; Strategy denotes different aspects of strategy variables; Control represents control variables including ownership structure, firm age and industrial sectors; ε_1 and ε_2 are random error terms of each equation, and they are assumed to be correlated.

To test whether the estimated correlations between two equations are statistically significant, we apply the Breusch and Pagan test for independence (Breusch and Pagan, 1980). The null hypothesis assumes that the covariance between the two equations is equal to zero. We might reject the null hypothesis when the calculated χ^2 is greater than the critical value.

Table 3.1. Results of common method bias test for knowledge management, strategy and family orientation

		Component					
		1	2	3	4	5	6
Formal KM practices	Our company collaborates with other organizations (companies, universities, technical college) through alliances.	**0.63**	0.07	0.25	-0.04	0.05	0.00
	The organization encourages employees to join formal or informal networks outside the organization.	**0.71**	0.03	0.16	0.04	0.11	-0.16
	Sending employees to exhibitions, congresses or seminars on a regular basis.	**0.73**	0.08	0.16	0.08	0.02	-0.14
	Staying in touch with professionals and experts outside the company.	**0.61**	0.20	0.25	-0.03	0.16	0.02
	To stay in touch with new developments, our company hires new employees with particular expertise.	**0.60**	0.03	0.14	0.10	-0.04	-0.18
	People work a lot in groups here as a way to learn from each other.	**0.56**	0.20	0.07	0.14	0.09	-0.11
	We pay a lot of attention to the share the 'best practice' within the organization.	**0.41**	0.34	-0.02	-0.07	0.28	-0.13
	Knowledge gained within the firm is frequently stored in formal repositories (written notebook, or computer database).	**0.40**	0.17	-0.02	0.29	0.14	-0.14
	All the employees in the organization have access to the organization's databases.	**0.54**	0.01	-0.08	0.21	0.11	-0.25
Informal KM practices	Management consults employees frequently to discuss new developments.	0.16	**0.69**	0.16	0.07	0.09	0.02
	Employees play an important role in coming up with new ideas or other improvements for the business.	0.15	**0.65**	0.17	0.12	0.17	-0.02
	Employees share knowledge and experience by talking to each other.	0.10	**0.68**	-0.10	-0.01	-0.10	-0.04

Table 3.1. Results of common method bias test for knowledge management, strategy and family orientation (Cont.)

		Component					
		1	2	3	4	5	6
Innovation Orientation	Does the company emphasize renewal of products, services or industrial processes?	0.14	0.14	**0.72**	0.03	-0.02	-0.06
	Are you going to invest in new products or services in the next 12 months?	0.15	0.09	**0.68**	0.11	-0.05	-0.09
	Within our company, people constantly think about new products or services that serve future needs.	0.14	0.03	**0.63**	0.08	0.21	-0.13
	Within our company, there is emphasis on bringing in new customers with new needs.	0.19	-0.12	**0.46**	0.09	0.30	-0.00
Market Orientation	Does the company emphasize marketing activities aimed at improving sales performance?	0.07	0.12	0.05	**0.78**	0.17	-0.05
	Are there in the company employees –including CEOs or owners- who work on marketing activities in their daily profession?	0.19	-0.01	0.25	**0.75**	-0.01	-0.04
Competitor Orientation	Within our company, we regularly exchange information regarding strategies of our competitors.	0.14	0.06	0.10	0.06	**0.87**	-0.02
	The management regularly discusses strengths of our competitors.	0.15	0.11	0.12	0.11	**0.84**	0.03
Family Orientation	The owners are related to family?	-0.16	-0.03	-0.12	-0.01	-0.02	**0.86**
	To what extent do family members determine strategy?	-0.11	-0.07	-0.09	0.00	-0.02	**0.81**
	The managers are related to family?	-0.21	0.01	-0.04	-0.10	0.07	**0.77**
	Would you describe your company as a family business?	-0.12	0.01	-0.05	-0.04	-0.05	**0.74**
	Cronbach's alpha	0.79	0.57	0.58	0.59	0.83	0.74

3.5. Results

3.5.1. Frequency statistics

Results of a frequency analysis on KM practices are presented in Table 3.2. More than half of the respondents in our sample indicate that five of the KM practices are either 'applicable to a great degree' or 'totally applicable' to their firm. The most common practice used for *acquiring knowledge* is staying in touch with professionals and experts outside the company (reported by 53% of our respondents). It seems that the majority of SMEs in our sample seek required knowledge through external connections. Regularly maintaining and reactivating such connections is thus important for SMEs. While SMEs might capture required knowledge through external connections, they are also exposed to the risk of knowledge spillover of their unique organizational know-how to the external organizations. Therefore, a formal approach is necessary for monitoring and controlling external acquisition practices in order to reduce the risk of spillover (Nooteboom, 2001).

The most common *knowledge storage* practice is through storage in formal repositories (reported by 57% of our respondents). Though having argued that an SME is less likely to use formal knowledge repositories due to its resource constraints and simpler organizational structure (e.g. Wong and Aspinwall, 2004), SMEs within our sample indeed use a formal approach to codify and store their organizational knowledge.

Furthermore, three informal KM practices are most frequently used by SMEs among the identified five KM practices. This indicates that informal KM practices are widely carried out by SMEs. The most frequently used KM practice is that employees share knowledge and experience by talking to each other (reported by 80% of our respondents). Socialization dominates overall KM practices within an SME (Desouza and Awazu, 2006). Owner-managers also seem to play an active role in knowledge transference. 68% of the respondents reported that management consults employees frequently to discuss new developments. Furthermore, we observe that employees take their initiatives in enabling knowledge in SMEs (reported by 61% of the respondents).

Table 3.2. Frequencies (%) for knowledge management practices

	Knowledge Management practices	Frequency
Formal KM practices	*Knowledge Acquisition*	
	Our company collaborates with other organizations (companies, universities, technical college) through alliances.	41
	The organization encourages employees to join formal or informal networks outside the organization	19
	Sending employees to exhibitions, congresses or seminars on a regular basis.	29
	Staying in touch with professionals and experts outside the company.	**53**
	To stay in touch with new developments, our company hires new employees with particular expertise.	33
	Knowledge Storage	
	Knowledge gained within the firm is frequently stored in formal repositories (written notebook, or computer database).	**57**
	Knowledge transfer	
	People work a lot in groups here as a way to learn from each other.	35
	Knowledge sharing	
	We pay a lot of attention to sharing 'best practices' within the organization.	44
	Knowledge exploitation	
	All the employees in the organization have access to the organization's databases.	46
Informal KM practices	*Knowledge transfer*	
	Management consults employees frequently to discuss new developments.	**68**
	Knowledge sharing	
	Employees share knowledge and experience by talking to each other.	**80**
	Knowledge exploitation	
	Employees play an important role in coming up with new ideas or other improvements for the business	**61**

* Frequencies are based on the number of respondents reporting that a particular KM practice is applicable to a great degree or totally applicable (last 2 points of a five point scale).

3.5.2. Results according to Seemingly Unrelated Regression (SUR)

Bivariate relationships are first examined using Pearson product-moment bivariate correlation statistics. As a prior step to seemingly unrelated regression (SUR) analysis, we checked for multicollinearity by calculating the Variation Inflation Factors (VIF) score for each of the regressions.

Table 3.3 presents descriptive statistics and correlations among all variables used in the study. Except the correlation between firm size and number of managers, none of the others exceed 0.5. Univariate relationships between variables also show that two variables of KM practices are significantly correlated (B=0.40, p<0.01). Furthermore, some of our strategy variables, i.e. innovation orientation, competitor orientation, sales-focused market orientation and strategy formalization, are found to be significantly correlated to the two dependent variables (p<0.01). Family orientation and firm size are only significantly correlated to formal KM practices (p<0.01). With two KM practices variables as the dependent variables, the VIFs are computed and range from 1.03 to 1.56. Given the rule of thumb cut-off of 10 (Neter et al, 1990), we can conclude that multicollinearity is unlikely to be an issue. Still, we use step-wise regressions to learn about the interrelationships among the independent variables.

Results of the SUR analysis are presented in Table 3.4. Regarding the Breusch-Pagan test, the calculated $\chi 2$ values range from 54.50 to 82.12 (p<.001) which suggest rejections of the null hypotheses at all significance levels in each model. This confirms that the error terms of our two KM equations are significantly correlated. Comparing R^2 of each model in Equation (1) to those in Equation (2), we find that our independent variables explain more variance of formal KM practices (R^2: 0.16 to 0.31) than those of informal KM practices (R^2: 0.02 to 0.10).

Regarding control variables, our results demonstrate that ownership structure with more managers is positively associated with formal KM practices (see Model 1 to 7 of Equation (1): p<0.05). Compared to the service sector, SMEs in the construction sector are less likely to engage in formal KM practices (see Model 1 to 7 of Equation (1): p<0.01).

Hypothesis 1 predicts a positive relationship between firm size and formal KM practices. Model 1 of Table 3.4 shows a significantly positive coefficient for firm size while predicting formal KM practices (Equation (1): B=0.14, p<0.01). There is no significant relationship found between firm size and informal KM practices (Equation (2): B= 0.04, n.s.). This result supports Hypothesis 1. However, we notice that the size effect diminishes while adding strategy variables into the model (see Equation (1) of Model 2 to 7).

In Hypothesis 2, we assume that more family-oriented firms are less likely to use formal KM practices. Our regression results show that family orientation is negatively associated with formal KM practices (see Equation (1) of Model 1 to 7: $p<0.01$). Hypothesis 2 is thus supported strongly for formal KM practices. Furthermore, though not tested as part of Hypothesis 2, family orientation is found to be positively, though not quite as strongly associated with informal KM practices, especially in models controlling for differences in strategy (see Equation (2) of Model 3 and 4: $p<0.05$; Model 2, Model 5 to 7: $p<0.1$). .

Hypothesis 3 predicts a positive relationship between a firm's strategy formalization and its engagement in both formal and informal KM practices. Results indicate that there are significantly positive coefficients for strategy formalization even when including another strategy variable in the model (See Table 3.4, Model 2 to 7 in both equations: $p<0.01$). Hypothesis 3 is thus supported.

Hypotheses 4 to 6 predict a positive relationship between innovation orientation (model 3), sales-focused market orientation (model 4), competitor orientation (model 5) and KM practices, respectively. Our results clearly show that the three strategies are positive determinants of the engagement in both formal and informal KM practices. Model 3 of both equations show significantly positive coefficients for innovation orientation (see Equation (1): B=0.25, $p<0.01$; Equation (2): B=0.21, $p<0.01$). Model 4 indicates that sales-focus market orientation has a significantly positive association with the engagement in both formal and informal KM practices (see Equation (1): B=0.18, $p<0.01$; Equation (2): B=0.17, $p<0.01$), as does competitor orientation strategy (see Model 5, Equation (1): B=0.21, $p<0.01$; Equation (2): B=0.12, $p<0.01$). Our empirical results thus support hypotheses 4, 5 and 6.

Finally, the regression coefficients for service orientation and cost optimization are not significant (Model 6 and 7 in both equations). Therefore, we can not support a positive association with service orientation to KM practices (hypothesis 7), nor a negative association between cost optimization and either formal or informal KM practices (hypothesis 8).

Table 3.3. Mean, standard deviation and Pearson correlations for all variables in the study (n=496)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Formal KM practices	1.00																
2	Informal KM practices	0.40 (**)	1.00															
3	Innovation orientation strategy	0.38 (**)	0.26 (**)	1.00														
4	Competitor orientation strategy	0.37 (**)	0.20 (**)	0.25 (**)	1.00													
5	Sales-focused market orientation strategy	0.31 (**)	0.23 (**)	0.28 (**)	0.28 (**)	1.00												
6	Cost optimization strategy	0.00	0.03	-0.01	0.07	0.14 (**)	1.00											
7	Service orientation strategy	-0.02	-0.00	-0.03	0.01	0.07	0.20 (**)	1.00										
8	Strategy formalization	0.35 (**)	0.18 (**)	0.18 (**)	0.15 (**)	0.23 (**)	0.03	-0.01	1.00									
9	Number of owners	0.12 (**)	-0.02	0.05	0.08	0.01	-0.07	-0.09	0.12 (**)	1.00								
10	Number of managers	0.25 (**)	0.07	0.13 (**)	0.11 (*)	0.16 (**)	0.03	-0.05	0.17 (**)	0.26 (**)	1.00							
11	Combined director-ownership	-0.18 (**)	-0.04	-0.04	-0.03	-0.06	-0.01	0.00	-0.12 (**)	-0.12 (**)	-0.15 (**)	1.00						
12	ln (Firm size)	0.28 (**)	0.06	0.15 (**)	0.09 (*)	0.18 (**)	0.06	-0.01	0.23 (**)	0.19 (**)	0.52 (**)	-0.29 (**)	1.00					
13	Firm age	0.02	-0.05	0.06	0.01	0.03	0.08	-0.09 (*)	-0.07	-0.02	0.16 (**)	-0.13 (**)	0.24 (**)	1.00				
14	Manufacturing sector	0.07	0.03	0.12 (**)	0.03	0.04	0.10 (*)	-0.09 (*)	0.01	-0.04	0.07	-0.05	0.10 (*)	0.13 (**)	1.00			
15	Retail & wholesale sector	-0.10 (*)	-0.02	-0.01	0.04	0.10 (**)	0.03	0.07	-0.04	-0.06	-0.12 (**)	0.13 (**)	-0.21 (*)	-0.04	-0.24 (**)	1.00		
16	Construction sector	-0.15 (**)	-0.07	-0.12 (**)	-0.10 (*)	-0.20 (**)	0.01	0.04	-0.05	0.02	-0.00	-0.00	-0.00	-0.10 (*)	-0.18 (**)	-0.24 (**)	1.00	
17	Family orientation	-0.23 (**)	0.03	-0.09 (*)	-0.04	-0.12 (*)	-0.00	0.01	-0.18 (*)	-0.03	-0.04	0.22 (**)	0.17 (**)	0.08	-0.03	0.06	0.07	1.00
	Mean	2.73	3.85	-0.00	2.63	-0.01	1.89	1.97	1.51	1.72	2.09	1.94	2.45	26.28	0.15	0.24	0.15	-0.01
	Standard deviation	0.91	0.89	1.01	1.28	1.01	0.31	0.17	0.50	0.71	0.80	0.24	0.92	28.03	0.36	0.43	0.36	1.09
	VIF			1.09	1.05	1.16	1.03	1.04	1.10	1.10	1.41	1.12	1.56	1.15	1.24	1.33	1.26	1.10

* $p<0.05$; ** $p<0.01$, two tailed tests of significance

Table 3.4. Results of regression analysis on two KM variables

Equation (1): Dependent variable: Formal KM practices

	Firm size and family orientation Model 1		Formality approach Model 2		Innovation orientation Model 3		Sales-focused market orientation Model 4		Competitor orientation Model 5		Service orientation Model 6		Cost optimization Model 7	
	Coef.	t-value	Coef.	t-value	Coef.	t-value	Coef.	t-value	Coef.	t-value	Coef.	t-value	Coef.	t-value
Constant	2.58**	6.82	1.95**	5.16	2.20**	6.11	2.12**	5.72	1.62**	4.52	1.91**	3.34	2.01**	4.67
Strategies														
Strategy formalization			0.48**	6.39	0.41**	5.61	0.41**	5.53	0.41**	5.73	0.48**	6.39	0.48**	6.39
Innovation orientation					0.25**	7.23								
Sales-focused market orientation							0.18**	4.84						
Competitor orientation									0.21**	7.83				
Service orientation											0.02	0.08		
Cost optimization													-0.04	-0.32
Family orientation	-0.14**	-3.81	-0.11**	-3.10	-0.09**	-2.89	-0.10**	-2.87	-0.10**	-3.21	-0.11**	-3.10	-0.11**	-3.10
Firm size	0.14**	2.74	0.09†	1.88	0.08	1.62	0.07	1.53	0.09†	1.87	0.09†	1.87	0.09†	1.89
Control variables														
Number of owners	0.05	0.84	0.02	0.47	0.02	0.40	0.04	0.71	0.01	0.15	0.03	0.48	0.02	0.44
Number of managers	0.17**	3.04	0.15**	2.79	0.13**	2.57	0.13*	2.44	0.13*	2.47	0.15**	2.79	0.15**	2.79
Combined director-ownership	-0.26	-1.61	-0.23	-1.43	-0.25†	-1.65	-0.22	-1.45	-0.24	-1.59	-0.23	-1.43	-0.23	-1.43
Firm age	-0.00	-0.55	0.00	0.13	-0.00	-0.20	0.00	0.00	0.00	0.04	0.00	0.13	0.00	0.14
Manufacturing sector	-0.00	-0.01	-0.00	-0.00	-0.06	-0.61	-0.01	-0.07	-0.01	-0.13	0.00	0.00	0.00	0.03
Retail & wholesale	-0.15	-1.51	-0.15	-1.61	-0.16†	-1.78	-0.19*	-2.13	-0.18*	-2.06	-0.15	-1.61	-0.15	-1.58
Construction sector	-0.38**	-3.42	-0.36**	-3.41	-0.29**	-2.89	-0.28**	-2.69	-0.30**	-3.01	-0.36**	-3.40	-0.36**	-3.39
R-square	0.16		0.22		0.30		0.26		0.31		0.22		0.22	

† $p<0.1$; * $p<0.05$; ** $p<0.01$, two tailed tests of significance; The reference group for sectors is service sector

Table 3.4. Results of regression analysis on two KM variables (Cont.)

Equation (2): Dependent variable: Informal KM practices

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7	
	Coef.	t-value	Coef.	t-value	Coef.	t-value	Coef.	t-value	Coef.	t-value	Coef.	t-value	Coef.	t-value
Constant	4.07**	10.17	3.65**	8.93	3.87**	9.68	3.82**	9.46	3.46**	8.54	3.70**	5.95	3.54**	7.58
Strategies														
Strategy formalization			0.32**	3.90	0.26**	3.19	0.25**	3.11	0.28**	3.43	0.32**	3.90	0.32**	3.88
Innovation orientation					0.21**	5.44								
Sales-focused market orientation							0.17**	4.30						
Competitor orientation									0.12**	3.97				
Service orientation											-0.02	-0.10		
Cost optimization													0.06	0.50
Control variables														
Family orientation	0.05	1.26	0.07†	1.78	0.08*	2.11	0.08*	2.07	0.07†	1.84	0.07†	1.78	0.07†	1.78
Number of owners	-0.05	-0.93	-0.07	-1.18	-0.07	-1.29	-0.06	-1.00	-0.08	-1.37	-0.07	-1.19	-0.07	-1.14
Number of managers	0.07	1.21	0.06	1.00	0.04	0.77	0.04	0.66	0.04	0.78	0.06	1.00	0.06	1.00
Combined director-ownership	-0.15	-0.85	-0.12	-0.72	-0.14	-0.84	-0.12	-0.72	-0.13	-0.76	-0.12	-0.72	-0.12	-0.72
Firm size	0.04	0.76	0.01	0.19	-0.00	-0.07	-0.01	-0.15	0.01	0.13	0.11	0.20	0.01	0.17
Firm age	-0.00†	-1.70	-0.00	-1.29	-0.00	-1.58	-0.00	-1.42	-0.00	-1.36	-0.00	-1.29	-0.00	-1.31
Manufacturing sector	0.04	0.31	0.04	0.33	-0.01	-0.13	0.03	0.27	0.03	0.26	0.04	0.32	0.03	0.27
Retail & wholesale	-0.04	-0.38	-0.04	-0.40	-0.05	-0.48	-0.08	-0.84	-0.06	-0.59	-0.04	-0.40	-0.04	-0.44
Construction sector	-0.15	-1.30	-0.14	-1.22	-0.08	-0.75	-0.06	-0.56	-0.11	-0.94	-0.14	-1.22	-0.14	-1.25
R-square	0.02		0.05		0.10		0.08		0.08		0.05		0.05	
Breusch-Pagan test of independence	82.12	p<0.001	71.44	p<0.001	54.50	p<0.001	62.02	p<0.001	59.38	p<0.001	71.45	p<0.001	71.61	p<0.001

† $p<0.1$; * $p<0.05$; ** $p<0.01$, two tailed tests of significance
The reference group for sectors is service sector

3.6. Discussion, Conclusion and Implications

The aim of this chapter is to provide a general understanding of KM practices in SMEs. Based on a large sample consisting of 496 Dutch SMEs, we first investigate the prevalence of different KM practices to generalize the characteristics of KM practices in SMEs. We furthermore explain the variation of KM practices among SMEs by exploring the relationship between certain aspects of organization context and KM practices.

3.6.1. The characteristics of KM practices in SMEs

Frequency analysis indicates that five KM practices are commonly carried out by SMEs in our sample. The most commonly used knowledge acquisition practice is that of staying in touch with professionals and experts outside the firm. This inclination of SMEs to search for knowledge outside their firms is consistent with findings of Desouza and Awazu (2006), which they suggest may reflect resource constraints which hamper internal development of knowledge. External connections provide an important channel for SMEs to acquire necessary knowledge that is crucial for their success. However through such channels an SME also exposes itself to the risk of knowledge spillover of its unique organizational know-how. Nooteboom (2001) thus recommends that SMEs use a formalized approach to monitor and control such knowledge processes though this was not examined in the current study.

We observed that a KM practice commonly used for knowledge storage is in the form of formal repositories. Furthermore, this result suggests that, counter to our expectations; diffusion of computer-based technologies is widespread in the Netherlands, even among SMEs. This finding also suggests that a majority of Dutch SMEs not only can afford but also have decided to use computers for codifying and storing knowledge. Though not explored further in our own research, this would provide a number of benefits, such as preventing the problem of knowledge loss when key personnel leave, and more generally to increase the absorptive capacity of a firm (Nooteboom, 2001). Note that our findings counter predictions and findings of previous research, which suggests that SMEs are less likely to use formal repositories due to their expense and poor fit with simple organizational structures (Nooteboom, 2001; Wong and Aspinwall, 2004).

Furthermore, more than 60% of our respondents confirm that informal KM practices emphasizing individual know-how and involvement (owner-managers and employees) are widely carried out. The commonly referred sharing practice by Dutch SMEs is that of employees discussing with one another to share knowledge and experience. This finding is consistent with previous studies indicating that socialization is a dominant peculiarity of KM in

SMEs (Wong and Aspinwall, 2004; Desouza and Awazu, 2006). Owner-managers also play a vital role in managing the knowledge transfer process. This is in line with previous findings that owner-managers value the opportunity of knowledge and decide whether and how such knowledge should be captured, to what extent such knowledge ought to be transferred and shared, and in turn manage such knowledge effectively (Alvarez and Busenitz, 2001; Wong and Aspinwall, 2004).

The reasons for emphasizing this informal approach by individual involvement in knowledge transferring and sharing practices might be due to the less technological sophistication of SMEs, or due to the fact that the simple organization structure and low level hierarchy of SMEs makes a formal approach unnecessary (Mintzberg, 1983). It might also be an intentional decision made by owner-managers not to formalize KM practices. Several studies indicate that owner-managers tend to limit knowledge sharing and transferring within certain determined areas because they fear losing control of the key knowledge that they have obtained. By doing so, they also prevent knowledge leakage to their competitors via the mobility of their key personnel (Gorman et al., 1997; Matlay, 2001). Therefore, they may avoid providing formal transferring and sharing practices such as training, which requires externalizing knowledge to broader audiences.

Moreover, rather than a systematic formal KM approach, our data suggests that it is more likely the employees themselves who take the initiative to exploit knowledge within the SME. This supports the argument that the success of an SME relies highly on individual know-how (Wiklund and Shepherd, 2003). This furthermore explains why there is a disproportionate amount of innovation coming from SMEs (Thompson and Leyden, 1983; Acs and Audretsch, 1993). In spite of resource constraints, SMEs have their own way to exploit knowledge to yield superior performance. More important, tapping into the know-how of employees appears to be the rule, rather than the exception.

To summarize, we can characterize KM practices in SMEs in the following ways: *first*, SMEs utilize both formal and informal KM practices. *Second*, the most prevalent KM practices among SMEs are people-centered informal KM practices. Socialization is a dominant element for knowledge sharing, transferring and even knowledge exploitation in SMEs; *Third*, SMEs often seek out external knowledge. Formally building and maintaining external connection is vital for SMEs because it can help them not only in acquiring necessary knowledge but also in preventing the spillover of internal knowledge; *Fourth*, formal knowledge repositories are used by SMEs to store their organizational knowledge. Our empirical findings confirm those from

previous qualitative studies with much smaller samples (Wong and Aspinwall, 2004; Dosouza and Awazu, 2006).

3.6.2. Firm size, family orientation and KM practices

Among the organization contextual variables, as predicted, we find that firm size has a positive relationship with formal KM practices (Hypothesis 1). Our finding supports the scale effect from a resource-based view. On the one hand, larger SMEs are likely to implement a more formalized KM approach when compared to their smaller counterparts, assuming a greater need to manage accumulated knowledge as the firm grows (Penrose, 1995). On the other hand, with an advantage of economies of scale, larger SME firms can also quickly recover from their development costs for formal KM programs (Nooteboom, 1993). However, we find that the scale effect of firm size diminishes sharply when any of the strategy variables are added to the model predicting formal KM practices. This might imply that the scale effect of firm size has an indirect effect on the implementation of formal KM practices through a firm's strategy. Future research might test for the mediating effect of strategy between size and formal KM practices.

Interestingly, unlike size, the effect of the number of managers on formalization of KM practices is only partially reduced when each strategy variable is added to the model, and remains positive and significant. Rather than scale effects, perhaps this variable reflects the proportionally higher need for managers as preconditions for effective implementation of the various formal KM practices.

Furthermore, we find that family-oriented firms are less likely to engage in formal KM practices (Hypothesis 2), and somewhat more likely to engage informal KM practices. This finding is consistent with expectations from past research that point to a less formal approach taken by family-oriented firms (Daily and Dollinger, 1993; Cromie et al., 1995; Reid and Adams, 2001; Jorissen et al., 2002; De Kok et al., 2006), and supports the theoretical arguments from both the agency theory and the resource-based view.

3.6.3. Strategy as an antecedent for the variation of KM practices

Taking a strategy implementation perspective from contingency theory, we investigate whether different aspects of strategy dictate administrative decisions in the engagement of KM practices and they explain the variation of KM practices among SMEs. Indeed, our results show that certain aspects of strategy, especially those aimed at creating a competitive position of a firm in a dynamic environment, are more likely to engage in both formal and informal KM

practices, supporting the strategic implementation perspective of contingency models of strategy. In further explanation, employees' attitudes and behaviors are necessary for successfully achieving organizational goals and objectives that are defined by a particular strategy (Naylor et al., 1980; Schuler and Jackson, 1987). These attitudes and behaviors can be shaped more effectively by organization practices that fit the requirement of a particular strategy (Naylor et al., 1980). Our findings further parallel findings from other studies, showing that strategy explains differences in HRM practices. (e.g. Schuler and Jackson, 1987; Lengnick-Hall and Lengnick-Hall, 1988). In the following, we elaborate our findings on these aspects of strategy that predict variation of KM practices.

First, we observed that firms having a *formalized strategy* are more likely to engage in KM practices (Hypothesis 3). Strategy provides focus such as what to do, what not to do, which resources are required, and how to allocate resources effectively. A formalized strategy is helpful for owner-managers to search continually for ways to reinforce and extend a firm's strategy, in order to respond to potential opportunities and to a changing environment. For firms competing in knowledge-based activities, a formalized strategy can help them more effectively to identify the knowledge gap and define the knowledge that is crucial to sustain their competitive position. These firms are more likely to engage in KM practices to acquire, create, store and disseminate key knowledge throughout the organization. Furthermore, a formalized strategy such as a mission and/or strategy statement can provide common knowledge to owner-managers and employees on a firm's goal and key activities. This provides clear guidance to implement KM practices in a more effective way. An effective KM in turn can produce significant value for a firm (Numri, 1998).

Second, our results indicate that firms with a stronger *innovation orientation strategy* are also more likely to engage in a wider range of KM practices (Hypothesis 4). Firms with such strategy aim to build their competitive advantage through innovation processes which in turn can produce unique new products and services. Knowledge is an important ingredient for innovation. As identified by frequency analysis in this study, SMEs are more likely to acquire knowledge from outside the firm compared to creating that knowledge in-house. External knowledge is often more crucial to the innovation process of SMEs (Pierce and Delbecq, 1977; Ravasi and Turati, 2005). The accumulation of such knowledge also enhances a firm's ability to evaluate the commercial value of technological advance (Teece, 2007). Furthermore, innovation is also about the effective application of new and/or existing knowledge (Huber, 1991). This process requires understanding by employees within the firm as well as the sharing

of knowledge amongst employees with unique or specialized skills. Knowledge transferring and sharing practices can facilitate the speed and effectiveness of the innovation process (Liao et al., 2003). In order to innovate, firms with innovation orientation therefore not only need to actively acquire external knowledge, externalize and store acquired knowledge, but also need to transfer and share newly acquired knowledge throughout the organization, and in turn exploit such knowledge within the firm – as was observed in this study.

Last, firms with a *sales-focused market orientation* or *competitor orientation* are found to be more actively involved in both KM practices (Hypotheses 5 and 6). Our findings reveal the underlying rationale of competitiveness of market orientation strategy proposed by Kohli and Jaworski (1990). Firms pursuing either of these two strategies focus on capturing new and maintaining existing market share, investigating competitors' moves and trying to understand future customer needs. In order to sustain competitive advantage, such firms need to generate market intelligence pertaining to current and future customer needs, and to disseminate this intelligence across the organization. Through external knowledge acquisition, firms can learn about competitors and opportunities and thereby more effectively position themselves in the market place. Through knowledge storage practices, historical information about markets, customers and competitors can be codified in a formal repository. Studying historical information can help make a better prediction on future needs and challenges. Furthermore, knowledge transferring and sharing practices, which disseminate intelligence from customers and competitors throughout the organization, can create organization wide responsiveness. Integrating new knowledge of customers and competitors to the existing knowledge eventually can improve business performance by providing uniquely tailored products and services. Therefore, engaging in both formal and informal KM practices can help these firms to fulfill their strategy in a more efficient and effective manner.

3.6.4. Implications

By identifying the prevalence of KM practices among SMEs, this study indicates a number of ways in which SMEs manage their knowledge processes within their organization. Counter to prior assumptions and findings, the use of formal KM approaches to acquire and store knowledge is fairly widespread amongst Dutch SMEs. Our results suggest that many SMEs reach out for information beyond their boundaries, including other organizations and individuals. Thus the barriers toward dissemination of knowledge may not be as great as it is sometimes assumed. This may also help to explain why indeed SMEs have historically been responsible for a fairly high rate of innovation relative to larger firms. External knowledge

acquisition is reported to be organized in a formal way in our sample. This implies that owner-managers are aware of the possible leakage of internal knowledge to the external organizations through the connections by which they could capture required knowledge. Though beyond the scope of the present study, other researchers have suggested that SMEs may need to monitor and control this process, however, to reduce the risk of knowledge spillovers. Furthermore, more than half of SMEs in our sample use a formal repository to store their organizational knowledge. This might be due to fairly inexpensive and widespread access to computer-based technologies in the Netherlands combined possibly with the recognition by SMEs of the value of codifying and organizing knowledge with such tools. Thus, most SMEs clearly find ways to allocate their resources, however limited, to invest in such tools.

Even so, SMEs rely heavily upon people-centered informal KM approaches than on formal KM approaches. They significantly rely on individual social interactions to transfer, share and exploit knowledge. Socialization is a dominant knowledge process in SMEs. People-centered informal KM approaches might be appropriate, efficient and effective for SMEs because the organization knowledge in SMEs is more tacit and the organization structure of SMEs are simpler with low level of hierarchies. More than 60% of the respondents in our sample report that people-centered KM practices are widely carried out. The importance of people-centered knowledge processes also suggests that owner-managers of SMEs should be aware of a need to develop competencies of their employees by nurturing their knowledge base as well as by retaining key (e.g. knowledgeable) employees through the right incentives. By doing so, the SME can also prevent the knowledge leakage through the loss of key employees and the spillover via external connections.

Furthermore, we observed that certain organizational contexts and certain aspects of strategy predict variation of KM practices among SMEs. As expected, larger SMEs are more likely to use formal KM practices. Also as predicted, family orientation is negatively associated with the use of formal KM practices but indeed contributes positively to informal KM practices. That knowledge is less externalized and codified in family firms may simply be due to other barriers including family traditions where communications are kept within the family circle. However, as discussed earlier, acquiring external knowledge, codifying and storing knowledge brings large benefits for a firm's long-term competitiveness. We thus suggest that there is a need to educate owners of family firms, especially, to be more open to outside influences and be aware of the benefit of codifying and storing knowledge to foster innovation and change.

Generally speaking, SMEs with competitive strategies, which aim to create a competitive position in a value chain, to differentiate a firm in the eyes of customers and aim at adding value through a mix of activities that are different from those used by competitors (Porter, 1980), are more likely to engage in KM practices. From a dynamic capabilities view, a firm's competitive success arises from the continuous development and reconfiguration of firm specific assets such as knowledge (Teece and Pisano, 1994; Teece et al., 1997). KM practices provide mechanisms by which a firm can continuously create new knowledge and disseminate it throughout the organization, and in turn improve the overall quality of organization knowledge. This can lead to a sustainable competitive advantage for a firm.

3.6.5. Limitations and suggestions for future research

This study is conducted empirically based on a large, randomly drawn sample representing multiple sectors within the Dutch population of SMEs. The results of this study are consistent with and further reinforce other qualitative research regarding KM practices in SMEs (e.g. Uit Beijerse, 1999; Sabatier et al., 2005; Uhlaner and van Santen, 2007). The findings of this chapter should only be seen as preliminary but are nevertheless encouraging. Some of the limitations in this study should be taken into account in future research.

First, the interrelation between different KM practices is interesting for further exploration in order to fully understand the approach that SMEs apply to KM practices. In the current study, we identify that formal KM practices are significantly correlated to informal ones. However, we are unable to test causal relationship between the two KM practices.

Second, we limited our study to certain organization contextual variables predicting variation in KM practices. It will be insightful to investigate how these attributes influence the quality of KM practices. Future research should include a performance variable as a possible consequence of using one set of practices versus another to measure the quality of KM practices, or treat KM practices as moderating variables between the attributes and the performance variable. This might provide convincing evidence for practical implications on implementing KM in SMEs.

Third, although firm size has been proven to be a positive determinant for formal KM practices, more evidence shows that the scale effect of size might have an indirect effect through other variables, for instance strategy or ownership structure. This indirect effect can be further examined in future research.

Fourth, we only focus on the strategy implementation perspective to examine the contingency models of strategy in the present study. However, a complete view of contingency theory should include both strategy formulation and implementation perspectives (Bourgeois, 1980; Quinn, 1980). A longitudinal study could be conducted in future research to provide a better understanding of the interdependence between these two perspectives.

In conclusion, this chapter contributes to the limited number of empirical studies on KM issues in SMEs by providing an empirical exploration on a large, random sample of 496 Dutch SMEs. We find that SMEs tend to use more people-centered informal KM practices that emphasize individual involvement and socialization. By combining people-centered, informal KM practices with formal KM approaches, which help the firm to acquire external knowledge and to store internal knowledge, SMEs find their own ways to build their competitive advantage on knowledge and overcome their resource constraints.

Our study also suggests that certain aspects of organization context predict the variation of KM practices among SMEs. Our findings support the underlying rationales hypothesized by existing theories such as the resource-based view and agency theory. Our empirical evidence contributes a unique insight to these theories from a SME context. Finally, our empirical findings support the assumption of the strategy implementation perspective of the contingency models, namely that firms with a competitive strategy are more likely to engage in KM practices than those with a simple survival strategy. Our empirical evidence reveals that strategy is associated with management practices to improve the effectiveness of executing this strategy. This finding thus contributes to the less explored field of the theorized relationship of strategy as an antecedent for organization practices, especially within SMEs.

Appendix 3.1. Description of Variables used in the regression

Variable	Description of Variables
Knowledge Management	
Formal KM practices α=0.79	The mean of the following nine questions was computed for formal KM practices. The items were answered using the following scale: (1='not at all applicable'; 2='not all that (barely) applicable'; 3='somewhat applicable'; 4='applicable to a great degree';5='totally applicable') 1. Our company collaborates with other organizations (companies, universities, technical college) through alliances. 2. The organization encourages employees to join formal or informal networks outside the organization 3. Sending employees to exhibitions, congresses or seminars on a regular basis. 4. Staying in touch with professionals and experts outside the company. 5. To stay in touch with new developments, our company hires new employees with particular expertise. 6. People work a lot in groups here as a way to learn from each other. 7. Knowledge gained within the firm is frequently stored in formal repositories (written notebook, or computer database). 8. All the employees in the organization have access to the organization's databases. 9. We pay a lot of attention to sharing 'best practices' within the organization.
Informal KM practices α=0.57	The mean of the following three questions was computed for informal KM practices. The items were answered with the following scale: (1='not at all applicable'; 2='not all that (barely) applicable'; 3='somewhat applicable'; 4='applicable to a great degree';5='totally applicable') 1. Employees play an important role in coming up with new ideas or other improvements for the business. 2. Management consults employees frequently to discuss new development. 3. Employees share knowledge and experience by talking to each other.
Strategy	
Innovation orientation α=0.58	This scale was created by combining answers to the following four questions using the CATPCA technique: The following question was answered with the following scale: (1='no'; 2='yes') 1. Does the company emphasize renewal of products, services or industrial processes? The following questions were answered with the following scale: (1='not at all applicable'; 2='not all that (barely) applicable'; 3='somewhat applicable'; 4='applicable to a great degree';5='totally applicable')

	2. Within our company, people constantly think about new products or services that serve future needs.
	3. Within our company, there is emphasis on bringing in new customers with new needs.
	The following questions were answered with the following scale: (1='no';2='probably';3= 'certainly')
	4. Are you going to invest in new products or services in the next 12 months?
Sales-focused market orientation α=0.59	This scale was created by combining answers to the following two questions using the CATPCA technique: 1. Does the company emphasize marketing activities aimed at improving sales performance? 2. Are there in the company employees – including CEOs or owners - who work on marketing activities in their daily profession? The items were answered with the following scale: (1='no'; 2= 'yes')
Competitor Orientation α=0.83	For competitor orientation, the mean of the following two questions was computed: 1. Within our company, we regularly exchange information regarding strategies of our competitors. 2. The management regularly discusses strengths of our competitors. The items were answered with the following scale: (1='not at all applicable'; 2='not all that (barely) applicable'; 3='somewhat applicable'; 4='applicable to a great degree';5='totally applicable')
Service strategy	Does the company emphasize excellent service to customers? (1='yes'; 0='no')
Cost optimization	Does the company emphasize focus on cost optimization? (1='yes'; 0='no')
Strategy formalization	Is the competitive strategy for your business formally written down? (1='yes'; 0='no')
Family Orientation	
Family orientation α=.74	This scale was created by combining answers to the following four questions using the CATPCA technique: The following questions were answered with the following scale: (1='no', 2='yes') 1. The owners are related to family? 2. The managers are related to family? 3. Would you describe your company as a family business? The scales for the following items are indicated below each question or set of questions: 4. To what extent do family members determine strategy? (1='not at all'; 2='to a very limited extent'; 3='to some extent'; 4= 'to a large extent')
Ownership Structure	
Number of owners	How many owners does the company have? (1='1';2= '2';3= 'more than two')
Number of	How many managers does the company have?

managers	(1='1';2= '2';3= 'more than two')
Combined director-ownership	The CEO is owner or co-owner. (1='yes'; 0= 'no')

General Context

Size	Computed as the natural logarithm of the response to the following question. How many persons does the company employ?
Age	Computed as the difference between founding year and 2006.
Manufacturing sector	Is the company operating in the industrial sector? (1= 'yes'; 0= 'no')
Construction sector	Is the company operating in the construction sector? (1= 'yes'; 0= 'no')
Retail and whole sale sector	Is the company operating in sales or repair of consumer products? (1= 'yes'; 0= 'no')

CHAPTER IV

Predicting innovation in SMEs: a knowledge-based dynamic capabilities perspective

Abstract: This chapter advances a knowledge-based dynamic capabilities framework to predict innovation in SMEs. We presume that SMEs can develop and renew their absorptive capacity and transformative capacity (i.e. their *realized* knowledge capacities) by actively implementing external knowledge acquisition and internal knowledge sharing practices (i.e. their *potential* knowledge capacities). These knowledge capacities form part of the basis for the firm's knowledge-based dynamic capabilities, which enhance the firm's innovation orientation and performance in turn. We test hypotheses on a sample of 649 Dutch SMEs, using multivariate OLS regression analysis and structural equation modeling. Results indicate that practices aimed at acquiring external knowledge foster an SME's innovation performance, mediated by innovation orientation. This finding implies a different means for SMEs to be innovative in spite of their resource constraints. Similar predictions for internal knowledge sharing practices however are not supported. Implications for policy makers and owners/entrepreneurs of SMEs are discussed.

4.1. Introduction

Small and new firms are surprisingly innovative. Research over the past thirty years repeatedly shows patterns that a disproportionate amount of innovation (including new patents and other inventions and discoveries) comes from small and medium sized firms (SMEs) (Thompson and Leyden, 1983; Acs and Audretsch, 1993). However, empirical research that explains how SMEs foster innovation within their firms is far more limited. This is a primary focus of the present study. More specifically, we test empirically for links between certain knowledge management (KM) practices and innovation within the context of a knowledge-based dynamic capabilities framework (Lichtenthaler and Lichtenhaler, 2009).

KM practices are those organizational routines by which a firm acquires, shares, transfers and/or exploits knowledge. In the SME context, we focus on two aspects of KM practices: *external knowledge acquisition* and *internal knowledge sharing*. KM practices, in turn, contribute to a firm's abilities to renew and develop its capabilities of managing different knowledge processes, which we call a firm's *knowledge capacities* (Lichtenthaler and Lichtenhaler, 2009). We adopt the terms *absorptive capacity* and *transformative capacity* to refer to the knowledge capacities resulting from external knowledge acquisition and internal knowledge sharing respectively. Absorptive capacity and transformative capacity are two of several possible capacities which contribute to the overall ability of the firm to manage its knowledge (Lichtenthaler and Lichtenhaler, 2009).

Innovation performance is defined as the extent to which a firm develops and/or introduces new products or services. In addition, we also introduce a term called *innovation orientation* in the framework, which refers to a firm's intention to develop new products, services or processes to renew or to improve existing products, services or processes (Homburg et al., 2002; Worren et al., 2002; Kundu and Katz, 2003).

The research areas of knowledge, knowledge management and organizational learning have become increasingly linked to one another and to the dynamic capabilities perspective. The dynamic capabilities perspective emphasizes that a firm's abilities to renew and to develop its organizational capabilities are essential for building and sustaining competitive advantage (Kogut and Zander, 1993; Nonaka and Takeuchi, 1995; Grant, 1996; Spender, 1996; Teece et al., 1997; Eisenhardt and Martin, 2000). In the proposed framework, the abilities to acquire, assimilate and apply knowledge, which we collectively refer to as knowledge capacities, represent a particular subset of dynamic capabilities which has taken on growing interest in the

management literature (Zahra and George, 2002; Lane et al., 2006; Lichtenthaler, 2009; Lichtenthaler and Lichtenthaler, 2009).

The assertion that knowledge capacities can affect firm-level outcomes, including innovation, is not new. However, the majority of this research focuses on large firms and on firm-level concepts (Nelson and Winter, 1982; Kogut and Zander, 1992; Teece et al., 1997; Eisenhardt and Martin, 2000; Winter, 2003). However, even in large firms, an understanding of why or how such capacities are linked with performance is still not clear. As pointed out by Cartwright (1989), firms do not act, people do. In this view, firms do not actually possess dispositions to act. Rather, firm-level routines can be viewed as recurring patterns of individual behaviors. Such patterns not only represent aggregations of individual acts however. Over time, they can be viewed as descriptive norms which establish guidelines for future behaviors (Aarts and Dijksterhuis, 2003; Nolan et al., 2008; Smith and Louis, 2008). Thus, there is a clear link between the individual and firm-level phenomena, grounded in individual concrete activities. Note that in this chapter we do not measure individual behaviors (also called micro-foundations by Abell et al (2008)) directly. However, we do attempt to examine in relatively concrete terms how SMEs actually foster innovation within their firms using various KM practices. We also examine the role of innovation orientation as emergent strategy, resulting from such routines, and, in turn, as a deliberate strategy influencing subsequent innovation performance.

To summarize, the present chapter contributes to the existing literature in several ways. *First*, building upon the model of Zahra and George (2002) and the concepts of Lichtenthaler and Lichtenthaler (2009), we present a knowledge-based dynamic capabilities model which treats KM practices as aspects of potential (vs. realized) knowledge capacities. *Second*, we expand on the empirical literature by providing insight into which KM practices contribute positively to innovation orientation and performance within SMEs (Wong and Radcliffe, 2000; Sparrow, 2001; Desouza and Awazu, 2006). *Third*, by focusing on KM practices as recurring patterns of behaviors or routines, we create a link between individual action (i.e. micro-foundations) and firm-level routines or capabilities, showing further, how organizational routines or practices may stimulate innovation. *Fourth*, our findings support a view of strategy in SMEs which shows that innovation orientation can be viewed from both an emergent and deliberate strategic perspective (Mintzberg et al., 1998). *Finally*, in the discussion section we link our findings to future directions in research which can further enhance our understanding of the micro-foundations of dynamic capabilities (Abell et al., 2008).

The remainder of this chapter is organized as follows: section 4.2, we present and explain key concepts used in our framework including KM practices, knowledge capacities, innovation orientation and innovation performance. Section 4.3, we present the conceptual framework, hypotheses and rationale. Section 4.4, we discuss the research methodology regarding sampling, measures and model tests. The remaining sections cover the results, discussion, practical implications and directions for future research, as well as conclusions.

4.2. Theoretical background

4.2.1. Knowledge management (KM) practices in SMEs

In the present chapter, we focus on two types of KM practices: *external knowledge acquisition* and *internal knowledge sharing*. Previous studies show that they both play an important role in managing and organizing a firm's external knowledge and internal knowledge (Hargadon and Sutton, 1997; von Hippel, 1988; Andersen and Drejer, 2008).

Compared to large firms, SMEs are less likely to have extensive research and development programs and thereby they limit their in-house knowledge creation capacity. Instead, knowledge in SMEs is more likely to be gained through the experiences and associated tacit and explicit learning of specific individuals (Carson and Gilmore, 2000; Wong and Radcliffe, 2000). Many SMEs acquire new knowledge through individual interaction or social ties with external sources. Knowledge can be transferred either by individuals directly, for instance via the acquisition of a new worker who brings in knowledge and experience into the firm and/or through the exchange of information between existing employees and external contacts. Zhou et al.(2007) report that more than half of their sample acquires new knowledge through a connection with external professionals, for instance.

Though external acquisition of knowledge is important, internal knowledge sharing is also viewed as an important practice for transferring externally acquired or internally generated knowledge between individuals within a firm (Van Wijk et al., 2008). Evidence shows that internal knowledge sharing practices provide competitive benefits to firms (Gupta and Govindarajan, 1986). Whereas large firms often focus on IT solutions, internal knowledge sharing in SMEs is typically people-based (Desouza and Awazu, 2006). For instance, approximately 80% of the Dutch SME sample reports that knowledge is shared via face-to-face communication (Zhou et al., 2007). The reason for the emphasis on these people-based approaches may be because much of the knowledge in SMEs remains tacit. Given its lack of

codification, tacit knowledge can be more easily *externalized*, that is the process for unlocking tacit knowledge and making it explicit through individual interactions (Davenport and Prusak, 1998; Nooteboom, 2001; Nonaka and Toyama, 2003). Despite resource limitations compared to large firms, SMEs typically have several advantages that make knowledge sharing easier, such as a flatter structure, shorter communication lines and direct involvement by top management and/or owners in the activities of the firm (Wong and Aspinwall, 2004). Regarding the involvement of entrepreneurs, furthermore, Wiklund and Shepherd (2003) find that SMEs rely heavily on their individual expertise. Thus, KM practices that enhance the knowledge base of an SME's directors may have a particularly significant effect on the firm's overall innovation performance.

4.2.2. Knowledge capacities

Here we examine two relevant knowledge capacities – absorptive capacity and transformative capacity. Some researchers refer to *absorptive capacity*, rather broadly, as the firm's ability to value new external knowledge, assimilate it and apply it to commercial ends (Cohen and Levinthal, 1990). In a recent paper, however, Lichtenthaler and Lichtenthaler (2009) suggest that a fine-tuning of the absorptive capacity concept may be useful. They suggest that absorptive capacity would be viewed as only one of several knowledge capacities which they categorize based on the phase of the knowledge management process being addressed (i.e. exploration or acquisition, retention, and exploitation or application) and on the source of knowledge (intrafirm vs. interfirm) being processed. Adopting their model, we define absorptive capacity more narrowly as the firm's ability to acquire external knowledge.

Transformative capacity, the second knowledge capacity we examine, emphasizes a firm's ability to assimilate and retain internal knowledge among employees over time (Walsh and Ungson, 1991; Garud and Nayyar, 1994; Lane et al., 2006; Lichtenthaler and Lichtenthaler, 2009). Knowledge retention needs to be actively managed in order to keep the necessary knowledge available inside a firm (Campbell, 1960; Lane et al., 2006). By doing so, a firm will be less influenced by the knowledge loss caused by termination of a particular skill or routine, or when an employee leaves the firm (Walsh and Ungson, 1991; Szulanski, 1996). Furthermore, transformative capacity emphasizes a firm's ability to reactivate and synthesize existing knowledge with new knowledge. This newly transformed knowledge, in turn, needs to be internalized and assimilated again (Nonaka, 1994; Pandza and Holt, 2007). A dynamic process of maintaining and reactivating knowledge is thus at the core of the transformative

capacity concept. We assume that internal knowledge sharing practices represent one set of routines to enhance transformative capacity.

Operationalizing knowledge capacities poses a major challenge for researchers (Kim, 1998; Zahra and George, 2002; Lane et al., 2006; Todorova and Durisin, 2007). As noted by Lane et al. (2006), using R&D expenditure for instance, seems to be a rather static indicator for measuring absorptive capacity and a particularly inappropriate pointer in the context of SMEs given the relatively limited amount of formal R&D that takes place in such firms. Adopting a modified version of Zahra and George's (2002) approach, which contrasts the concepts of *potential* and *realized* absorptive capacity, we treat KM practices as *potential* knowledge capacities. The actual underlying knowledge capacities (e.g. absorptive or transformative) can be viewed then as *realized* knowledge capacities (see Figure 4.1). A combination of these *potential* and *realized* knowledge capacities, in turn, represents some of the knowledge-based dynamic capabilities. Note that in this study, we treat the *realized* knowledge capacities (absorptive and transformative capacities) as unobserved variables.

4.2.3. Innovation performance and innovation orientation

Innovation represents the utilization or commercialization of knowledge that creates something new and offers economic value. In the present chapter, we focus on product and/or service innovations that are both new to the market and new to the company. To avoid dilution of focus, we intentionally exclude other classifications such as process innovation, organizational innovation, management innovation, and commercial/marketing innovation (Trott, 1998). This approach is consistent with findings of Johannessen et al. (2001), stating that the critical dimension of innovation (for SMEs) is the variation in newness or novelty, the distinctions between types of innovation being less important.

We further distinguish between the outputs (i.e. innovation performance) and the intentions or strategies to create or renew products or services (i.e. innovation orientation). In the present chapter, *innovation orientation* refers to the focus of individuals within the firm, including its employees and management, on investment and promotion of new products and processes, as well as encouragement of innovative thinking amongst employees (Homburg, et al., 2002; Worren et al., 2002; Kundu and Katz, 2003; Siguaw et al., 2006). Note that innovation orientation may encompass intentional or deliberate as well as emergent strategies for creating new products and services (Mintzberg et al., 1998).

Figure 4.1. Proposed research framework

A SME's knowledge- based dynamic capabilities

Potential knowledge capacities

External Knowledge Acquisition

Internal Knowledge Sharing

Realized knowledge capacities

Absorptive capacity

Transformative capacity

Innovation Orientation

Innovation performance

Note: dash line --- means unobserved in this study.
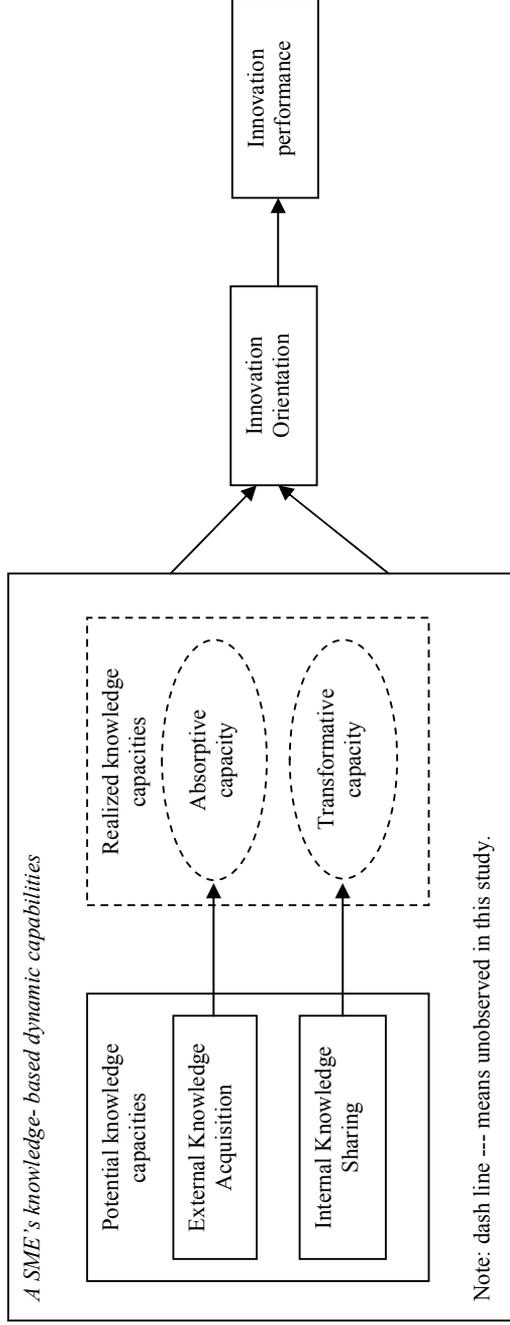
4.3. Hypotheses and rationale

We provide a detailed description of the proposed framework of this chapter in this section (see Figure 4.1). SMEs can develop and renew their absorptive capacity and transformative capacity (i.e. their *realized* knowledge capacities) by actively implementing external knowledge acquisition and internal knowledge sharing practices (i.e. their *potential* knowledge capacities). These capacities form the basis for certain knowledge-based dynamic capabilities, which in turn enhance the innovation orientation and innovation performance of the firm. We presume, furthermore, that innovation orientation mediates the relationship between KM practices (as concrete indicators of potential knowledge capacities) and innovation performance.

According to our model, KM practices are routines based on recurring patterns of behaviors within the firm—aggregations of the individual actions and interactions which relate to the acquisition or sharing of knowledge. This provides the logic for seeing the links between the micro-foundations of such routines and the routines themselves (Abell et al., 2008). A firm's (realized) knowledge capacities are dynamically developed over time by way of these KM practices (Campbell, 1960; Floyd and Wooldridge, 1999; Lichtenthaler and Lichtenthaler, 2009). We elaborate further on the rationale and implied hypotheses in the remainder of this section.

4.3.1. External knowledge acquisition, absorptive capacity and innovation performance

We view external knowledge acquisition practices as a key to innovation. The accumulation of external knowledge brought about by such practices can enhance the firm's ability to evaluate the commercial value of technological advances. Such knowledge can also help the firm to learn about competitors and opportunities and as such more effectively position itself in the market place. Such knowledge consequently increases the possibilities of recognizing and developing new technological opportunities for the firm (Teece, 2007). Though not measured directly, the quality of a firm's absorptive capacity in turn, depends on the intensity and speed of a firm's efforts to identify and gather knowledge, as well as the quality of information gathered. External knowledge acquisition practices foster this capacity through formal and informal networks (Zahra and George, 2002).

Past research suggests that outside sources of knowledge are often crucial to the innovation process (Pierce and Delbecq, 1977). Ravasi and Turati (2005) indicate that technology is generally transferred into a SME rather than developed in-house. Compared to

large firms, exploring external sources of knowledge is especially important for SMEs due to their resource constraints (Desouza and Awazu, 2006). External knowledge acquisition represents thus an important means to create new knowledge. Put another way, external acquisition allows firms to learn something different from what they already know (Cohen and Levinthal, 1989). Furthermore, external knowledge may also play a role in building internal connections. The more external knowledge is acquired, the more existing (i.e., internal) knowledge can be reconfigured to foster new competitive advantages (Cohen and Levinthal, 1990).

In sum, firms engaging in external communication react openly to the changing environment—that is, they are more likely to be open to new ideas and to perceive new opportunities—and thus be more inclined to innovate. Hence we propose the following hypothesis,

Hypothesis 1: External knowledge acquisition practices contribute positively to a firm's innovation performance by enhancing a firm's absorptive capacity.

4.3.2. Internal knowledge sharing, transformative capacity and innovation performance

Transformative capacity emphasizes a firm's ability to reactivate and synthesize or combine existing knowledge with new knowledge, and to further internalize and assimilate this newly transformed knowledge (Garud and Nayyar, 1994). Transformative capacity in a firm is important for recognizing new business opportunities. In practice it requires the communication of generated knowledge to all relevant departments and individuals (Liao et al., 2003).

The quality of a firm's transformative capacity results from effective internal knowledge sharing practices that allow a firm to analyze, process, interpret and understand the knowledge acquired from external sources or reconfigured within a firm (Szulanski, 1996; Kim, 1998). Complementary to absorptive capacity, transformative capacity plays a rather important role in creating a sustainable competitive advantage when a firm's innovation performance relies heavily on cumulative knowledge and entry timing, and when a firm operates in a more dynamic market (Garud and Nayyar, 1994).

Furthermore, transformative capacity reflects the degree to which *common knowledge,* that is, shared information or ideas, is widespread in the organization (Dixon, 2000). Common

knowledge is important due to its role in integrating knowledge, which in turn enhances a firm's ability to reactivate and utilize knowledge (Grant, 1996). Researchers have observed that firms must continuously leverage and recombine knowledge for new product development (Kazanjian et al., 2001). The *knowledge creation process,* that is, the effective application of new and/or existing knowledge (Huber, 1991), requires understanding by individuals within the firm as well as the sharing of knowledge amongst individuals with unique or specialized skills. As the knowledge creation process becomes embedded in routines, innovation should become more efficient—that is, the cost of developing innovation decreases, and the innovation activities in turn increase. Therefore, we assume that the greater use of internal knowledge sharing practices facilitates the speed and effectiveness of the innovation process (Liao et al., 2003).

In sum, it is likely that internal knowledge sharing practices not only create common knowledge among individuals which in turn stimulates innovation, but also facilitate innovative ideas generated by individuals during formal and informal discussions with each other. In turn, at an aggregate level, the degree to which internal knowledge sharing practices are embedded within the firm should result in a higher level of innovation performance at the firm level. Hence we propose the following hypothesis,

> *Hypothesis 2: Internal knowledge sharing practices contribute positively to a firm's innovation performance by enhancing a firm's transformative capacity.*

4.3.3.   The role of innovation orientation as a mediator

Attitude of the management team towards innovation is an important determinant of innovation performance (Nabseth and Ray, 1974). At an individual level of analysis, behavioral intentions are often viewed as a precursor for actual behavior (Wicker, 1969; Fishbein and Ajzen, 1975). In this study, we make inferences at the aggregated level of individual intentions. Since most of our observations are small firms led by individual entrepreneurs, this is probably a reasonable assumption, though we acknowledge that we are transferring this concept to a different level of analysis (from an individual level to a firm level).

Our rationale to support the mediating effect of innovation orientation is incomplete however without explaining the link between KM practices and innovation orientation. Mintzberg et al. (1998) compares the deliberate and emergent strategy approaches, the former in keeping with the view that strategy results from the realization of explicit intentions (in this

case, innovation) (Berthon et al., 1999). However, according to the emergent perspective of strategy, and in keeping with evolutionary theory, new strategies can grow from the interaction between established routines and novel situations, creating an important source of learning (Mintzberg et al., 1998, p. 185). According to the emergent strategy perspective, strategies emerge as individuals or groups of people learn more about a situation. Based on this logic, we would expect external knowledge acquisition practices to be a particularly rich basis for interaction between routines and novel situations. We furthermore propose that this can also take place with internal sharing, especially if the backgrounds and knowledge of the different members of the SME are sufficiently diverse. To summarize, we thus argue that innovation orientation plays a mediating role in the relationship between both types of KM practices (external knowledge acquisition and internal knowledge sharing) and innovation performance.

> *Hypothesis 3a: Innovation orientation is likely to mediate the relationship between external knowledge acquisition and innovation performance.*
> *Hypothesis 3b: Innovation orientation is likely to mediate the relationship between internal knowledge sharing and innovation performance.*

4.4. Methodology

4.4.1. Sample and data collection

This chapter uses a sub-sample of firm-level data from 'SME Business Policy Panel' that has been tracked longitudinally by EIM Business Policy and Research since 1998. The total panel consists of about 2000 SMEs and is stratified according to sectors (manufacture, construction, retail and wholesale, and service, according to BIK (Dutch Industrial Classification Chambers of Commerce) codes and size classes (0-9, 10-49 and 50-99 employees in FTEs).

For this particular study, we collected data to measure the key independent variables (KM practices and innovation orientation) via telephone (computer-aided) interviews in 2006. Using the same method, we collected data for the dependent variable (innovation performance) in 2007. By doing so, we reduced the risk of common method bias with respect to the dependent variable.

We also adopted a key informant approach for this study (Kumar et al., 1997) by interviewing the SME director in each case. Though this approach might lead to a single-response bias (Golden, 1992), our approach also benefits from direct measure of the perceptions of the director.

The target group of this particular study includes only independent companies with at least four employees from all sectors. This resulted in a sample of 649 firms available for empirical analysis. Within the sample, about 50% of respondent firms are less than 18 years old; about 50% of our sample is in the service sector. Regarding size, about 47% of respondent companies have 4-9 employees; 38% have 10-49 employees and the remaining 15% have 50-99 employees. Thus, the sample is somewhat overrepresented by relatively young and small companies in the service sector.

4.4.2. Models to be tested

In order to test the proposed hypotheses, we estimated the following models:

$$Innoperf = \alpha + \beta_1 \, (ExterA) + \beta_2 \, (InterS) + \beta_3 \, (Context) + \varepsilon \qquad (1)$$

$$Innoperf = \alpha + \beta_1 \, (ExterA) + \beta_2 \, (InterS) + \beta_3 \, (InnOri) + \beta_4 \, (Context) + \varepsilon \qquad (2)$$

Where InnoPerf represents innovation performance, ExterA represents external knowledge acquisition practices, InterS represents internal knowledge sharing practices, InnOri represents innovation orientation, and Context represents a set of contextual control variables (including company size, company age and sector dummies).

4.4.3. Variables

Scale construction. To construct multi-item variables, we used a combination of techniques, including Exploratory Factor Analysis, testing for reliability using the Cronbach-alpha reliability coefficient (See Table 4.1), and a check for face validity. Items were combined into variables using a protocol referred to as categorical principal components analysis (CATPCA) executed using the Statistical Package for the Social Sciences (SPSS). Appendix 4.1 provides a more extensive description of each variable.

Table 4.1. Results of Common Method Bias Test for Knowledge Management, Innovation Orientation and Innovation performance

			Component			
			1	2	3	4
Knowledge Management	External Knowledge Acquisition	Our company collaborates with other organizations (companies, universities, technical college) through alliances.	**0.69**	-0.04	0.17	-0.01
		The organization encourages employees to join formal or informal networks outside the organization	**0.67**	0.16	0.16	0.04
		Sending employees to exhibitions, congresses or seminars on a regular basis.	**0.72**	0.10	0.11	0.06
		Staying in touch with professionals and experts outside the company	**0.60**	0.16	0.21	-0.09
		To stay in touch with new developments, our company hires new employees with particular expertise.	**0.63**	0.15	-0.11	0.22
	Internal Knowledge Sharing	Director (management) holds frequent meetings with employees to share recent discoveries and insights.	0.14	**0.72**	0.12	0.09
		The company has special procedures or other ways to guarantee the sharing of best practices among members of the organization.	0.32	**0.57**	0.12	0.06
		Employees share knowledge and experience by talking to each other.	0.01	**0.79**	-0.01	-0.02
Innovation Orientation		Would you describe your strategy as renewing products, services or processes?	0.12	0.03	**0.75**	0.08
		Within our company people are constantly thinking about new products or services that serve future needs	0.11	0.17	**0.73**	0.10
		Are you going to invest in new products or services in the next 12 months	0.24	0.00	**0.59**	0.27
Innovation performance		Has the company introduced products or services to the market in 2006 that were new to the market.	0.07	0.11	0.41	**0.63**
		Has the company introduced products or services to the market in 2006 that were new to the company	0.03	0.03	-0.03	**0.80**
		Has the company developed new products or services in 2006	0.04	0.02	0.22	**0.72**
		Cronbach's alpha	0.80	0.63	0.62	0.64

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 5 iterations

Innovation performance. Three items, measuring whether the firm has introduced or developed new products or services (both new to the market and new to the firm), are combined into a scale for innovation performance using CATPCA (See Table 4.1) (Cronbach's $\alpha= 0.64$).

KM practices. For all the KM practices, items are measured on a five-point disagree/agree scale. Five items assess the intensity and direction of efforts expended in external knowledge acquisition (Cronbach's $\alpha= 0.80$) and three items measure internal knowledge sharing (Cronbach's $\alpha= 0.63$) (See Appendix 4.1). These items draw from the existing literature regarding knowledge management in SMEs (Uit Beijerse, 2000; Wong and Aspinwall, 2005). Similar items were used for the empirical study of the dimensions of potential absorptive capacity (Jansen et al., 2005).

Innovation orientation. Innovation orientation is based on a three item scale (Cronbach's $\alpha = 0.62$). This scale captures information regarding behavioral intentions of the director and/or employees towards innovation.

Control variables. We use company size, age and sector dummies, as control variables in our empirical analysis. Company size is measured by the natural logarithm of the number of employees in 2006. Four sectors are defined: manufacturing, construction, retail and wholesale, and services. Age is measured by the difference between the founding year and 2006.

Common method bias tests. Although reliabilities of scales in some cases are somewhat lower than desired, results from the common method bias test support the conclusion that each scale measures a separate construct (Podsakoff and Organ, 1986; Tippins and Sohi, 2003). More specifically, results were checked via an orthogonally rotated Principal Components Analysis (PCA) including individual items for KM practices, innovation orientation and innovation performance.

Based on Harman's single-factor test, results show that items for each of the two KM practices (external knowledge acquisition and internal knowledge sharing), innovation orientation and innovation performance all load on separate factors (See Table 4.1). In the unrotated solution, the largest factor explains only 26% of total variance. Furthermore, component loadings range from 0.57 to 0.80, with an average statement loading on the intended construct of 0.69. Of the 42 potential cross-loadings, only two loadings are above 0.30 (one being 0.41, the other 0.32). Together with the fact that innovation performance is

measured in a separate year, these findings provide reasonable confidence that the common method bias is not a major problem in the current study (Podsakoff et al., 2003).

4.4.4. Data Analysis

Initial tests. Bivariate relationships are first examined using Pearson product-moment bivariate correlation statistics. As a prior step to multivariate Ordinary Least Squares (OLS) regression analysis, we checked for multicollinearity using Variation Inflation Factors (VIF) scores. To test Hypotheses 1 and 2: we first carried out a multivariate OLS regression analysis. To test Hypotheses 3a and 3b: we followed the procedures to test for mediation described by Frazier et al (2004), and used the Sobel Test to check for significance (Frazier et al, 2004).

Structural equation modeling. As a further test of all the hypotheses, we use structural equation modeling (i.e. AMOS). A distinct advantage of structural equation models is the inclusion of latent variables, which allows for the measurement of abstract concepts that are not measured directly. In the present study, such latent variables are two aspects of KM practices (external knowledge acquisition and internal knowledge sharing), innovation orientation and innovation performance.

The overall fit of the structural equation model is checked by using chi-square (χ^2), degrees of freedom (df), and a probability estimate (p-value). The chi-square value should *not* be significant if there is a good model fit. In addition, the following indices are also commonly used to evaluate the model fit: relative chi-square or normal chi-square (CMIN/DF $\leq$ 3); goodness of fit (GFI) which checks for sample size effects and should be above 0.90; CFI, a comparative fit index, which checks for non-normal distribution should be above 0.90; and the root mean square error of approximation (RMSEA). The last index, RMESEA measures population discrepancy per degree of freedom and should be below 0.05 (Hu and Bentler, 1999; Murtha et al., 1998). Finally, when models are estimated using maximum likelihood estimation, it is also appropriate to use the Akaike information criterion (AIC), Bayes information criterion (BIC) and consistent AIC criterion (CAIC) to evaluate goodness of fit (Benetti and Kambouropoulos, 2006). These three values for the hypothesized model should be smaller than for the saturated and independence models.

4.5. Results

Table 4.2 presents descriptive statistics and correlations among all variables used in the study. Model 1 of Table 4.3 presents the regression results on the relationship between KM

practices and innovation performance; Model 2 presents the influence on this relationship due to mediating effect of innovation orientation. We also calculated VIF scores for each of the regressions to assess multicollinearity. The VIF scores range from 1.04 and 1.30. Given the rule of thumb cut-off of 10 (Neter et al, 1990), we can conclude that multicollinearity is unlikely to be an issue.

Hypothesis 1 predicts a positive relationship between external knowledge acquisition and innovation performance through enhancement of absorptive capacity (an unobserved variable in this study). Model 1 of Table 4.3 shows a significant positive coefficient for external knowledge acquisition (B=0.17, p<0.01). Thus, Hypothesis 1 is supported. Similar prediction has been made for internal knowledge sharing on innovation performance (Hypothesis 2). However, the coefficient for internal knowledge sharing is not significantly (only a trend) related to innovation performance (B=0.07, p<0.1). Hypothesis 2 is therefore not supported.

Hypotheses 3a and 3b predict the mediating effect of innovation orientation between KM practices (external knowledge acquisition and internal knowledge sharing) and innovation performance. When we add innovation orientation in model 2, the significant effects of both external knowledge acquisition and internal knowledge sharing disappear but model 2 shows a significant positive coefficient for innovation orientation (B=0.36, p<0.01) (see Table 4.3, Model 2). Using the Sobel Test for mediating effects, we find best support for the conclusion that the relationship between external knowledge acquisition and innovation performance is mediated fully by the innovation orientation variable (see Model a of Figure 4.2, Sobel test z=6.61, p<0.01). However, we do not find the same mediating effect for the relationship between internal knowledge sharing, transformative capacity and innovation performance (see Model b of Figure 4.2, Sobel test z=0.99, ns). Hypothesis 3b is thus not supported. One possible explanation could be that only certain SMEs benefit from internal knowledge sharing, namely those that rely heavily on cumulative knowledge or operate in more dynamic environments or under other specific conditions (Garud and Nayyar, 1994).

Table 4.2. Mean, standard deviation and Pearson correlations for all variables in the study (n=649)

		1	2	3	4	5	6	7	8	9
1	Innovation performance	1.00								
2	Innovation orientation	0.41***	1.00							
3	External knowledge acquisition	0.18***	0.39***	1.00						
4	Internal knowledge sharing	0.08	0.07	0.10*	1.00					
5	Size	0.09*	0.19***	0.29***	-0.11**	1.00				
6	Age	-0.03	-0.01	0.05	-0.05	0.25***	1.00			
7	Manufacturing sector	0.23***	0.10*	-0.06	-0.04	0.08*	0.11***	1.00		
8	Construction sector	-0.17***	-0.20***	-0.08*	-0.07	0.00	0.06	-0.18***	1.00	
9	Retail & wholesale sector	0.00	-0.05	-0.09*	-0.02	-0.20***	-0.06	-0.22***	-0.19***	1.00
	Mean	0.00	0.00	0.00	0.00	2.58	27.95	0.17	0.14	0.19
	Standard deviation	1.00	1.00	1.00	1.00	0.95	27.63	0.38	0.34	0.40

* p<0.05; ** p<0.01; *** p<0.001, two tailed tests of significance

**Table 4.3. Regression Results on Innovation Performance (n=649)**

Explanatory variables	Model 1		Model 2	
	b-value	t-value	b-value	t-value
Constant	-0.20	-1.58	-0.13	-1.13
Knowledge management practices				
External knowledge acquisition	0.17**	4.36	0.04	1.07
Internal knowledge sharing	0.07†	1.76	0.05	1.51
Innovation orientation			0.36**	9.20
General context				
Size	0.06	1.42	0.03	0.67
Age	-0.002†	0.08	-0.002	1.39
Manufacturing sector	0.64**	6.09	0.55**	5.54
Construction sector	-0.26*	-2.26	-0.11	-1.00
Retail & wholesale sector	0.16	1.61	0.17†	1.73
R-square	0.11		0.22	
Adjusted R-square	0.10		0.21	

† p<0.10; * p<0.05; ** p<0.01, two tailed tests of significance

Figure 4.2. Mediating effect of innovation orientation on the relationship between knowledge management practices and innovation performance (n=649)

a) External knowledge acquisition and innovation performance:

Sobel test: z=6.61, p<0.01

B=0.17, p<0.01 → B=0.04, n.s.

| External knowledge acquisition | Innovation orientation | Innovation performance |

B=0.34, p<0.01   B=0.42, p<0.01
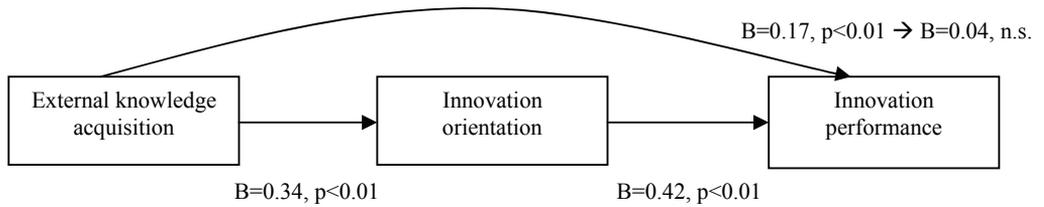
b) Internal knowledge sharing and innovation performance:

Sobel test: z=0.99, p=0.32

B=0.07, p<0.1 → B=0.05, n.s.

| Internal knowledge sharing | Innovation orientation | Innovation performance |

B=0.03, n.s.   B=0.42, p<0.01
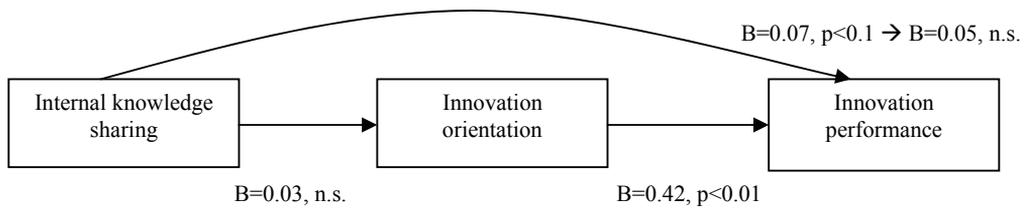
4.5.1. Results according to Structural Equation Modeling (SEM)

As an alternative approach to test the overall model, we also applied structural equation modeling. The results of SEM are reported in Figure 4.3. Note that the chi-square of the hypothesized model is 122.19, with 112 degrees of freedom, p-value is 0.24, which is not significant. Based on convention, (and perhaps counter-intuitively), a structural equation model is considered a good fit when the null hypothesis can be accepted (thus chi-square being non-significant as in the present case). Thus, the model is accepted as a good fit of the data. The other key statistical measures of the hypothesized model support that there is good model fit (see Figure 4.3). The CMIN/DF is 1.09, the GFI is 0.98, the CFI is 0.99 and the RMSEA is 0.01. We can thus conclude that the model is valid and proceed to interpret its results.

Indicators measuring each latent variable of this study are all highly statistically significant (p<0.001). Results confirm that indicators load only on the constructs to which they belong. Furthermore, path analysis shows that external knowledge acquisition (B=0.40, p<0.001) has a positive effect on innovation orientation but that internal knowledge sharing (B=-0.51, ns) has no significant effect. There is also no significant relationship between either of the KM practices and innovation performance. Innovation orientation positively contributes to innovation performance (B=0.33, p<0.001). Thus, consistent with conclusions drawn from the multivariate OLS regression analysis, our results show a significant mediating effect of innovation orientation in the relationship between external knowledge acquisition and innovation performance while internal knowledge sharing is associated neither with innovation orientation nor innovation performance (See Figure 4.3).

Figure 4.3. Results of Path Analysis (n=649) from SEM model
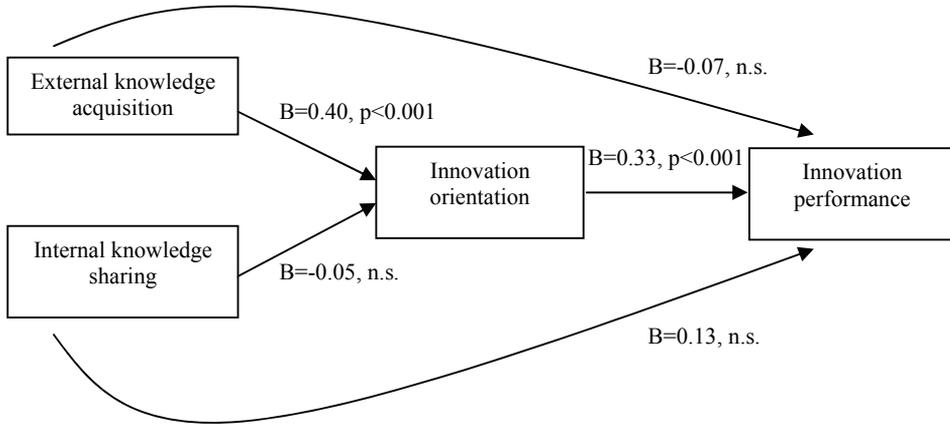
Constructs loadings in the Structural Model

			Estimate	S.E.	C.R.
vluh01eR	<---	External knowledge acquisition	1.00		
vluh01dR	<---	External knowledge acquisition	0.93***	0.10	9.04
vluh01bR	<---	External knowledge acquisition	1.10***	0.10	10.59
vluh01aR	<---	External knowledge acquisition	0.92***	0.10	8.93
vluh01cR	<---	External knowledge acquisition	1.12***	0.10	10.76
vluh03dR	<---	Internal knowledge sharing	1.00		
vluh03bR	<---	Internal knowledge sharing	2.58***	0.43	6.01
vluh03aR	<---	Internal knowledge sharing	1.64***	0.25	6.69
vd02cR	<---	Innovation orientation	1.54***	0.16	9.92
vc02aR	<---	Innovation orientation	0.48***	0.05	9.82
vf01aR	<---	Innovation orientation	1.00		
vta_02R	<---	Innovation performance	1.00		
vta_04R	<---	Innovation performance	1.56***	0.17	9.23
vta_03R	<---	Innovation performance	0.83***	0.10	8.79

Model fit summary: χ^2=122.19, df=122, p=0.24

	CMIN/DF	GFI	CFI	RMSEA	AIC	BIC	CAIC
Hypothesized model	1.02	0.98	0.99	0.01	278.19	627.28	705.28
Saturated model		1.00	1.00		380.00	1230.33	1420.33
Independence model	11.81	0.65	0.00	0.13	2056.69	2141.72	2160.72

$^{†}P<.10;$ $^*p<.05;$ $^{**}p<.01;$ $^{***}p<.001$

4.6. Discussion and conclusion

The aim of this study is to investigate how SMEs foster innovation within their firms. Taking a knowledge-based dynamic capabilities perspective, we empirically test the relationship between KM practices, innovation orientation and innovation performance based on a sample of 649 Dutch SMEs. We argue that the effects of KM practices on innovation performance take place by enhancing a firm's realized knowledge capacities. Results from multivariate OLS regression analysis clearly support the conclusion that only external knowledge acquisition contributes positively to innovation performance of a SME and presumably via the enhancement of absorptive capacity. Furthermore, the results are most consistent with the conclusion that internal knowledge sharing, on the other hand, is not associated with innovation performance. These findings would appear consistent with other research views that external knowledge acquisition practices (but not necessarily internal sharing practices) are an essential determinant especially in new product innovation for SMEs (Kazanjian et al., 2001).

Moreover, we empirically test and find support for the mediating effect of innovation orientation in the aforementioned relationship (see Figure 4.1). Combining results from multivariate OLS regression and SEM, the full mediating role of innovation orientation in the relationship between external knowledge acquisition, absorptive capacity and innovation performance is consistent with the predictions made in Hypothesis 3a. One interpretation of this result is as follows: Directors and other key employees of SMEs reporting more extensive use of external knowledge acquisition practices in their firms are likely to obtain more knowledge from outside the firm, and thus likely to build up greater absorptive capacity. This in turn, may enhance their judgments with respect to new and/or existing opportunities. Our evidence suggests that such knowledge also enhances the innovation intentions or orientation of individual employees within the firm, which leads to higher innovation performance. These findings are in keeping with an emergent view of strategy as proposed by Mintzberg et al. (1998).

Weaker support is found for the role of internal knowledge sharing in the SME's innovation performance. Perhaps many SMEs are simply too small or the diversity of their internal expertise too limited to benefit from such sharing. Or perhaps there are contingencies for which such sharing is less effective with respect to innovation.

4.6.1. Implications

The key findings of this study demonstrate the importance of external knowledge acquisition versus internal knowledge sharing in fostering innovation orientation and innovation performance within SMEs. Empirical evidence shows that a disproportionate amount of innovation (including new patents and other inventions and discoveries) comes from SMEs (Thompson and Leyden, 1983; Acs and Audretsch, 1993). Our study suggests that SMEs may innovate in different ways than large firms. Instead of building new knowledge and creating innovation opportunity in-house, SMEs often seek opportunities and acquire new external knowledge through social ties and interaction with external resources. A favorable external communication system can make SMEs more innovative, perhaps by improving their ability to identify new opportunities from the external environment.

This is in line with the dynamic capabilities perspective, which argues that a firm's competitiveness depends on its dynamic capabilities, that is, its capacity to sense and shape opportunities and threats (Teece, 2007). Amongst SMEs, external knowledge acquisition strategies are especially helpful and appear to foster innovation. Therefore, policy makers who want to stimulate SMEs' innovation performance may want to assist SME directors in making better use of their external environment by learning how to network more effectively. Indeed, recent small-scale experiments with Dutch agricultural entrepreneurs over a six-month period provide support for the feasibility of networking workshops (Verstegen and de Lauwere, 2009).

Furthermore, findings from our study support the notion that organizational routines may represent recurring patterns of activities taken by individuals within the organization, such as joining networks, attending seminars and conferences, and that such activities have a direct positive effect on innovation orientation and innovation performance of the firm in turn. Although better tests are needed, these findings are consistent with the notion that actions of individuals have a direct impact at the aggregate or firm level outcomes. In turn, such actions, in our view, may be considered the micro-foundations for the routines that can lead to the firm's (realized) knowledge capacities (e.g. absorptive, transformative) at the organization level.

Finally, one of the most interesting findings may be the mediating effect of innovation orientation in the relationship between external knowledge acquisition practices and innovation performance. These findings provide support for a combined emergent and deliberate view of innovation strategy. On the one hand, external exposure to ideas appears to enhance learning

and interest in strategic renewal and innovation (i.e. emergent view). External knowledge search activities appear to make SMEs more inclined in other words, to engage in innovation activities, and perhaps realize the benefits of innovation. On the other hand, a heightened innovation orientation is clearly related to greater innovation performance during a subsequent period, supporting a deliberate view of strategy as planned and based on behavioral intentions. This combined emergent-deliberate view is in keeping with a view of strategy proposed by Mintzberg et al. (1998).

4.6.2. Limitations and Future Research

This study has certain limitations that might be addressed by future research. First of all, we measure KM practices as potential knowledge capacities but only infer the existence of realized knowledge capacities as unobserved intervening variables. For instance, since transformative capacity is unobserved, based on our methodology, we cannot conclude whether our findings are due to a lack of effect of sharing practices or the irrelevance of transformative capacity for SMEs. One way to solve this problem in future research would be to design direct measures of realized knowledge capacities. For instance, a future measure of absorptive capacity might assess the adequacy of external information acquired, in terms of various dimensions (e.g. quantity, timeliness, appropriateness for solving of internal problems). We do question, nevertheless, the way absorptive capacity has been measured in the past, especially those studies which measure absorptive capacity as the amount or proportion of capital allocated to research and development (Cohen and Levinthal, 1990; Cantner and Pyka, 1998; Rocha, 1999; Stock et al., 2001). Capital itself is a resource, not a capacity, per se.

In addition to the variables examined in this study, the prediction of innovation performance could be strengthened by including a more complete set of KM practices in future research to reflect a broader range of knowledge capacities as identified by other recent research (e.g. Lichtenhaler, 2009; Lichtenhaler and Lichtenhaler, 2009). Other independent variables might also include human capital variables, such as aggregates of employee and/or director characteristics such as aptitude, creativity, knowledge, education and work experience.

We realize the limitation of having only one key informant per firm. Future research may also focus more explicitly on micro-foundations of routines, for instance, by obtaining self-reports of KM practices from individual members of each firm, in addition to the director as key informant. Although obtaining multiple respondents data per firm is challenging, it would allow for a more rigorous testing of the micro-foundations approach to the dynamic capabilities perspective. Asking respondents not only about their own behavior but also their

perception of the dominant or accepted behaviors in the firm would also provide measurement of descriptive norms regarding KM practices.

One final area to explore in future research is the examination of the model on a time-series basis. Although there is a one-year lag between the independent and dependent variables, the dependent variable by its nature measures retrospective information from the previous year, thus not providing much time delay. Measurement of all variables for several time periods could thus be conducted to provide a more thorough means to test the assumptions of emergent versus deliberate strategy.

In conclusion, our study responds to calls for research on origins of organizational routines and capabilities, and their relationships to firm-level outcomes. The present chapter contributes to the management literature on knowledge management, dynamic capabilities, emergent versus deliberate strategy and emerging micro-foundations approaches in the following ways: *first*, providing empirical insight into how SMEs foster their innovation from a knowledge-based dynamic capabilities perspective; *second*, revealing a combined emergent-deliberate view of innovation strategy for SMEs by testing mediating effect of innovation orientation; and *last*, creating a link between individual action and firm-level routines or capabilities by focusing on KM practices as recurring patterns of individual behaviors.

Furthermore, our empirical findings imply that SMEs can be innovative in spite of their (potential) resource constraints. SMEs which actively acquire external knowledge are able to build a greater competitive absorptive capacity to sense and seize business opportunities. This in turn may motivate them to be proactive in innovation activities, and hence leads to new or improved products or processes. Thus, by strategically managing knowledge management and especially external knowledge acquisition practices, owners/entrepreneurs of SMEs and their firms will benefit in the long term.

Appendix 4.1: Description of Variables

Variable	Description of Variable
Knowledge management practices	
External knowledge acquisition α=0.80	The external acquisition construct was created using CATPCA, using the following five questions: 1. Our company collaborates with other organizations (companies, universities, technical college) through alliances. 2. The organization encourages employees to join formal or informal networks outside the organization 3. Sending employees to exhibitions, congresses or seminars on a regular basis. 4. Staying in touch with professionals and experts outside the company 5. To stay in touch with new developments, our company hires new employees with particular expertise. The items were answered with the following scale:(1='not at all applicable'; 2='not all that (barely) applicable'; 3='somewhat applicable'; 4='applicable to a great degree';5='totally applicable')
Internal knowledge sharing α =0.63	The internal sharing construct was created using CATPCA, using the following three questions: 1. Manager consults employees frequently to discuss new developments. 2. The company has special procedures or other ways to guarantee the sharing of best practices among members of the organization. 3. Employees share knowledge and experience by talking to each other. The items were answered with the following scale: (1='not at all applicable'; 2='not all that (barely) applicable'; 3='somewhat applicable'; 4='applicable to a great degree';5='totally applicable')
Innovation Orientation	
Innovation orientation α =0.62	The innovation orientation construct was created using CATPCA, using the following three questions: 1. Would you describe your strategy as renewing products, services or processes? (1='no';2='yes') 2. Within our company people are constantly thinking about new products or services that serve future needs The items were answered with the following scale: (1='not at all applicable'; 2='not all that (barely) applicable'; 3='somewhat applicable';

	4='applicable to a great degree';5='totally applicable') 3. Are you going to invest in new products or services in the next 12 months? (1='no';2='probably';3='certainly')
Innovation performance	
Innovation performance α=0.64	This scale was created by combining answers to the following three questions using the CATPCA technique: 1. Has the company introduced products or services to the market in 2006 that were new to the market? 2. Has the company introduced products or services to the market in 2006 that were new to the company? 3. Has the company developed new products or services in 2006? (1='no';2='yes')
Control variables	
Size	Computed as the natural logarithm of the response to the following question. How many persons does the company employ?
Age	Computed as the difference between founding year and 2006.
Manufacturing sector	Is the company operating in the industrial sector? (1='yes'; 0='no')
Construction sector	Is the company operating in the construction sector?(1='yes'; 0='no')
Retail and wholesale sector	Is the company operating in sales or repair of consumer products? (1='yes'; 0='no')

CHAPTER V

Flexible labor and innovation performance: evidence from longitudinal firm-level data

Abstract: This chapter examines the nexus between flexible labor and innovation performance using a longitudinal firm-level data (1992-2000) in the Netherlands. Our results indicate that firms with high shares of workers on fixed-term contracts have significantly higher sales of *imitative* new products but perform significantly worse on sales of *innovative* new products ("first on the market"). High functional flexibility in "insider-outsider" labor markets enhances a firm's new product sales, as do training efforts and highly educated personnel. We find weak evidence that larger and older firms have higher new product sales than do younger and smaller firms. Our findings should be food for thought to economists making unqualified pleas for the deregulation of labor market.

5.1. Introduction

In recent years, studies on the determinants of innovative behavior in Europe have been encouraged by the increasing availability of firm-level data through the European *Community Innovation Survey* (*CIS*). The emerging literature has focused on determinants of innovation such as market structure, firm size, knowledge spillovers, R&D collaboration, conditions for the appropriation of innovation benefits, and others. This chapter will address a factor that has not been covered in *CIS* studies: What is the influence of the increased flexibility of labor on innovation?

Over the last twenty years, many labor market economists have strongly recommended that high unemployment should be reduced by making European labor markets more flexible. An example is the OECD's Jobs Study (1994). Subsequent to the Jobs Study, a literature has developed that tries to substantiate that more flexible labor markets would not only be favorable for employment, but may also allow for higher economic growth and higher productivity growth (e.g. Nicoletti and Scarpetta, 2003). Nonetheless, flexible labor contracts as determinants of innovation or productivity growth are still under-researched. There are only few firm-level studies, including Laursen and Foss (2003), Michie and Sheehan (2003), Arvanitis (2005), Kleinknecht et al (2006), and Lucidi and Kleinknecht (2009). This is regrettable, as labor relations and human resources have been suggested to have a significant impact on innovation through their influence on knowledge processes (Amabile et al., 1996; Guest, 1997; Trott, 1998). Good human resources may be even more crucial for small and medium sized enterprises (SMEs) as their performance tends to be highly dependent on key individuals (Wiklund and Shepherd, 2003).

This chapter makes an empirical contribution to our sparse knowledge about the impact of flexible labor on innovation using firm-level data from several subsequent surveys with broad industry coverage in the Netherlands. Our database covers a "direct" measure of innovation: sales performance of new or improved products, introduced during the past 2 years. We take advantage of the fact that there is a wide spectrum of typical labor contract patterns in the Netherlands (and in our database). A number of Dutch firms still have fairly rigid "Rhineland" labor relations, while others have highly flexible "Anglo-Saxon" practices in hiring. "Rhineland" firms typically offer their personnel good wages, fair protection against dismissal, and longer-term commitments. "Anglo-Saxon" firms employ significant labor on

fixed-term contracts, hired from employment agencies or freelance workers, which allows them to adapt to changing demand conditions by easily hiring or firing people.[13]

We trust that the wide spectrum of "Rhineland" versus "Anglo-Saxon" labor contracts in the Netherlands allows for a meaningful study of the possible impact of flexible labor on innovation performance. This chapter is organized as follows: Section 5.2 provides a brief sketch of the theoretical background and discusses our hypotheses. Section 5.3 describes our data and the empirical model. Section 5.4 reports the regression results. Section 5.5 rounds up with conclusions.

5.2. Patterns of flexible labor and innovation

Labor market flexibility can be subdivided into three types of flexibility: (1) numerical flexibility, (2) functional flexibility and (3) wage flexibility (e.g. Beatson, 1995). This chapter is confined to analyzing numerical and functional flexibility. Numerical (or "external") flexibility allows for easy hiring or firing of personnel, resulting in significant reductions of a firm's wage bill.[14] High numerical (or "external") flexibility is at the core of the "Anglo-Saxon" model of labor relations.

Functional flexibility is the ability of firms to reallocate labor in their internal labor markets, relying on training that allows personnel to carry out a wider range of tasks (e.g. Beatson, 1995). Functional flexibility reflects the multiple competencies of workers, such as multi-skilling, multi-tasking, cooperation and the involvement of workers in decision making (Arvanitis, 2005). Functional (or "internal") flexibility is characteristic of the "Rhineland" model of labor relations, providing opportunities for long-term careers in the same firm. Such long-term commitments may be interpreted as an investment in the trust, loyalty and commitment of individuals.

Many mainstream economists tend to be in favor of more flexible, "Anglo-Saxon" labor markets. In a traditional microeconomics view, markets can never be flexible enough. There are a number of detailed arguments in favor of more numerical flexibility. First, long tenured

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[13] Hall and Soskice (2001) suggested that rigid "Rhineland" arrangements are more conducive to incremental innovation, while flexible "Anglo-Saxon" contracts are better for radical innovation. This suggestion did, however, meet some criticism recently (see Akkermans *et al*., 2009).

[14] For evidence from the OSA database on the wage-reducing effects of flexible work, both at the firm and the individual levels see Kleinknecht *et al*. (2006).

employees may become conservative, being attached to outdated products and processes, and reluctant to adapt to significant changes due to "lock-in" effects (Ichniowski and Shaw, 1995). Second, labor market rigidity may reduce the reallocation process of labor from old and declining to newly emerging industries and the difficulty of firing personnel might frustrate labor-saving process innovations (Bassanini and Ernst, 2002; Scarpetta and Tessel 2004; see also Nickell and Layard, 1999). Third, with strong protection against dismissal, labor may become too powerful, increasing the chance that monopoly profits from innovation will be (partly) absorbed through higher wage claims. Monopoly profits from innovation are a reward for taking innovative risks; such risk-taking would be discouraged if labor could claim part of the premium. Powerful labor, negotiating wage contracts at the firm level, could therefore "hold up" investments in innovation (Malcomson, 1997). Finally, one might add that higher flexibility would also allow for easier replacement of less productive personnel by more productive people and the threat of firing might prevent shirking. Easier hiring and firing could also help keep wages low, as is evidenced by estimates of wage equations.[15] Moreover, as has recently been emphasized by Arvanitis (2005), firms can more effectively fulfill their demands for specialized services by making use of temporary work.

As counterarguments against high numerical flexibility, we propose the following: high numerical flexibility may weaken a firm's historical memory and continuity of learning. A high external labor turnover rate may reduce employees' loyalty and commitment, resulting in easier leakage of knowledge to competitors; such externalities would discourage investment in R&D. The argument that high numerical flexibility will make it difficult for firms to store innovative knowledge is particularly relevant for firms that have a "routinized" Schumpeter II innovation regime (Kleinknecht et al., 2006). In a Schumpeter II regime, the path-dependent historical accumulation of knowledge is critical to superior product and process performance. Much of the accumulated knowledge is "tacit." Different from documented and codified knowledge, "tacit" knowledge is ill-documented and idiosyncratic, as it is based on personal experience (Polanyi, 1966). Accumulation of such knowledge is favored by a longer tenure in the same firm.

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[15] Kleinknecht *et al.* (2006) give evidence from individual-level as well as firm-level wage equations that flexible personnel earn lower hourly wages, and that firms with high shares of flexible personnel pay lower wages. Similar evidence from individual-level wage equations has been reported by Booth *et al*., 2002, McGinnity and Mertens 2004; Sànchez and Toharia 2000, or Ségal and Sullivan, 1995.

Shorter job durations may also discourage investments in firm-sponsored training. In highly flexible labor markets, employees may be interested in acquiring general knowledge that increases their employability elsewhere, but they may be reluctant to acquire firm-specific knowledge (e.g., studying safety instructions) if they anticipate a short stay in the firm. Moreover, Naastepad and Storm (2006) have shown that (growing) flexibility in labor relations in OECD countries leads to a significant growth in management bureaucracies to control disloyal behavior. While adherents of flexible labor markets emphasize that difficult firing of redundant personnel would frustrate labor-saving innovations, it can also been argued that personnel who are easy to fire have strong incentives to hide information about how their work can be done more efficiently. This can be damaging to productivity growth as far as the management is dependent on their personnel's "tacit" knowledge to efficiently implement process innovations (see also Lorenz, 1999). Finally, easy firing may change power relations in a firm. Personnel on the shop floor are less likely to criticize powerful (top) managers, and poor critical feedback from the shop floor may favor problematic management practices.

Given the opposing theoretical arguments pertaining to numerical flexibility, it is interesting to look at empirical findings. Two recent studies using UK firm-level data show a *negative* correlation between numerical flexibility and innovation (Michie and Sheehan, 1999, 2001). Similar results are reported by Chadwick and Cappelli (2002) from US data. Arvanitis (2005) reports mixed results. In one of his specifications, he finds that temporary work has a positive impact on innovation, which he ascribes to the need to hire specialists on a temporary basis for the R&D process. When using part-time work as another indicator of flexible labor, he finds a significantly negative impact on innovation. His general conclusion is that "… firms with high productivity are those which apply new forms of workplace organization but do not engage many part-time and temporary workers" (Arvanitis, 2005: 1010). Given that the results by Arvanitis are not clear-cut, we shall also test whether there is a non-linear relationship, using quadratic terms of numerically flexible labor.

While the impact on innovation of numerical flexibility is doubtful, Arvanitis (2005) does find a positive impact on productivity and innovation for several of his indicators of functional flexibility. Similar results have been found by others (Michie and Sheehan, 1999, 2001; Chadwick and Cappelli, 2002; Kleinknecht et al., 2006). High functional flexibility in internal labor markets reflects a firm's ability to organize flexibly without destroying loyalty and commitment by firing. This is likely to reduce positive externalities through the exit of trained people or through disloyal behavior (e.g., the leaking of trade secrets to competitors).

Furthermore, high functional flexibility can reduce communication barriers between different departments. Better sharing and transfer of knowledge across departments can favor innovation.

5.3. Data, variables and methodology

We use longitudinal firm-level data collected by the *Organization for Strategic Labor Market Research* (*OSA*) in the Netherlands. Since 1988, OSA has built an enterprise panel in all sectors of manufacturing, services, agriculture and in non-commercial services, including the government sector. In fact, OSA samples *all* organizations in the Netherlands that employ personnel, with a minimum of five people, stratified by industries and firm size classes. The database provides information about the labor force (e.g., inflow, outflow, type of contract, internal mobility), as well as about R&D and new products sales. Since 1989, the survey has been conducted every two years. Organizations taking part in a previous survey are also included in the next survey. New organizations are added to each wave in order to compensate for sample fall-out (see Appendix 5.1). Data collection is performed using a combination of questionnaire-based face-to-face interviews and a questionnaire to be filled in by a manager and returned by mail.

We construct a longitudinal dataset that includes dependent variables in year *t* and lagged independent variables in year *t*-2, the latter coming from the previous survey. Our final dataset is confined to the period 1992-2000, as information from earlier surveys is not fully comparable. Furthermore, we estimate our models on the total sample as well as on a sub-sample of 929 commercial SMEs with less than 250 employees. Restriction to SMEs has the advantage of having a more homogeneous sample. We confine our sample to four business sectors, i.e., manufacturing (SBI 15- SBI 37), construction (SBI 45), trade (SBI 50-52) and (other) services (SBI 55, SBI 60-67, SBI 70-74, and SBI 77). We exclude government and other non-commercial organizations.

Our database allows the use of a "direct" indicator of product innovation; i.e., sales of new (or significantly improved) products and/or services. It is similar to the "innovation output" indicator in the CIS database. There are two deviations of the OSA questionnaire from the CIS concept as described in the OECD Oslo Manual (2005). First, the CIS asks for new or improved products introduced during the past three years, while OSA covers the past two years. Second the CIS distinguishes products that are "new to the firm" from those that are

"new to the market," whereas OSA only asks for the former. We interpret products "new to the firm" as "imitative" innovations, and products "new to the market" as "true" innovations. As in the CIS, innovation performance in our OSA database is measured by asking respondents to subdivide their present product range into three types of product:

(1) Products that remained *largely unchanged* during the past two years;

(2) Products that were *incrementally improved* during the past two years; and

(3) Products that were *radically changed* or introduced as *entirely new* products during the past two years.

Subsequently, respondents are asked to report the share of these three types of product in their last year's total sales. As our dependent variable, we use the logs of new product sales per employee introduced during the past two years; when using logs, this variable conforms better to a normal distribution. Constructing this variable, we add categories (2) and (3), i.e., incremental and radical innovations. One should note that the new product sales under (2) and (3) need to be novel in that they include new technological knowledge; at least, they should be based on novel (and creative) combinations of existing technological knowledge, the latter being most relevant in the service industries. As mentioned earlier, the data do not allow us to distinguish "imitative" innovations ("new to the *firm*") from "true" innovations ("new to the *market*"). Only the 2001 survey provides information on novelty. It comes as no surprise that only a smaller portion of the innovating firms have products that are "new to the market" (see Table 5.1). In other words, our indicator of new product sales is dominated by "imitative" innovations. We evaluate the slight evidence on "new to the market" innovations in a separate estimate.

Table 5.1. Degree of novelty of new products in OSA survey (only survey 2001)

Firms declaring that their new products were:	# of All firms (%)	# of SMEs (%)
'new to the market'	268 (15.7)	188 (14.6)
'partially new to the market'	903 (52.8)	655 (50.9)
'hardly new to the market'	540 (31.5)	445 (34.5)
Totals	1,711 (100)	1,288 (100)

Our most important ***independent variables*** are numerical flexibility and functional flexibility. We use two indicators of numerical flexibility: Annual external labor turnover (i.e., percentages of people that joined or left the firm during the last year) and percentages of people on fixed-term contracts (hired directly by the firm). The correlation tables in the appendix 5.4 and 5.5 show that the two indicators are weakly correlated; fortunately, our robustness checks with the multivariate analyses below indicate that this is not disturbing. Annual external labor turnover is measured by the maximum value of either the share of newly hired people or the share of people that left the firm in the past year. We also made robustness checks, using, e.g., the *sum* of people that left or joined the firm. This changed our results very little. We expect both indicators of numerical flexibility to have positive impacts on innovation performance until an optimum point, thereafter turning negative. We try to capture such non-linear effects by the inclusion of quadratic terms. Our indicator of functional (or "internal") flexibility is measured by the percentage of employees that changed their function and/or department within the firm during the past year. We expect functional flexibility to have a positive impact on innovation performance.

We use the following ***control variables***, which are described in more detail in Appendix 5.2:

(1) Quality of human capital. This is measured by the percentage of employees with university or higher professional education degrees and by the percentage of employees who participated in training. Previous studies indicate that highly educated people can adapt more quickly to a changing environment, thus contributing to better business performance (Holzer, 1987; Becker and Huselid, 1992; Galende and Suarez, 1999). Furthermore, formal and informal training can enhance an employee's development and is likely to contribute positively to organizational outcomes and innovation (Russell et al., 1985; Bartel, 1994; Knoke and

Kalleberg, 1994; Laursen and Foss, 2003). We thus expect both of these variables to have positive impacts on innovation performance.

(2) R&D intensity as a proxy of inputs to the innovative process.

(3) The logarithm of firm size. The relationship between firm size and a firm's innovation performance is inconclusive. On the one hand, small firms have little bureaucracy, short communication lines and dedicated management by their owners. On the other hand, strong dependence on the owner as a key figure can also have disadvantages. Moreover, small firms often suffer from a lack of (financial) resources and access to technological knowledge (see Tidd et al., 2006). A major disadvantage of small firms is that they have little capability to reduce risks by means of a diversified portfolio of innovative projects.

(4) The logarithm of firm age. The impact of firm age on innovation is again a two-sided story. Young firms can be expected to have highly dedicated and flexible management and they can be more ambitious in innovation, as there is no internal resistance by vested interests in older product lines. Their innovation performance may, however, suffer from lack of experience with innovation (van de Panne et al., 2003). As far as innovative activities take advantage of accumulated technological knowledge and management experience from the past, firms with a long innovation history might use their R&D more efficiently.

(5) Export intensity. The causal relationship between export and innovation is bidirectional. First, innovation stimulates exports performance (Posner, 1961; Vernon, 1966). Then, endogenous growth and new trade theories emphasize that export stimulates investment in R&D as operations on export markets give better access to international knowledge spillovers through flows of ideas and/or goods (Grossman and Helpman, 1991; Aghion and Howitt, 1998). Hughes (1988) reports empirical evidence on the simultaneous relationship between export and R&D at sector level; evidence of a simultaneous relationship at the firm level has been reported by Kleinknecht and Oostendorp (2002). Using export shares in total sales lagged by two years, we try to mitigate the endogeneity problem.

(5) Industry average of new product sales. A firm's score on new product sales crucially depends on the typical length of the product life cycle in its sector of principal activity. Obviously, a sector like ICT with short product life cycles will have higher sales of new products than sectors with long life cycles, such as aircraft construction. The dependent variable can therefore <u>not</u> be compared across industries unless we correct for life cycle differences. As life cycle data are not easily collected in enterprise surveys, we use, as a

substitute, the log of average new product sales in a firm's sector of principal activity. Inclusion of this variable comes down to explaining the deviation of a firm's new product sales from the average of its industry. Besides correcting for typical differences in product life cycles between industries, this variable can also capture other unobserved specifics of industries, such as differences in technological opportunity or in the appropriability of innovation benefits. Not surprisingly, inclusion of this variable made industry dummies insignificant. In our robustness checks, it turned out that a tentative exchange of this variable against industry dummies had little effect on the coefficients of the other variables.

5.3.1. Econometric model

We assume that flexible labor patterns are related to a firm's new product sales as follows:

$$y_{i,t} = \alpha + \beta_1 NFL_{i,t-2} + \beta_2 FFL_{i,t-2} + \beta_3 Con_{i,t-2} + \beta_4 Years_t + \varepsilon_{i,t-2} \qquad \text{Equation (1)}$$

Here, y (for firm i and year t) denotes the log of "new product sales per employee." We include lagged values of the following independent variables: "NFL" includes variables of numerical flexibility measured by external labor turnover and percentages of people on temporary contract; "FFL" denotes functional flexibility, i.e., the percentages of employees changing function or department within firms; "Con" represents seven control variables; and "Years" represents year dummies. By using 2-year lagged values of independent variables, we reduce potential endogeneity problems.

We use four econometric models on pooled longitudinal data: an OLS model, a Tobit model, a Heckman model and a Heck-tobit model. We do not estimate panel data models because of high attrition. A balanced panel covering 5 waves of data would leave only very few firms. Rather than using one-way error component models or equally complex methods for unbalanced panels (for a survey see Baltagi and Song, 2004), we use straightforward regression techniques on pooled longitudinal data, correcting for repeated observations (clustering) with robust estimation methods.

First, we use a pooled OLS model (Model 1). This has the disadvantage of sample selection bias since it only includes firms that have positive innovation output. Firms with zero or missing innovation output are excluded (also because of the log transformation), with a possible sample selection bias as a result. In order to correct for selection bias, we have two options, and we use both. First, we use the Tobit model (Model 2). A Tobit model (e.g.

Maddala, 1985) corrects for non-normality of the distribution of our dependent variable that is caused by the high probability mass at zero due to firms that have no new product sales. Including firms with no innovation reduces the sample selection bias.

The mathematical representation of a simple Tobit procedure is as follows:

$$y_i = \begin{cases} y_i^* & if \ y_i^* > 0 \\ 0 & if \ y_i^* \leq 0 \end{cases} \qquad \text{Equation (2)}$$

Where y_i^* is a latent variable: $y_i^* = \beta x_i + u_i , u_i \sim (0, \sigma^2)$ Equation (3)

Second, we use a Heckman model (Model 3) to correct for item non-response bias. The Heckman model also includes firms that did not report their innovation output, again reducing sample selection bias. In the Heckman model, a selection equation is introduced with a binary variable z (for firm i and year t), which indicates whether the dependent variable (y) is observed or not. The underlying continuous variable is modeled as follows:

Heckman selection equation: $z_{i,t} = w_{i,t-2} \gamma + u_{i,t-2}$, Equation (4)

where w represents the independent variables listed in the linear equation (Equation 1) and an instrumental variable. We choose for the latter a variable that measures a firm's sensitivity to economic fluctuations. The latter does not correlate with the error terms in the linear equation, but does have a significant impact on the propensity to innovate in the selection equation. This instrumental variable thus ensures the identification of the Heckman model (Heckman, 1979; Greene, 2002).

Finally, we also use a Heck-tobit model (Model 4) to control for both aforementioned possible selection biases. We first formally test for sample selection bias using a Heckman two-step procedure and generate an inverse Mill's ratio (Heckman 1979; Berk, 1983). This ratio captures the probability of responding to the survey as a function of the variables listed in w of equation 4. We then include this ratio in the Tobit model to statistically control for item non-response bias.

5.4. Results from four regression models

Descriptive statistics are reported in Appendix 5.3. Appendices 5.4 and 5.5 show the correlations between our independent variables in the total sample and the SME sample. No correlation exceeds 0.5. The variance inflation factors (VIFs) range from 1.03 to 1.21, from which we conclude that multicollinearity is unlikely to be a problem. Tables 5.2A and B present the results of four regression models in the total sample and in the SME sample.

We explain *the log of new product sales per employee* achieved by firms that have such sales. In other words, our interpretation is strictly confined to innovating firms. The four regression models produce fairly consistent results. It is reassuring that the coefficients proved robust to tentative inclusion or exclusion of various independent variables. An important result in the earlier rounds of our estimates (not documented here) comes from experiments with quadratic terms of our variables on numerical flexibility. Their inclusion had little influence on the other coefficients, and, against our expectations, these quadratic terms proved insignificant throughout. They are therefore omitted from our final version.

Both tables show that, as expected, R&D intensity is highly significantly positive in all four models. The positive effect of export intensity on innovation performance is also highly significant in all versions. It is no surprise that an individual firm's new product sales are heavily related to the average new product sales in its sector of principal activity. Including industry average new product sales implies that our model explains deviations of an individual firm's new product sales from its industry average. The two indicators of human capital (educational achievements and training) have positive impacts on a firm's innovation performance (significant at the 5% level in all four models). This reconfirms the importance of qualified human capital to the innovation process.

Pertaining to firm size and firm age, we conclude that the advantages and disadvantages of a firm being small or big and being young or old seem almost to cancel each other out. We find only weak evidence (at the 10% level) that older and larger firms might have higher new product sales when considering the total sample (see Table 5.2A). When taking SMEs separately, however, the coefficients for size or age become insignificant (see Table 5.2B).

As expected, high rates of individual changes in function or department *within* the firm ("functional flexibility") contribute positively to new product sales, being significant at 5% level in all four models in both samples. This underlines the importance of "insider-outsider" labor markets for keeping knowledge in the firm and investing in the loyalty and commitment

of employees while allowing for flexibility. In a SME context, this also reflects the importance of personnel with multiple competences.

Finally, all four models in both samples indicate that a high external labor turnover has no impact on innovation. In three out of four models, however, high shares of employees on temporary contract seem to have a positive impact on innovation output (significant at the 5% level in the SME sample and at the 10% level in the total sample). This finding supports the argument by Ichniowski and Shaw (1995) discussed earlier, but is hard to reconcile with recent firm-level studies in the Netherlands (Kleinknecht et al., 2006) and in Italy (Lucidi and Kleinknecht, 2009) that find a negative impact of numerically flexible labor on labor productivity growth. It is important to keep in mind that two studies using UK firm-level data also show a negative correlation between numerical flexibility and innovation (Michie and Sheehan, 1999, 2001), and that similar results are reported by Chadwick and Cappelli (2002) from US data. As mentioned above, Arvanitis (2005) reports mixed results on the topic.

Table 5.2A. Explaining logs of new product sales per employee [a] (Summary of regressions from total sample)

Dependent variable Log (new product sales per employee)	Model 1 OLS	Model 2 Tobit	Model 3 Heckman (linear part)	Model 4 Heck-tobit
	Coefficient (t-value)	Coefficient (t-value)	Coefficient (t-value)	Coefficient (t-value)
Labor flexibility:				
External labor turnover (max.)	0.004 (0.76)	0.007 (0.95)	0.005 (0.91)	0.014 (1.16)
% of temporary work	0.039 (1.92)†	0.061 (2.03)*	0.037 (1.83)†	0.047 (1.29)
Functional flexibility	0.063 (2.75)**	0.091 (2.68)**	0.064 (2.83)**	0.099 (2.74)**
Control variables:				
Qualified personnel	0.026 (2.93)**	0.040 (2.97)**	0.025 (2.88)**	0.035 (2.29)*
Training efforts	0.017 (2.24)*	0.026 (2.10)*	0.017 (2.26)*	0.026 (2.10)*
Export intensity	0.020 (3.04)**	0.030 (3.05)**	0.020 (3.11)**	0.033 (3.02)**
Firm age	0.012 (1.80)†	0.019 (1.88)†	0.012 (1.86)†	0.021 (2.01)*
R&D intensity in new product/service	0.074 (5.71)**	0.119 (5.96)**	0.074 (5.71)**	0.118 (5.90)**
Firm size	0.001 (1.71)†	0.001 (1.86)†	0.001 (1.54)	0.001 (0.56)
Industry average new product sales	0.962 (3.09)**	1.411 (2.85)**	0.904 (2.86)**	0.948 (1.16)
Year1997 [b]	-7.423 (-3.40)**	-11.042 (-3.17)**	-6.993 (-3.14)**	-7.603 (-1.28)
Year1999	-7.080 (-3.25)**	-10.499 (-3.03)**	-6.773 (-3.09)†	-8.044 (-1.65)†
Year2001	-8.747 (-3.93)**	-13.393 (-3.76)**	-8.583 (-3.87)**	-12.094 (-3.02)**
Constant term	0.693 (0.53)	-4.295 (-1.99)*	0.465 (0.35)	-6.085 (-1.89)†
Instrumental variable				
Nonselection hazard				4.729 (0.73)
Economic fluctuations [c]			-0.096 (-2.48)*	-0.094 (-2.53)*
Number of observations	1032	1032	2329	1031
Censored observations		395	1298	395
Uncensored observations		637	1031	636
Statistics summary	R² = 0.1354	Log likelihood = -2561.5084 Pseudo R² = 0.0272	Wald chi2(13): 183.00 Prob>chi2: 0.0000 Wald test of independent equations (rho=0): chi2(1)=0.90 Prob>chi2 = 0.3438	Log likelihood = -2562.3007 Pseudo R² = 0.0257

[a] †: at 0.1 significance level; *: at 0.05 significance level; **: at 0.01 significance level; two-tailed test
[b] The reference group of year dummies is 1995
[c] The coefficient of 'sensitivity to economic fluctuations' is in the selection equation of the Heckman model, not in the linear equation

Table 5.2B. Explaining logs of new product sales per employee [a] (Summary of regressions from SME sample)

Dependent variable Log (new product sales per employee)	Model 1 OLS Coefficient (t-value)	Model 2 Tobit Coefficient (t-value)	Model 3 Heckman (linear part) Coefficient (t-value)	Model 4 Heck-tobit Coefficient (t-value)
Labor flexibility:				
External labor turnover (max.)	0.007 (1.14)	0.012 (1.31)	0.008 (1.35)	0.023 (1.59)
% of temporary work	0.045 (2.19)*	0.070 (2.30)*	0.042 (2.06)*	0.046 (1.15)
Functional flexibility	0.062 (2.33)*	0.091 (2.22)*	0.062 (2.35)*	0.091 (2.21)*
Control variables:				
Qualified personnel	0.026 (2.79)**	0.042 (2.86)**	0.026 (2.76)**	0.037 (2.38)*
Training	0.019 (2.34)*	0.029 (2.22)*	0.020 (2.44)*	0.034 (2.43)*
Export intensity	0.018 (2.38)*	0.027 (2.39)*	0.019 (2.52)*	0.036 (2.49)*
Firm age	0.011 (1.52)	0.018 (1.60)	0.011 (1.59)	0.022 (1.83)†
R&D intensity in new product/service	0.074 (5.38)**	0.122 (5.69)**	0.074 (5.37)**	0.122 (5.66)**
Firm size	0.003 (0.95)	0.005 (0.99)	0.003 (0.84)	0.002 (0.28)
Industry average new product sales	1.002 (2.99)**	1.574 (2.86)**	0.942 (2.80)**	1.058 (1.39)
Year1997 [b]	-8.062 (-3.43)**	-12.767 (-3.31)**	-7.608 (-3.23)**	-8.904 (-1.61)
Year1999	-7.522 (-3.21)**	-11.880 (-3.10)**	-7.248 (-3.10)**	-9.562 (-2.12)*
Year2001	-9.415 (-3.93)**	-15.314 (-3.87)**	-9.350 (-3.93)**	-14.789 (-3.71)**
Constant term	0.479 (0.34)	-5.283 (-2.18)*	0.050 (0.03)	-8.900 (-2.08)*
Instrumental variable				
Nonselection hazard				7.386 (1.00)
Economic fluctuations [c]			-0.097 (-2.34)*	-0.093 (-2.35)*
Number of observations	928	928	2044	927
Censored observations		372	1117	372
Uncensored observations		556	927	555
Statistics summary	R² = 0.1348	Log likelihood = -2266.7467 Pseudo R² = 0.0279	Wald chi2(14): 172.41 Prob>chi2: 0.0000 Wald test of independent equations (rho=0): chi2(1)=2.13 Prob>chi2 = 0.1440	Log likelihood = -2263.0926 Pseudo R² = 0.0281

[a] †: at 0.1 significance level; *: at 0.05 significance level; **: at 0.01 significance level; two-tailed test
[b] The reference group of year dummies is 1995
[c] The coefficient of 'sensitivity to economic fluctuations' is in the selection equation of the Heckman model, not in the linear equation

Interpreting our finding of a positive impact of temporary contracts on new product sales, two caveats should be kept in mind. The first qualification shown in Table 5.3, is that the screening of personnel is an important motive for employing people on a fixed-term basis. The motive of savings on the wage bill plays only a minor role (3.2%). More than 40% of the temporary contracts in the OSA database serve as a trial period, after which individuals may extend their employment with the firm. This indicates that firms are dependent on probationary periods to select the right personnel. In particular, recent university graduates typically begin their employment on a temporary basis. After a period of good performance, they can expect tenure. In this context, it is interesting to see a correlation between qualified personnel and temporary work (significant at the 5% level) in Appendices 5.4 and 5.5.

Table 5.3. Descriptive statistics: Reasons of using fixed term contracts [a]

Reasons for fixed-term contracts:	Total sample:	SME sample:
1. Fluctuations	217 (28.07%)	154 (27.11%)
2. Cost purpose	25 (3.23%)	18 (3.17%)
3. Personal preference of people	7 (0.91%)	6 (1.06%)
4. Replacement because of illness / absence	61 (7.89%)	49 (8.63%)
5. (Extended) try-out period	330 (42.69%)	254 (44.72%)
6. Seasonal peaks	17 (2.20%)	14 (2.46%)
7. Temporarily off work	60 (7.76%)	40 (7.04%)
8. Others	56 (7.24%)	33 (5.81%)

[a] Source: OSA database; information available only in surveys 2001 and 1997

As a second qualification, recall that our dependent variable is heavily influenced by products that are new to the *firm*, i.e., by "*imitative*" rather than "*innovative*" ("new to the market") products. We cannot distinguish between "imitative" and "innovative" products, except in the survey administered in 2001, which includes a separate question about degrees of novelty. Table 5.1 showed that the majority of firms that introduce new products are market followers (or imitators) rather than market leaders: less than 16% of the firms have products that are fully "*new to the market*." Using these data, we estimated an ordered logit model in Table 5.4. The table shows three things: First, firms with high R&D intensities tend to have

higher probabilities of introducing products that are "new to the *market*." Second, the same holds for firms in industries with high shares of new products sales. Third, high percentages of workers on temporary contracts have a <u>negative</u> impact on the probability that a firm's new products will be "new to the market." Similar results hold when we confine the sample to firms with less than 250 workers (not documented here). The finding in Table 5.4 is opposed to the positive coefficient of temporary contracts in our estimate in Table 5.2. It appears that the arguments in favor of rigid labor relations mainly hold for the market leaders that undertake substantial R&D efforts. For the larger stream of imitators, more flexible labor relations are more attractive.

Table 5.4. What factors determine whether a product will be new to the market rather than new to the firm? [a] (Summary of Ordered logistic regressions, total sample)

The dependent variable is: Novelty of innovative products (1 = new to firm; 2 = partially new to market; 3 = new to market (reference group: 'new to the firm')		
	Model 1:	Model 2:
Labor flexibility:	Coefficient (t-value)	Coefficient (t-value)
External labor turnover (max)	-0.010 (-0.12)	-
Percentage of workers on temporary contract	**-0.038 (-1.69)**[†]	**-0.042 (-2.01) ***
Functional (internal) flexibility	0.010 (0.57)	0.010 (0.56)
Control variables:		
Export intensity	-0.004 (-0.70)	-0.003 (-0.50)
Firm age	0.003 (0.43)	0.003 (0.46)
R&D intensity (product or service-related R&D)	**0.018 (1.66)**[†]	**0.018 (1.71)**[†]
Firm size	0.000 (0.02)	-0.000 (-0.04)
Industry average new product sales	**0.594 (1.84)**[†]	**0.604 (1.89)**[†]
Cut1	5.539	5.621
Cut2	8.173	8.260
Number of observations	150	155
Log likelihood	-144.33	-149.08
Pseudo R²	0.031	0.032
Statistics summary	Wald chi2(8)= 10.80	Wald chi2(8)= 11.09

[a] The results are based on a cross-sectional OSA data; the dependent variable is taken from the 2001 survey (covering year 2000); the independent variables come from the 1999 survey, covering year 1998.
[b] [†]: at 0.1 significance level; *: at 0.05 significance level; **: at 0.01 significance level; two-tailed test

5.5. Discussion and conclusions

This chapter makes an empirical contribution to the sparse knowledge about the impact of flexible labor on innovation, using new product sales as a direct measure of innovation and controlling for factors such as human capital, R&D intensity, export intensity, firm size and age, and industry average new product sales. As opposed to some previous studies, our data allow a 2-year lag between the dependent and independent variables, which we hope will relax the problems of endogeneity that are notorious in this type of analysis. Not surprisingly, R&D intensity, export intensity and levels of education and training all contribute positively to new product sales. As expected, an individual firm's new product sales are heavily related to average sales in its sector of principal activity.

We find weak evidence that larger and older firms have higher new product sales than their young and small counterparts. Especially, this evidence is insignificant if we confine our sample within firms having less than 250 employees. It seems as if the (dis)-advantages of a firm being small or big or being old or young almost cancel each other out. This is hard to reconcile with evidence reported earlier by Acs and Audretsch (1993) using new product announcement data. They found that, in many sectors, smaller firms made a disproportionately large contribution to innovative output. Investigating new product announcement data more thoroughly, however, evidence has been found indicating that the data are biased in favor of smaller firms (see van der Panne, 2004). The output indicator used in this paper does not seem to have such a bias (Kleinknecht et al., 2002). We conclude that the advantages typical of small and young firms, such as little bureaucracy and short communication lines, dedicated management by the owners or the ability to occupy market niches that are less interesting for big firms, seem to be compensated (or perhaps slightly over-compensated) by the advantages enjoyed by bigger and older firms, such as the ease of financing of innovations due to some monopoly power, the exploitation of strong marketing functions and brand names, accumulated knowledge and experience from (the management of) earlier innovations, or the diversification of risks through a large portfolio of innovation projects.

The positive impact of functional flexibility is significant in all four models of both samples and is consistent with previous results by Michie and Sheehan (1999, 2001); Chadwick and Cappelli (2002) and Arvanitis (2005). Our findings confirm the important role of functional flexibility in reducing barriers to knowledge sharing and building multiple competencies of employees in internal labor markets. Functional flexibility in "insider-outsider" labor markets allows for flexibility while being socially responsible towards a firm's

personnel. The latter might be interpreted as an investment in trust, loyalty and commitment. Such investment is likely to economize on supervision and monitoring costs and reduces the leaking of a firm's knowledge to competitors. Functional flexibility can be an important means for SMEs to motivate and retain their key individuals.

Our model is remarkably robust to changes in specifications and in sample size. This also holds for inclusion of non-linear terms of numerical flexibility variables. Specifications with non-linear terms are not documented in this chapter, as these terms all proved insignificant. Intuitively, one might have expected that there is some optimum level of numerical flexibility that would enhance innovation and that beyond the optimum point, flexibility becomes counter-productive. However, the data do not support this.

We find mixed results on numerical flexibility. While one of the proxies of numerical flexibility, external labor turnover, is insignificant in all four models, another proxy, temporary work, has a positive effect on innovation performance, or, being more precise, on "imitative" ("new to the firm") products. As could be seen from Table 5.1, most of our new product introducers are market followers rather than market leaders, i.e., they introduce products that are "new to the firm" rather than products "new to the market." Many of these firms are likely similar to what Pavitt (1984) named "supplier-dominated innovators," i.e., firms that innovate mainly by adopting (and creatively using) new equipment from suppliers. Such adoption may be favored by carefully screening the right personnel. As we saw from Table 5.3, an important motive behind using temporary contracts is personnel screening. Typically, young university graduates are hired under a probationary period and can expect tenure if they perform well. Such temporary contracts seem to be positively related to "imitative" innovations.

Further explorations suggest, however, that the probability of having products "new to the market" (rather than "new to the firm") is <u>negatively</u> influenced by high shares of temporary workers. Hence, the minority of R&D intensive market leaders tend to rely significantly less on flexible work, which is consistent with the findings of Arvanitis' (2005) study on data from Switzerland. It also underlines the arguments by Lucidi and Kleinknecht (2009) about the need for the continuous accumulation of (tacit) knowledge that is favored by longer commitments of workers to their firms. It appears that the much criticized "rigidity" of insider-outsider labor markets is favorable to R&D intensive market leaders, while the larger stream of imitators and market followers prefer using temporary contracts to try out new people with fresh ideas, which may favor technology adoption.

This finding also gives an explanation on a different means for SMEs to innovate. The majority of SMEs are more likely to be imitative innovators than market leaders given their potential resource constraints. Technology is generally transferred into a SME rather than developed in-house (Ravasi and Turati, 2005). This transfer can be done either by an individual directly, for instance via the acquisition of a new worker who brings in knowledge and experience into the firm or by outsourcing to or cooperating with external contacts (Uit Beijerse, 2000; Nooteboom, 2001; Holsapple and Jones, 2004). Using temporary contracts thus serves as an effective mechanism for SMEs to screen and select the right personnel and to fulfill their specified demands.

Finally, our results warn against the unconditional plea by mainstream economists for the deregulation of labor markets (see e.g. the OECD's Job Study, 1994). It seems that the "rigidity" of insider-outsider labor markets also has advantages, as it allows for "functional" flexibility. The often criticized protection of "insiders" can be interpreted as an investment in the loyalty and commitment of workers. Moreover, functional flexibility on internal labor markets has advantages for the continuity of (organizational) learning, and strengthens the historical memory of firms. Neoclassical economists should note that temporary contracts might have advantages for imitative firms, but definitely are not an option preferred by market leaders who seem to have a greater need for continuity in learning and in preventing knowledge from leaking to competitors.

Appendix 5.1. Overview of firms that participated in each wave (1991-2005)[a]

Year of first wave	1989	1991	1993	1995	1997	1999	2001	2003	2005
1989	*2041*[b]	1391	985	676	467	292	131	72	36
1991		*626*	404	297	194	120	38	26	17
1993			*653*	407	252	152	69	38	25
1995				*1316*	797	450	192	96	50
1997					*825*	438	172	96	52
1999						*1273*	551	282	120
2001							*2046*	986	446
2003								*3152*	1186
2005									*1199*
Total	2041	2017	2042	2696	2537	2725	3199	4748	3131

[a] Source: OSA Labour Demand Panel (Explanatory notes) 1991-2006

[b] *Italics*: Numbers of newly participating firms

Appendix 5.2. Description of variables

Variable names:	Variables description:
Dependent variable:	
Log (new product sales per employee)	The logarithm of turnover from new products 'new to the firm and/or 'new to the market' introduced during the past two years divided by total employees. Note that 'imitative' innovations ('new to the firm' but already known in the market) are much more numerous than innovations 'new to the market'. In fact, we measure imitation rather than innovation.
Variables on flexible labor:	
External flexibility	Maximum of the share of newly hired employees and the share of employees that left the firm during the last year.
Temporary work	The percentage of employees having fixed-term contracts hired directly by the firm.
Functional flexibility	The percentage of employees that changed their function and/or department within the firm.
Control variables:	
Qualified personnel	The percentage of employees with university or higher professional education degrees.
Training	The percentage of employees that participated in training (both internal and external trainings).
Export	Export as the share of turnover.
R&D intensity	R&D expenditure on new products or services as a percentage share of turnover
Firm age	Difference between survey year and establishment year
Firm size	Number of employees in full-time equivalents
Industry average new product sales	Average of logs of new product sales per employee in a firm's sector of principal activity.
Instrumental variable	
Economic fluctuations	Categorical variable: Whether the firm is sensitive to fluctuations in the economy; 1=not sensitive, 2= a little bit sensitive, 3=very sensitive.

Appendix 5.3. Descriptive statistics (Total sample vs. SME sample)

Variable name	Mean	Median	Std. Dev.	Min	Max
Dependent variable					
Log (new product sales per employee)	5.88	7.86	5.32	0	25.52
	(*6.71*)	(*10.00*)	(*5.62*)	(*0*)	(*19.80*)
Variables on flexible labor					
External labor turnover	14.18	10.71	19.79	0	1111
	(*14.96*)	(*10.73*)	(*20.10*)	(*0*)	(*500*)
Personnel on temporary contract	4.37	0	9.76	0	100
	(*3.94*)	(*0*)	(*8.29*)	(*0*)	(*100*)
Functional flexibility	2.88	0	6.54	0	117
	(*2.72*)	(*0*)	(*5.83*)	(*0*)	(*75*)
Control variables					
Qualified personnel	23.22	10.53	28.57	0	100
	(*13.90*)	(*7.12*)	(*19.20*)	(*0*)	(*100*)
Training	35.51	26.91	27.88	0.3	100
	(*31.35*)	(*24.15*)	(*24.35*)	(*0*)	(*100*)
Export	8.25	0	22.09	0	100
	(*14.36*)	(*0*)	(*27.22*)	(*0*)	(*100*)
R&D intensity	8.31	0	13.17	0	30
	(*9.67*)	(*0*)	(*13.69*)	(*0*)	(*30*)
Firm age	27.04	17	27.77	0	99
	(*26.55*)	(*18*)	(*26.09*)	(*0*)	(*103*)
Firm size	205.05	51	540.36	5	23500
	(*63.21*)	(*39*)	(*60.37*)	(*5*)	(*250*)
Industry average new product sales	9.59	10.49	2.64	1.74	13
	(*9.41*)	(*10.84*)	(*2.99*)	(*1.74*)	(*13*)
Instrumental variable					
Economic fluctuation	1.94	2	0.78	1	3
	(*0.24*)	(*2*)	(*0.72*)	(*1*)	(*3*)

Appendix 5.4. Correlations between variables (total sample)

	Variable name	1	2	3	4	5	6	7	8	9	10	11	VIFs
1	Log (new product sales per employee)												
2	External labor turnover	0.01											1.19
3	Temporary work	0.01	0.15*										1.17
4	Functional flexibility	0.11*	0.11*	0.05*									1.13
5	Qualified personnel	0.13*	-0.03*	0.13*	0.03*								1.16
6	Training	0.10*	0.01	0.03*	0.07*	0.19*							1.07
7	Export	0.14*	-0.02	-0.02*	0.05*	-0.12*	-0.09*						1.12
8	R&D intensity	0.17*	0.03*	0.02*	0.08*	0.03*	-0.06*	0.23*					1.20
9	Firm age	-0.07*	-0.07*	-0.01	-0.02	-0.06*	-0.06*	0.06*	0.04*				1.02
10	Firm size	0.10*	-0.01	-0.01	0.19*	0.02	-0.06*	0.02*	0.06*	0.04*			1.07
11	Industry average new product sales	-0.02	0.08*	-0.02*	0.05*	-0.06*	0.14*	0.04*	0.05*	-0.02*	0.00		1.03
12	Economic fluctuation	0.02	0.03*	-0.03*	0.00	-0.22*	-0.07*	0.14*	0.10*	0.03*	-0.04*	0.02*	

* p<0.05, two-tailed tests

Appendix 5.5. Correlations between variables (SME sample)

	Variable name	1	2	3	4	5	6	7	8	9	10	11	VIFs
1	Log (new product sales per employee)												
2	External labor turnover	0.06											1.21
3	Temporary work	0.12*	0.27*										1.20
4	Functional flexibility	0.14*	0.23*	0.11*									1.10
5	Qualified personnel	0.15*	0.10*	0.15*	0.12*								1.13
6	Training	0.11*	0.01	0.03	0.08*	0.16*							1.06
7	Export	0.16*	-0.03	0.01	0.08*	0.01	-0.07*						1.19
8	R&D intensity	0.24*	0.02	0.07*	0.09*	0.16*	-0.01	0.25*					1.18
9	Firm age	0.05	-0.10*	-0.00	-0.02	-0.04	0.06*	0.00	-0.01				1.06
10	Firm size	0.13*	-0.07*	0.09*	0.11*	0.05*	-0.01	0.26*	0.20*	0.16*			1.19
11	Industry average new product sales	-0.06	0.06*	0.05*	0.06*	0.09*	0.13*	0.01	0.01	-0.00	-0.10*		1.03
12	Economic fluctuation	0.04	0.01	-0.02	0.02	-0.12*	0.00	-0.01	0.02	0.01	0.05*	-0.06*	

* $p < 0.05$, two-tailed tests

CHAPTER VI

Determinants and dimensions of firm growth: an exhaustive analysis

Abstract: Firm growth is an important indicator of a thriving economy. Although the determinants of firm growth have been studied in various disciplines, an exhaustive analysis is still lacking. This chapter attempts to provide such an analysis. Many determinants of firm growth are summarized and classified into three dimensions: individual, organizational, and environmental determinants. By conducting an empirical study using 523 Dutch small and medium sized firms, we identify the determinants of firm growth that is measured by employment growth. Our findings show that environmental determinants do not affect firm growth. Individual ones do: entrepreneurs with growth motivation and having technical knowledge background are more likely to grow their firms while entrepreneurs characterized by a strong need of achievement are less likely to grow. Organizational determinants have the largest influences on firm growth: the older the firm, the less likely it is to grow. Availability of financial capital is found to be crucial for firm growth. Finally, a firm's growth orientation is found to have a positive impact. Our empirical findings should be interpreted as a starting point to develop a more complex model to test the presence of moderation and mediation effects of the determinants of firm growth.

6.1. Introduction

The growth of small and medium sized enterprises (SMEs) is important for generating jobs (Carree and Klomp, 1996). Meanwhile, SMEs also economically benefit from its growth. Thus, insight into the determinants of firm growth is important from both a policy perspective and a business perspective. Over the last two decades, determinants of firm growth have been studied in various disciplines, such as economics, strategy, psychology, network theory and innovation. Nevertheless, it is observed that knowledge of firm growth is still limited (P. Davidsson & Wiklund, 2000; J. Wiklund, Patzelt, & Shepherd, 2007). The existing literature is highly fragmented. For instance, research from a psychological perspective focuses on the behaviour of entrepreneur (Begley & Boyd, 1987); research from a strategy point of view concentrates on the relationship between environment, business strategy and growth (McDougall, Robinson, & DeNisi, 1992); while research on economics solely focuses on the relation between growth and firm size (Audretsch et al., 2004). Thus, there exist diverse views, with none of them explaining the determinants of firm growth in a holistic manner.

Firm growth is complex and path-dependent: it is an organizational outcome resulting from the combination of firm-specific resources, capabilities and routines (Nelson & Winter, 1982). A firm's growth opportunities are highly related to its current organizational production activities (Coad, 2009). Firm growth is uncertain: environmental conditions such as competition and market dynamics play their roles. For small firms, firm growth could be influenced by personal ambition of an entrepreneur. Not every entrepreneur aims to grow her business. For instance, Mosselman et al. (2002) observed that only 16% of the Dutch small business owners aim to grow. Although recent studies attempt to link determinants from different perspectives or dimensions (Baum et al., 2001; J.G. Covin & Slevin, 1997; Lumpkin & Dess, 1996), their explanatory power is low due to the relatively small number of variables (P. Davidsson, Delmar, & Wiklund, 2006).

The present chapter attempts to provide an exhaustive analysis on the determinants of firm growth using a firm-level data set that consists of information on a wide range of known determinants summarized from the existing literature. We classify these determinants into three dimensions: individual, organizational and environmental determinants (Baum et al., 2001). In addition, we also include growth barriers. We attempt to identify the most important determinants from a wide range of perspectives within the framework of a simple model. The model is simple in the sense that moderation and mediation effects will not be taken into account. Also, only one indicator of firm growth, that is employment growth, is used as our

dependent variable. Therefore, our interpretations are limited to employment growth. Finally, the cross-sectional nature of the data does not allow for an analysis of dynamic aspects.

The present chapter contributes to the existing literature in several ways. *First*, it provides an extensive literature review that summarizes many known determinants from different existing perspectives; *Second*, it is one of few empirical studies that integrate as many determinants as possible into a simple model. *Third*, by identifying the most important determinants among others, this chapter serves as a first step to develop a more systematic analysis for future research on determinants of firm growth.

The reminder of this chapter is structured as follows. In section 6.2, 6.3, 6.4 and 6.5, we review the literature on the determinants of firm growth in the sequence of individual, organizational, environmental dimensions and growth barriers. In section 6.6, we describe the research methodology regarding sampling, data collection and model testing. In section 6.7, we further discuss variables and scale constructions. We present the results of empirical analysis in section 6.8. In section 6.9, we discuss the key findings and implications for future research.

6.2. Individual Determinants

Firm growth is to a certain extent a matter of decisions made by an individual entrepreneur. Previous studies indicate that an entrepreneur's personality traits, growth motivation, individual competencies and personal background are the most important determinants that determine the growth of a firm (Baum et al., 2001; Delmar, 1996; Shane, Locke, & Collins, 2003). These determinants are elaborated on in the following sub-sections.

6.2.1. Personality traits

The Big Five model (Barrick & Mount, 1991; Hurtz & Donovan, 2000; B. Johnson, 1990) is often used and identified as a robust indicator of an individual's personality. The Big Five factors – extraversion, emotional stability, agreeableness, conscientiousness and openness to experience – are generally agreed among some personality theorists as representative personality traits or characteristics (Judge, Higgins, Thoresen, & Barrick, 1999; Mount & Barrick, 1998). It has been argued that the Big Five also represent the potential personality traits of entrepreneurs (Nicholson, 1998). Based on the Big Five model, entrepreneurial personality traits have been further classified and the following characteristics are widely recognized by earlier quantitative and qualitative research:

Need for achievement: McClelland (1965) argues that individuals with a high degree of need for achievement to engage in activities or tasks are more likely to take greater responsibility for outcomes than those who have a low degree of need for achievement. Based on a review of 23 studies, Johnson (1990) concludes that there is a positive relationship between need for achievement and entrepreneurial activity. A recent study also confirms the important role of need for achievement in explaining entrepreneurial activity (Collins, Locke, & Hanges, 2000). There is a strong positive relationship indicated between need for achievement and ambition to grow the firm (Lau and Busenitz, 2001). Hence, we can imply that there might be a positive relationship between need for achievement and firm growth.

Risk taking propensity: Risk taking propensity seems to be an important trait of an entrepreneur. An entrepreneur can be characterized as someone who seeks opportunities, faces uncertainties and takes risks (Venkataraman, 1997). It has been indicated that owners of young and established firms who are not risk averse are more likely to be ambitious to grow the firm (Bager & Schøtt, 2004). Similar evidence has also been found at the individual level by Casser (2007). Individuals with a high degree of risk taking propensity do not fear to take action for growing their business further. However, most of the empirical studies have not shown any significant role of risk taking propensity in entrepreneurial activities (Babb & Babb, 1992; Kogan & Wallach, 1964; Litzinger, 1961; Low & Macmillan, 1988; Palich & Bagby, 1995). The reason behind such a weak relation might be that entrepreneurs have different perceptions of risks (Corman, Perles, & Vancini, 1988; Fry, 1993; Sarasvathy, Simon, & Lave, 1998). Based on the relationship between risk taking propensity and growth ambition, we propose a positive impact of risk taking propensity on actual firm growth.

Locus of control: Locus of control is the belief of an individual to what extent their actions or personal characteristics affect outcomes. Individuals with an *external locus of control* believe that the outcome of an event is out of their control (Shane et al., 2003). Individuals with such beliefs are less likely to grow their firms (Rotter, 1966). Entrepreneurs are generally considered to have an *internal locus of control*. They believe that their actions and decisive behaviour affect the outcome of an event (Rotter, 1966). In the entrepreneurship literature, *internal locus of control* is regarded as one of the motivations to start and develop one's own business. Individuals with an *internal locus of control* are more likely to seek entrepreneurial roles in order to let their action have a direct impact on the results (Rotter, 1966).

Self-efficacy: Self-efficacy is defined as an individual's ability to gather and implement the necessary personal resources, skills and competencies in order to achieve a given task (Bandura, 1997). Goal orientation and openness are considered important attributes of self-efficacy. It is well known that higher goals often lead to better performance results than moderate or low goals (Locke & Latham, 1990). Openness can be interpreted as being intellectual, intelligent, and open to new ideas and experience. Bird (1989) claims that creativity and ability to discover innovative ways are key factors in the venture success. Self-efficacy has also proved to be a robust predictor of an individual's performance for a specific task (Shane et al., 2003). Growth is an important indicator of individual performance, specifically if the individual is an owner of a small business. One can argue that an individual with high self-efficacy for a given task will put more effort and time into it, make better plans and strategies, self-evaluate and modify goals if necessary to successfully accomplish the task. This type of individual is open to suggestion and feedback and takes a positive attitude while facing negative situation (Shane et al., 2003). He/she knows how to continuously improve based on feedback and previous experience. Baum (1994), in his empirical analysis on the architectural woodworking industry, found among all used variables, that self-efficacy has a strong positive relationship with realized growth. We can therefore argue that self-efficacy may be a predictor of growth.

Extraversion: Extraversion is primarily associated with the quantity and intensity of building and maintaining relationships, and requires active engagement with high energy levels, positive emotion and excitement (DeNeve & Cooper, 1998). Extraversion has been used originally as an indicator of job performance for managers and sales people (Barrick & Mount, 1991; Vinchur, Schippmann, Switzer, & Roth, 1998). It is also applicable to entrepreneurs since they play a crucial role in both management and profit-oriented practices in order to survive and grow (Ciavarella, Buchholtz, Riordan, Gatewood, & Stokes, 2004). Morrison et al. (2003) observe that extraversion is strongly related to the performance of franchises. *Sociability* is an important component of extraversion. Entrepreneurs with strong sociability are more likely to engage in developing social networks, ultimately resulting in stronger relationships with suppliers, customers and partners (Barringer & Greening, 1998). Baron and Markman (2000) argue that the ability to establish and develop networks with suppliers, advisors and customers is crucial for effectively increasing the likelihood of venture success and consequently the growth of venture. We can thus suggest a positive relationship between extraversion/sociability and firm growth.

6.2.2.   Growth motivation

Personality traits of entrepreneurs are important but they may not necessarily result in the actual growth of a firm. It has been argued that personality traits contribute more to the *growth motivation* which plays a rather important role in an entrepreneur's behaviour which in turn contributes to the actual growth (Delmar, 1996). Delmar (1996) argues that an entrepreneur who has greater growth motivation, who experienced growth before or who is more innovative, is more likely to be ambitious towards firm growth and is more likely to engage into further growth. Often a firm starts very small and grows to a certain size to become economically viable. Once the firm reaches a minimum efficient scale, the entrepreneur has the freedom to decide whether he wants the business to grow or not. Not every entrepreneur aims to have his/her business grow further. For instance, Glancey (1998) shows that entrepreneurs primarily motivated by 'being your own boss' are less likely to pursue growth. The rationale behind this is that they do not want to delegate key functions which lead to a loss of control in decision making. Only 16% of the small business owners in the Netherlands were found to have motivation to grow (Mosselman, Frederiks, & Meijaard, 2002). Several studies across various countries (Cliff, 1998; Delmar & Davidsson, 1999; Dennis & Solomon, 2001; Human & Matthews, 2004) also demonstrate that most business founders have modest growth aspirations, which in turn has a direct effect on firm growth. Therefore, incorporating growth motivation of an entrepreneur is crucial in determining firm growth.

6.2.3.   Individual competencies

Individual competencies can be defined as the knowledge, skills and/or abilities required to perform a specific job. It can be categorized into general individual and organizational competencies, and specific competencies (Boyatzis, 1982). Chandler and Jansen (1992) combine the general individual and organizational competencies – referring to them as organizational skills – with opportunity recognition skills and name them as managerial skills. Specific competencies include for example technical and industrial skills. Having conducted an empirical research on US architectural woodwork firms, Baum et al. (2001) found that specific competencies have a highly significant direct impact on a firm's growth.

6.2.4.   Personal background

Personal background includes general information on an individual such as gender, age, education and experience. Various studies have been conducted on this aspect. Welter (2001) found a significant difference between the ambition to grow among male and female entrepreneurs. The result indicates that male entrepreneurs have higher growth ambitions when

compared to female entrepreneurs (Welter, 2001). This may be due to the constraints in time, experience and resources available to female entrepreneurs (Cliff, 1998). However, the effect of gender is still ambiguous. Some studies show that female entrepreneurs do not underperform in growing their business regarding profit and employment (DuRietz & Henreksson, 2000) while others do find that female owned business grow less (Cooper, Gimeno-Gascon, & Woo, 1994; Fischer, Reuber, & Dyke, 1993). Nevertheless, we propose that male entrepreneurs are more likely to engage in actual growth compared to female entrepreneurs.

Age is another important factor that influences growth ambition. The results of previous studies all indicate a significantly negative relation between age and growth ambition (Autere & Autio, 2000; Welter, 2001). Scholars argue that this negative relationship may be due to the entrepreneur's initial goal of growth, or due to a higher energy level and willingness of younger entrepreneurs to test their abilities as compared to older entrepreneurs (P. Davidsson, 1991; Sapienza & Grimm, 1997; Welter, 2001). Based on the previous evidence, we argue that the older the entrepreneur, the less likely he/she is to make the firm grow.

Earlier research also shows that an entrepreneur's experience with industry and any prior entrepreneurial experience have a positive impact on firm performance. Orser et al. (1998) found a positive relationship between entrepreneurs with related industry experience and their willingness to engage in growth activities. They argue that related experience builds up a high degree of self-confidence among entrepreneurs (Orser, Hogarth-Scott, & Wright, 1998). Delmar and Shane (2006) found that founders' entrepreneurial experience and experience with related industry does matter to venture success. Previous entrepreneurial experience provides tacit knowledge of organizational routines and skills by which they know how to find required resources and how these resources can be appropriately utilized for current business (Ripsas, 1998; Shepherd, Douglas, & Shanley, 2000). Entrepreneurs with prior entrepreneurial experience have much clearer ideas of necessary roles and responsibilities in organizations (Ericsson & Smith, 1991). By learning from previous mistakes, experienced entrepreneurs can be more effective in managing the new venture (Ripsas, 1998; Shepherd et al., 2000). In addition, experienced entrepreneurs have already established a network of employees, suppliers, investors and customers during their previous business (Campbell, 1992). This network plays a crucial role for the success of a new venture. Based on the aforementioned arguments, we thus suggest that entrepreneurial experience has a positive impact on firm growth.

Industrial specific knowledge such as production processes, market niches, or technology is also tacit and only available through industry participation (P. Johnson, 1986). Entrepreneurs with industry experience will have a better understanding of the industrial environment, such as customer characteristics of the market that the new venture engage in. The social network within the industry may help them to obtain first important commitment from suppliers and customers, which is very crucial for the success of a new venture. Research shows that entrepreneurs with industry experience are more likely to survive and to develop their businesses compared to inexperienced ones (Cooper et al., 1994; Klepper, 2001). Hence, we can conclude that industry experience has a positive influence on firm growth.

Although it is observed that high education level has a positive impact on firm performance in terms of growth (Sapienza & Grimm, 1997; Storey, 1994), the relationship between high education and growth remains ambiguous. While Kolvereid (1992) shows that entrepreneurs with high education are more likely to have their business grow, both Nandram and Samsom (2002) and Welter (2001) demonstrate a negative relationship between education level and the ambition to grow. Though an entrepreneur with more knowledge is able to make good use of opportunities and resources, more knowledge can also make him/her slow in decision making. An empirical study based on a large longitudinal data set indicates that education and experience affect growth only when accompanied by growth motivation (J. Wiklund & Shepherd, 2003). We argue that although highly educated entrepreneurs might be slow in decision making, they are able to make rational decisions which leads to actual firm growth.

6.3. Organizational Determinants

Firm growth is an increase in certain attributes, such as sales, employment, and/or profit of a firm between two points in time (Hakkert & Kemp, 2006). Firm growth can be determined by the degree of effectiveness and capability with which firm-specific resources such as labour, capital and knowledge are acquired, organized, and transformed into sellable products and services through organizational routines, practices, and structure (Nelson & Winter, 1982; Nickell, 1996; Nickell, Nicolitsas, & Dryden, 1997). Thus, organizational determinants should have more direct impacts on firm growth. Various empirical studies have been conducted to explore the determinants of growth with respect to this dimension. In summary, the following determinants have been frequently discussed in previous studies from various disciplines: firm attributes, market orientation, entrepreneurial orientation, growth orientation, firm specific

resources and capabilities including human capital, financial resources and organization learning, and organizational structure. These determinants are discussed in the following sub-sections.

6.3.1. Firm attributes

The classical firm attributes refer to *firm age* and *size*. The discussion on the relationship between firm age/size and firm growth has its origin in Gibrat's law (Audretsch et al., 2004), which states that the growth rate of a firm is independent of its initial size and that there is no difference between firms in the probability of a given growth rate during a specific time interval within the same industry. However, empirical studies do not find supporting evidence (Becchetti & Trovato, 2002). Several studies show that younger firms show higher growth rates than firms that exist for many years. The negative effect of age on firm growth is consistent even among various countries and industries (Geroski & Gugler, 2004; Glancy, 1998; Liu, Tsou, & Hammitt, 1999; Reichstein & Dahl, 2004; Robson & Bennett, 2000; Yasuda, 2005).

The stylized fact of *firm size* has been found in the industrial economic literature. Small firms grow relatively fast since they have to achieve a minimum efficient size (D.B. Audretsch, Klomp, Santarelli, & Thurik, 2004). Similarly, Yasuda (2005) finds a negative effect of firm size on firm growth in the case of Japanese manufacturing firms. Other studies which incorporated different countries and industries also indicate a negative effect of size on firm growth (Almus & Nerlinger, 2000; Bottazzi & Secchi, 2003; Calvo, 2006; Dunne & Hughes, 1994; Goddard, Wilson, & Blandon, 2002; McPherson, 1996). Furthermore, researchers who studied firm growth in different size groups suggest that Gibrat's law of size independence only holds for firms above a certain size threshold, for instance a relatively large size with over 400 employees (Bigsten & Gebreeyesus, 2007). Based on their study, we thus conclude that there exists a negative relationship between firm size and growth especially for SMEs.

6.3.2. Market orientation

Market orientation can be considered an important determinant of growth. Firms with market orientation are able to track and respond to the customer's needs and preferences. They are more likely to develop their market intelligence as well as have the ability to coordinate internal processes in order to respond quickly and effectively to customers and external stakeholders. Consequently, market orientation enables better satisfaction of customers and stakeholders which in turn result in a firm's growth (Hult, Snow, & Kandemir, 2003; Narver & Slater, 1990). There are several ways of defining market orientation. *One*, Jaworski and Kohli

(1990) identify three sets of activities, namely intelligence generation, intelligence dissemination, and responsiveness. *Two*, a framework focused on organizational culture defines market orientation on dimensions of customer orientation, competitor orientation and inter-functional coordination (Narver & Slater, 1990). Nevertheless, regardless of the various definitions of market orientation, empirical study does show that market orientation is significantly related to the overall performance of a firm (Jaworski & Kohli, 1993).

6.3.3. Entrepreneurial orientation

Entrepreneurial orientation is defined as *innovation*, *proactiveness* and *risk taking* on the firm level and reflects a firm's degree of entrepreneurship (Miller, 1983). The concept is further developed into five dimensions with the additional dimensions of *autonomy* and *competitive aggressiveness* (Lumpkin & Dess, 1996, 2001). *Autonomy* is defined as independent action by an individual or a team aimed at bringing forth a business concept or vision and carrying it through to completion. *Innovativeness* refers to a willingness to support creativity and experimentation in introducing new products/services and novelty, technological leadership, and R&D in developing new processes. *Risk taking* means a tendency to take bold actions such as venturing into unknown new markets, committing a large portion of resources to ventures with uncertain outcomes and/or borrowing heavily to invest in business. *Proactiveness* is an opportunity-seeking, forward-looking perspective involving introducing new products or services ahead of the competition and acting in anticipation of future demand to create change and shape the environment. *Competitive aggressiveness* reflects the intensity of a firm's efforts to outperform industry rivals, characterized by a combative posture and a forceful repose to competitor's actions.

It is believed that entrepreneurial-oriented firms will remain ahead of competition by introducing new products/services to the market, which in turn brings competitive advantage and may lead to significantly improved financial results (J. Wiklund, 1998; Zahra & Covin, 1995). Empirical evidence shows that entrepreneurial orientation is positively related to growth (J. Wiklund, 1998; Zahra & Covin, 1995). Based on a data set of 110 manufacturing firms, researchers demonstrate a positive effect of entrepreneurial orientation on the growth rate of sales (J.G. Covin, Green, & Slevin, 2006). Wiklund and Shepherd (2005) also found that entrepreneurial orientation has an impact on growth and financial performance and such effect has been moderated by environment dynamism and capital availability. Entrepreneurial orientation is becoming an overarching determinant since future business environment requires firms to seek new opportunities to survive and grow. Firms which can sustain or enhance their

entrepreneurial orientation over a period can achieve better results than their competitors and may experience high growth rates (Madsen, 2007).

6.3.4. Growth orientation

Similar to entrepreneurial orientation, *growth orientation*, which is one of eight dimensions of Stevenson's entrepreneurial management, also reflects a firm's degree of entrepreneurship. Terrence et al. (2001) found that entrepreneurial management only partly overlaps with entrepreneurial orientation. According to their study, both of them turn to be conceptually sound, but empirically they are distinct aspects of entrepreneurship (Terrence et al., 2001).

Stevenson's entrepreneurial management is defined as a set of opportunity-based management practices by which entrepreneurs can achieve their aims, irrespective of their personal intentions, regardless to the resource they currently control and uncertain about environment incentives and future outcomes (Stevenson, 1983; Stevenson and Gumpert, 1985; Stevenson and Jarillo, 1986; 1990). It has been argued that entrepreneurial management can help firms sustain their competitive advantages and affect the likelihood of a positive outcome (Stevenson and Jarillo, 1990; Terrence et al., 2001). We thus hypothesize that growth orientation may be a positive determinant of firm growth.

6.3.5. Firm specific resources and capabilities

Based on a resource-based view, *financial resources* and *human capital* are the most important resources for small business growth (J. Wiklund et al., 2007). It has been argued that securing financial resources might be particularly important in promoting firm growth (Bamford, Dean, & McDougall, 1997; Sexton & Bowman-Upton, 1991). This is because financial resources can relatively easily be converted into other types of resources (Dollinger, 1999). With sufficient resources, firms are able to experiment new things, which not only increases their innovation potential but also enables the business to pursue new growth opportunities (Castrogiovianni, 1996; Zahra, 1991). Empirical studies show that access to financial resources has a positive effect on small business growth (Cooper et al., 1994; Storey, 1994).

Past financial performance of a firm is a secondary input to the financial resources for firms. Profit yielded in the past can be reinvested into the firm. By this means, a firm not only relies on external funding, but instead also uses internal funds to finance investments. Coad (2007) argues that financial performance can be expected to correspond to firm growth given

the principle of 'growth of the fitter' from evolutionary theory. Following this logic, only firms with superior financial performance can grow. However, the empirical evidence on this phenomenon still remains ambiguous. While some studies show significantly positive relationship between financial performance and growth (Bottazzi & Secchi, 2005), others find only moderation effects (Coad, 2007) and even some negative effects (Hardwick & Adams, 2002). The rationale behind this is that there are a large number of unexplained variations in the growth rate (Coad, 2007).

Human capital represents knowledge, skills and experience. On the organizational level, human capital of the total workforce plays a more determined role when compared to the entrepreneur alone (Birley & Westhead, 1990; Chandler & Hanks, 1994). Employees are considered as the most important resource for SMEs. Individual's knowledge plays a crucial role in building competitive advantage of a firm. Therefore, selection of highly qualified workforce and further development of human resources within the organization are important capabilities that a firm should possess. Rauch et al. (2005) conducted an empirical analysis based on longitudinal data from 119 German business owners and found that human resources is the most important factor predicting growth of SMEs.

Organizational learning serves a similar aim of knowledge creation as does R&D. While R&D brings in or creates explicit and technical knowledge within firms, organizational learning externalizes the tacit knowledge embedded into individuals and specific groups to organizational knowledge. Knowledge is a key source of a firm's competitive advantage (Barney, 1991; Grant, 1991) and it is especially crucial for innovation (Cohen & Levinthal, 1990). Through learning processes, an organization's stock of knowledge can be created and expanded. Consequently, overall quality of organizational knowledge can be leveraged (Hult et al., 2003). Managers see organizational learning as a powerful tool to exploit their knowledge resources and in turn to improve the performance of their organizations. An effective learning process involves several phases, such as acquisition, interpretation, transfer, and reconstruction (Hanssen-Bauer & Snow, 1996). Hult et al. (2003) capture three aspects of learning process: the value of cross-functional teamwork, the interconnectedness of various parts of the organization, and the mechanisms for knowledge sharing. Their empirical analysis indicates a significantly positive relationship between organizational learning and firm performance.

6.3.6. Organizational structure

As already described, human resources, in other words labour, is considered the most important input for SMEs (Heskel, 1999; Rauch et al., 2005). Therefore, organizational structure that concerns the distribution of tasks among labour units and the coordination mechanism between labour units is relevant to a firm's growth (Mintzberg, 1979; Jensen and Meckling, 1992; Chaston, 1997; Athey and Roberts, 2001). Though different dimensions are used by various authors to describe distribution of tasks, *centralization*, *formalization* and *departmentalization* are commonly agreed dimensions (Pugh and Hickson, 1976; Mintzberg, 1979; Dewar et al., 1980; Geeraerts, 1984; Robbins, 1990; Burton and Obel, 1998). *Centralization* represents the degree to which authorities of decision making are delegated throughout an organization; it is the opposite of *decentralization* (Aiken and Hage, 1968). *Formalization* refers to the extent to which organizational rules, procedures, authority relationship, communication, and norms are defined (Hall et al., 1967). Formalization along with *standardization* and *coordination* are utilized to control and optimize organizational procedures. *Departmentalization* is normally measured by the number of departments involved in organizational activities or by the number of managerial levels (Jaworski and Kohli, 1993; Meijaard et al., 2005).

Adopting from previous concepts, Meijaard et al. (2005) examined the relationship between five structural dimensions, namely *departmentalization*, *specialization*, *decentralization*, *coordination*, and *formalization*, and performance of Dutch SMEs. They found that formalization and standardization overlapped in their data set, and that specialization derives two dimensions in terms of task and skill. Firms with a decentralized structure generally perform well regardless of their size, but to their surprise firms with a centralized structure also turned to be performing equally well. Hierarchical, centralized structure with strictly specialized employees turned out to perform well in terms of growth (Hart and Moore, 1999; Meijaard et al., 2005). In addition, firm with specialization were found to be larger in size (Garicano and Hubbard, 2003; Meijaard et al., 2005). Although the effect of organizational structure on firm growth is rather complex due to the dependencies on other factors such as firm size, sector, and organizational configuration, it is suggested that including them in studies could give a better understanding of the determinants of firm growth.

6.4. Environmental Determinants

A general finding in literature is that most firms start small, live small and die small. One major reason for this is that a majority of the business start-ups are imitative businesses in mature industries that serve local markets (Audretsch and Mahmood, 1994; Baldwin and Gellatly, 2003). Environmental inducements thus may largely determine the growth potential of firms. Dess and Beard (1984) show that the environment varies along several dimensions: dynamism, heterogeneity, hostility and munificence. These dimensions are adopted and further developed to investigate their effects on small firms (Covin and Covin, 1990; Kolvereid, 1992; Pelham and Wilson, 1996). *Dynamic environment*, either market dynamics or technology dynamics, is measured by the level of environmental predictability (Houston, 1986). It is argued that there are more opportunities for growth when there are changes in society, politics, market and technology (Wiklund et al., 2007). *Munificence* represents an environment's support (for example, great market potential) for firm growth (Aldrich and Wiedenmayer, 1993). A firm in such an environment with better access to required resources has higher chances to grow. Unfortunately, a previous study shows a slightly significant direct effect of munificence on firm growth (Baum et al., 2001). *Hostile environment* can create threats to the firm through increased intensity of competition. *Competitive intensity* (Houston, 1986) thus reduces the growth opportunities for small firms. *Heterogeneity* indicates the complexity of the environment regarding the concentration or dispersion of organizations in the environment. It is argued that small firms which serve niche markets can find growth opportunity with relatively more ease in a heterogeneous market than in a homogeneous one (Wiklund et al., 2007).

6.5. Growth Barriers

While the aforementioned determinants generally facilitate firm growth, there are also factors that hinder potential growth (Davidsson, 1989). Such factors are titled as *growth barriers*. It is argued that SMEs are more likely to face entry barriers and growth barriers compared to their larger counterparts. Commonly addressed barriers for small businesses include *institutional barriers* and *financial barriers*. *Institutional barriers* are mainly discussed with the focus on firms' interaction with government, including legalization, taxation, and government support amongst others. Based on consistent results from both theoretical and empirical data, Davidsson and Henreksson (2002) strongly argue that certain institutions intentionally discriminate against the growth of SMEs which in turn act as a growth barrier. It

is not difficult to imagine that SMEs would have a tough period when they face unfavourable tax systems, discriminatory regulations and complicated laws.

Financial barriers represent lack of financial resources. It has been argued that credit constraints, lack of external debt, and equity capital are the main obstacles to the growth of SMEs (Pissarides, 1998; Riding and Haines, 1998; Becchetti and Trovato, 2002). Evidence suggests that banks are more conservative when they provide loans to SMEs. Due to the information asymmetries, SMEs are more likely to be charged relatively high interest rates and asked for high collateral and loan guarantees (Stiglitz and Weiss, 1981). Furthermore, SMEs could also face external barriers, internal organizational barriers and social barriers which cover aspects of market position of a firm, access to qualified human capital, and access to network (Bartlett and Bukvič, 2001).

To summarize, we have extensively discussed the determinants of firm growth from three dimensions—namely individual, organizational and environmental determinants. We have also further discussed the determinants that act as growth barriers. We observe that growth is a rather complex phenomenon which can hardly be determined by one group of determinants. There are interactions between certain determinants which yield moderating or mediating effects, which subsequently impacts firm growth (e.g. Baum et al., 2001; Wiklund et al., 2007). As described in the previous sections, there exist a substantial number of determinants that might have a relationship with firm growth. This leads to an equal number of hypotheses which depict positive, negative, or no relationship between a determinant and firm growth. In order to offer a simplistic view on these determinants derived from our literature review and the respective hypothesized relationship with firm growth, we have summarized them in Table 6.1.

Table 6.1. Determinants of growth and hypothesized relationship with growth

Category	Determinants from Literature Review	Expected relationship[a]
INDIVIDUAL DIMENSION		
Personal traits	Need for achievement	+
	Risk taking propensity	+
	Internal locus of control	+
	Self-efficacy	+
	Extraversion (including Sociability)	+
Motivation	Growth motivation	+
Individual competencies	Managerial skills	0
	Specific skills	+
Personal background	Individual age	-
	Gender	+/-
	Education	+
	Experience	+
ORGANIZATIONAL DIMENSION		
Firm attributes	Firm age	-
	Firm size	-
Strategies	Market orientation	+
	Entrepreneurial orientation	+
	Growth orientation	+
Firm specific resources	Financial capital availability	+
	Human resource development	+
	Past finance performance	+
Dynamic capabilities	Organizational learning	+
Organizational structure	Centralization	+
	Formalization	0
	Standardization	0
	Specialisation (task or skills)	+
	Departmentalization	+
ENVIRONMENTAL DIMENSION		
	Market dynamism	+
	Technology dynamism	+
	Heterogeneity	+
	Uncertainty	+
	Competitive intensity	-
	Munificence	+
GROWTH BARRIERS		
	Barriers	-

a. *All hypotheses are based on our literature review; '+' = positive relationship, '-' = negative relationship, '0'= no significant relationship*

6.6. Sample, Data Collection and Methodology

6.6.1. Sample and Data Collection

This paper makes use of a firm-level data set which is composed on the basis of an extensive questionnaire with information on the determinants of firm growth that are discussed in the previous section. Furthermore, there are several measures of growth available, such as employment, turnover, and profit. Respondents were randomly selected amongst Dutch entrepreneurs. Data was collected via several rounds of telephone (computer-aided) interviews by EIM Business Policy and Research in 2005. Approximately 1100 Dutch entrepreneurs were also asked to report their employment, turnover, and profit both in 2003 and in 2005. This gives an opportunity to calculate the relative growth.

The sample is stratified according to sector and size. The sector classification contains the five main sectors of the Dutch economy: manufacturing (International Standard Industrial Classification code D), construction (ISIC code F), trade (ISIC codes G, H), transport & communication (ISIC code I), and services (ISIC codes J, K, N, O, P). Due to our interest in SME growth, our specific sample only includes independent firms that have less than 250 employees (the European Union's cutoff for SMEs). Since not all the respondents finished the questionnaire completely, some of the data points were missing. We thus exclude the cases with missing values and this eventually results in a final data set consisting of 523 firms.

Within our sample, the average age of respondent firms is about 23 years; about half of them belong to the service sector. About 60% of respondent firms are small firms with less than 10 employees. Thus, the sample is somewhat dominated by relatively young and small companies in the service sector.

6.6.2. Model to be tested

As described in the introduction, we attempt to identify the most important determinants of firm growth within a framework that does not take into account moderation or mediation effects. We use a multivariate linear regression model to test the influence of the determinants listed in Table 6.1 on firm growth:

$$Growth = \alpha + \beta_1 \ (determinant) + \beta_2 \ (Barrier) + \beta_3 \ (control) + \varepsilon \qquad (1)$$

where Growth denotes variables of relative growth in employment; determinants includes variables/factors of individual, organizational and environmental determinants; barriers covers variables/factors of growth barriers; control represents control variables.

6.7. Scale Construction and Variables

Most questions of our selected determinants are measured on a seven-point Likert scale (varying from 1 'not at all applicable' to 7 'totally applicable'). To construct multi-item variables, we used a combination of techniques, including factor analysis, testing for reliability using the Cronbach-alpha reliability coefficient, and a check for face validity. Items were combined into factors using the Statistical Package for the Social Sciences (SPSS). Appendix 6.1 provides a more extensive description of each variable.

Two approaches were adopted to construct factors for the determinants; we named them the *conceptual approach* (A) and the *statistical approach* (B). In the conceptual approach, we determine a priori with the help of our knowledge from the literature review, which question(s) of the questionnaire is (are) used to measure a determinant. Subsequently, using factor analysis, we combined the questions into different factors which correspond to the determinants on the basis of the theoretical dimensions. The reliabilities of the factors are tested by the Cronbach-alpha reliability coefficient. Only factors with a Cronbach-alpha around 0.7 are retained (Nunnally, 1967). In the statistical approach, we rely on the data and the outcome of the analysis irrespective of its theoretical basis. In other words, we examine the data in an exploratory manner. Using factor analysis, we group the questions into factors solely on statistical grounds. Then we check whether reliable factors anticipate on the basis of the theoretical dimensions that summarized in the literature review. Appendices 6.1 and 6.2 provide a detailed description of the factors and variables that resulted from both approaches.

6.7.1. Dependent variable

Firm growth can be measured by several attributes such as turnover/sales, employment, assets, market shares, and profits. Among these measures, sales and employment are in particular broadly used indicators for growth (Davidsson, 1991; Delmar, 1997; Ardishvili et al., 1998; Weinzimmer et al., 1998; Wiklund, 1998). This is because growth in sales and employment reflect both short-term and long-term changes in a firm and they are easy to obtain. Furthermore, compared to other indicators such as market shares, sales and employment are more objective measures (Delmar, 1997). Our data set contains several indicators of firm growth such as employment, turnover, and profit. However, the response rates to different indicators differ. In order to maximize our sample for the empirical analysis, we thus use growth in employment as an indicator of firm growth in this study.

There are also different ways in measuring growth, for instance absolute growth and relative growth. Relative growth is commonly used in studies of firm growth (Birch, 1987;

Delmar et al., 2003; Shepherd and Wiklund, 2009), and it is usually measured by the growth rate in percentage terms. With the available information on employment in both 2003 and 2005, we can calculate the relative growth in employment and use it as the dependent variable in the regression model. As a consequence, our dependent variable includes information of both positive and negative growth. The average growth rate in our sample is 34%.

6.7.2. Independent Variables

The independent variables include factors and individual variables representing individual determinants, organizational determinants, environmental determinants, and growth barriers. The *conceptual* and the *statistical* approaches result in two sets of factors as independent variables, consisting of 12 reliable factors and 14 reliable factors, respectively. Appendix 6.2 provides a detailed description of the difference between factors resulted from both approaches.

Individual determinants include personal traits, growth motivation, individual competencies, and personal background. In both the conceptual and the statistical approaches, the same factors are generated for *need for achievement* (Cronbach α=0.70 with 3 items)*, risk taking propensity* (Cronbach α=0.78 with 3 items) and *self-efficacy* (Cronbach α=0.87 with 8 items). Instead of a 4-items factor of *experience* (Cronbach α=0.75) in the conceptual approach, the statistical approach suggests a 3-items factor of *industrial experience* and an individual variable for *entrepreneurial experience*. This 3-items factor improves the reliability to 0.85. In addition to the factors, the rest of individual determinants, i.e. internal locus of control, sociability, extraversion, individual competencies, individual's age, gender, education and growth motivation, are represented by individual variables in the empirical analysis (see Appendix 6.1).

With respect to the organizational determinants, the factors differ between the two approaches. Only the factor of *past financial performance* (Cronbach α=0.70 with 3 items) appears to be the same. There are four other factors generated by the conceptual approach (see Appendix 6.1): *market orientation* (Cronbach α=0.85 with 8 items)*, entrepreneurial orientation* (Cronbach α=0.78 with 5 items)*, grow orientation* (Cronbach α=0.74 with 3 items)*, and *organizational learning* (Cronbach α=0.81 with 6 items). Using the statistical approach, *Market orientation_S (Cronbach α=0.85 with 9 items)* captures one more dimension, but the reliability of this factor does not improve. *Entrepreneurial orientation* and *growth orientation* in the conceptual approach are combined into one factor *(Cronbach α=0.84 with 8* items). We name it *entrepreneurial-growth orientation*. This new factor has the highest reliability

coefficient compared to the two factors solutions resulted from the conceptual approach. Instead of a 6-items factor, the statistical approach suggests a 4-items factor for *Organizational learning_S* (Cronbach α=0.80). The reliability of this 4-items factor was found to be slight lower than the one in the conceptual approach (see Appendix 6.2). In addition, the rest of organization determinants, i.e. firm age and size, organizational structures, firm specific resources, appear as individual variables in the empirical analysis (see Appendix 6.1).

Both the conceptual and the statistical approaches yield the same factors for *competitive intensity* (Cronbach α=0.87 with 2items) and *Munificence* (Cronbach α=0.70 with 3 items) among environmental determinants. *Market dynamism* (Cronbach α=0.71 with 2 items), individual variables of technology dynamism, uncertainty and heterogeneity in the conceptual approach are combined into one factor called *dynamism and complexity* (Cronbach α=0.77 with 5 items) while using the statistical approach (see Appendix 6.1).

In the conceptual approach, we create one factor for *growth barriers* (Cronbach α=0.90 with 17 items), while the statistical approach yields three distinct factors: *institutional barriers* (Cronbach α=0.66 with 3 items), *financial barriers* (Cronbach α=0.68 with 4 items) and *non-institution/finance barriers* (Cronbach α=0.89 with 12 items).

6.7.3. Control variables

We use the following variables as control variables in our empirical analysis.

1) *Sector dummies* are commonly used as control variables. It has been proved that sector differences do matter in empirical results. For instance, a firm in the labour-intensive sector might be more likely to engage in employment growth when compared to the less labour-intensive one. Five sectors dummies are defined in this study: manufacturing, construction, trade, transport and communication, and services.

2) *Organizational configuration* ranges from a simple structure to a multidivisional form, including direct, division, function, and hierarchy. Meijaard et al. (2005) indicate that the effect of organization structure is dependent on organizational configuration. We thus include organizational configuration as a control variable in this study.

3) *Merge experience* used a control variable in order to confine our dependent variable 'firm growth' to the form of organic growth. The heterogeneity of firm growth should not be ignored (Delmar et al., 2003). Broadly speaking, there are three forms of firm growth: organic growth, acquisition growth, and internationalization growth. Organic growth is defined as business expansion through increasing output and sales. Acquisition growth happens by means

of business expansion via mergers, acquisition, or take-overs. Therefore, acquisition-based growth in itself does not directly contribute to economic growth. Internationalization growth is often based on alliances and networks and it is regarded as an entrepreneurial act since it entails the opening up of product markets (Thorelli, 1987; Ibeh, 2003). It has been argued that different forms of growth may have different determinants and effects (Delmar et al., 2003). Therefore, confining different forms of growth might be crucial while conducting an empirical analysis.

4) *Stage in the market lifecycle* includes new market, growing market, mature market, and shrinking market. A firm's growth potential is dependent on market stages. For instance, a firm is more likely to grow fast in a growing market compared to the one that engages in a mature market. Therefore, stage in the market lifecycle is an important control variable.

6.8. Results

Bivariate relationships are first examined using Pearson bivariate correlations. The correlation coefficients between independent variables are all below 0.5. Furthermore, variance inflation factor (VIF) scores are computed for each of the regressions and range from 1.14 to 2.6, thus suggesting that the analysis should not be seriously distorted by multicollinearity. In conclusion, multicollinearity is unlikely to be an issue (see Table 6.2A and 6.2B).

Table 6.2A presents the results of the examined relationship using independent variables which are generated by the *conceptual approach*. There are 37 determinants and 11 control variables included in the model. They explain 22.3% of the variation in dependent variable 'relative growth in employment' ($R^2=0.223$; Adjust $R^2=0.146$).

Seven determinants are identified to have significant impacts on firm growth. Among the *individual determinants*, specific skills (B=18.52, p<0.05) and growth motivation (B=0.28, p<0.01) are positively conducive to firm growth while need for achievement (B=-10.24, p<0.05) shows a negative relationship. Among the *organizational determinants*, growth orientation (B=10.35, p<0.05), past financial performance (B=14.89, p<0.01) and extra finance (B=16.59, p<0.10) have positive impacts on firm growth. Firm age (B=-0.37, p<0.05) contributes negatively to firm growth. There were no significant determinants found among the *environmental determinants*. The value of R^2 change (ΔR^2) differed between dimensions; it indicates that *organizational determinants* explain the most variation of relative growth in

employment ($\Delta R^2=0.114$), followed by *individual determinants* ($\Delta R^2=0.060$). *Environmental determinants* explain the least variation of employment growth ($\Delta R^2=0.026$).

Table 6.2B presents the regression results using the independent variables from the *statistical approach*. In total, 31 determinants and 11 control variables are included in the regression analysis. They explain 21.3% of the variation in dependent variable 'relative growth in employment' ($R^2=0.213$; Adjust $R^2=0.144$).

The statistical approach yields six significant determinants and they reconfirm the findings in the conceptual approach. Among the *individual determinants*, need for achievement, specific skills and growth motivation are identified to be significant determinants of firm growth. Need for achievement (B=-10.267, p<0.05) has a negative impact while the rest, specific skills (B=18.06, p<0.05) and growth motivation (B=0.29, p<0.01), has a positive influence on firm growth. Among the *organizational determinants*, firm age again turns out to be a negative determinant of firm growth (B=-0.35, p<0.10). A firm's entrepreneurial-growth orientation (B=10.45, p<0.05) and past financial performance (B=16.35, p<0.01) show a positive relationship with firm growth. We do not find any significant determinants among the *environmental determinants*. The value of ΔR^2 varies between dimensions. Similar to the finding from the conceptual approach, determinants from organizational dimensional explain the most variation of relative growth in employment ($\Delta R^2=0.095$), followed by the determinants from individual dimension ($\Delta R^2=0.053$). Determinants from environment dimension explain the least variation ($\Delta R^2=0.024$).

Table 6.2A. Regression results on determinants based on the conceptual approach

Factors/Variables	Coefficient	t-value	VIF
Constant	5.18	0.16	
CONTROL VARIABLES			
Merge experience	-6.19	-0.30	1.22
Division structure	-12.98	-0.48	1.19
Hierarchy structure	9.71	0.49	1.27
Function structure	**-23.81**†	**-1.95**†	1.30
Manufacture	**-19.92**†	**-1.74**†	1.29
Construct	-16.46	-0.97	1.24
Trade	-13.08	-1.37	1.42
Transport&communication	5.20	0.33	1.13
New market	**25.49**†	**1.92**†	1.22
Grow market	10.44	1.14	1.49
Shrink market	-7.36	-0.46	1.24
INDIVIDUAL DIMENSION			
Need for achievement	**-10.24***	**-2.37***	1.72
Risk taking propensity	-1.01	-0.26	1.40
Internal locus of control	2.36	1.04	1.21
Sociability	-1.61	-0.60	1.49
Extraversion	1.47	0.60	1.45
Self efficacy	-5.10	-1.02	2.18
Experience	-3.68	-0.89	1.59
Specific skills	**18.52***	**2.19***	1.35
Managerial skills	2.42	0.31	1.34
Individual age	0.00	0.19	1.18
Gender (Male=1)	6.78	0.85	1.26
Education	10.07	1.31	1.36
Growth motivation	**0.28****	**2.70****	1.55
ORGANIZATIONAL DIMENSION			
Firm age	**-0.37***	**-2.04***	1.41
Firm size	-13.37	-1.59	1.88
Centralization	0.87	0.43	1.21
Standardization	-0.62	-0.30	1.40
Formalization	3.38	1.75	1.54
Specialisation (tasks)	-0.09	-0.04	1.42
Specialisation (skills)	-0.61	-0.31	1.29
Departmentalization	-0.43	-0.12	1.58
Market orientation	3.65	0.70	2.42
Entrepreneurial orientation	0.49	0.09	2.53
Growth orientation	**10.35***	**2.17***	2.08
Organizational learning	2.30	0.51	1.85
Past financial performance	**14.89****	**3.71****	1.53
Extra finance	**16.59**†	**1.85**†	1.35
Financial bottleneck	-6.22	-0.57	1.42
Human resource development	0.02	0.61	1.16
ENVIRONMENTAL DIMENSION			
Competitive intensity	-0.36	-0.09	1.58
Market Dynamism	5.18	1.06	2.20
Technology turbulence	-0.08	-0.03	1.75
Munificence	3.15	0.66	2.13
Heterogeneity	-0.90	-0.39	1.69
Uncertainty	1.15	0.50	1.45
GROWTH BARRIERS			
Growth barriers	0.98	0.23	1.65
R^2	*0.223*		
Adjusted R^2	*0.146*		

†: P<0.1; *: P<0.05; **: P<0.01

Table 6.2B. Regression results on determinants based on the statistical approach

Factors/Variables	Coefficient	t-value	VIF
Constant	8.88	0.35	
CONTROL VARIABLES			
Merge experience	-6.98	-0.34	1.23
Division structure	-11.83	-0.44	1.17
Hierarchy structure	4.83	0.25	1.25
Function structure	**-23.39†**	**-1.91†**	1.30
Manufacture	**-20.17†**	**-1.77†**	1.27
Construct	-17.84	-1.05	1.24
Trade	-13.77	-1.48	1.35
Transport&communication	4.30	0.27	1.12
New market	**25.43†**	**1.90†**	1.23
Grow market	9.97	1.19	1.48
Shrink market	-6.32	-0.39	1.26
INDIVIDUAL DIMENSION			
Need for achievement	**-10.26***	**-2.43***	1.65
Risk taking propensity	-0.98	-0.26	1.36
Internal locus of control	2.07	0.91	1.20
Self efficacy	-2.58	-1.13	1.91
Industrial experience	-4.19	-1.01	1.57
Entrepreneurial experience	5.30	0.60	1.17
Specific skills	**18.06***	**2.16***	1.32
Managerial skills	3.65	0.46	1.33
Individual age	0.01	0.20	1.18
Gender (Male=1)	6.73	0.84	1.28
Education	10.10	1.33	1.31
Growth motivation	**0.29****	**2.78****	1.54
ORGANIZATIONAL DIMENSION			
Firm age	**-0.35†**	**-1.92†**	1.39
Firm size	-13.16	-1.57	1.85
Centralization	0.96	0.48	1.19
Standardization	-0.27	-0.13	1.37
Formalization	3.24	1.69	1.52
Specialisation (tasks)	-0.30	0.14	1.41
Specialisation (skills)	-0.64	0.32	1.28
Departmentalization	-0.33	-0.09	1.54
Market orientation_S	3.56	0.68	2.43
Entrepreneurial-growth orientation	**10.45***	**1.98***	2.53
Organization learning_S	1.65	0.39	1.65
Past financial performance	**16.35****	**4.09****	1.51
Human resource development	0.02	0.46	1.13
ENVIROMENTAL DIMENSION			
Competitive intensity	-0.45	-0.11	1.55
Dynamism & complexity	3.91	0.84	1.93
Munificence	3.22	0.69	1.99
GROWTH BARRIERS			
Non-institutional/finance barriers	1.03	0.21	2.14
Finance barriers	2.73	0.69	1.46
Institution barriers	-0.69	-0.16	1.62
R^2	*0.214*		
Adjusted R^2	*0.144*		

†: $P<0.1$; *: $P<0.05$; **: $P<0.01$

Comparing the results of the two approaches, we can conclude that both approaches yield more or less similar results. Table 6.3 summarizes the findings from the conceptual and the statistical approach. Determinants that were found to have a significant influence (at 10% significant level) on firm growth are tabulated. Apparently, most of the results seem to be sufficiently robust: they do not alter with a slight difference in specification of variables or factors.

Table 6.3. Summary of significant determinants of firm growth

Determinants	Conceptual approach	Statisitcal approach
Need for achievement	-	-
Specific skills	+	+
Growth motivation	+	+
Firm age	-	-
Past financial performance	+	+
Growth orientation	+	
Entrepreneurial-growth orientation		+
Extra finance	+	

6.9. Discussion, Conclusions and Limitations

In this chapter, we investigate the determinants of firm growth. Based upon an extensive review of the existing literature, we summarize many known determinants and classify them into three dimensions: individual, organizational and environmental determinants. This gives an opportunity to evaluate the importance of the three dimensions as well as all underlying determinants. We identify the most important determinants of firm growth using a simple model.

Most of our empirical findings are consistent with previous studies. Among the individual determinants, our empirical results show a positive relationship between growth motivation and firm growth. This confirms the argument from the motivation theory stating that a motivated entrepreneur will perform better in firm growth since he/she will devote more time and energy (Davidsson, 1989; Kolvereid, 1992; Delmar, 1996). Our empirical results also show that the entrepreneur's specific skills, in particular with the technical background, have a significant impact on firm growth. From a learning perspective, entrepreneurs with a technical background can learn managerial skills via daily operations. However, it may be more difficult for a non-technical entrepreneur to understand the technical aspects. Furthermore, technically

accomplished entrepreneurs are more aware of the technical opportunities. Our findings support that technical competency is an important expertise which facilitates the implementation of the entrepreneur's vision and strategy (Baum et al., 2001).

Among the organizational determinants, a negative effect of firm age on firm growth is found in our empirical study. This is in line with the view that younger firms feel the urge to reach the minimum efficiency scale and thereby exhibit higher growth rates compared to the older ones. The empirical results also show that both extra finance and past financial performance are positively related to firm growth. This finding is consistent with previous studies (Cooper et al., 1994; Storey, 1994). Availability of capital is crucial for firm growth because it can be converted into other types of resources. Firms with secured financial resources are able to experiment which consequently yields new opportunities for growth (Sexton and Bouman-Upton, 1991; Zahra, 1991; Castrogiovianni, 1996; Bamford et al., 1997; Dollinger, 1999). The positive relationship between availability of capital and employment growth is also straightforward. The hiring of new employees will result into an increase in a firm's costs. Hence a firm will not be able to expand without a precondition of sufficient finance.

Contrary to previous studies, our empirical findings show that *need for achievement* as an entrepreneurial trait has a negative effect on firm growth. Our explanation is that entrepreneurs in our sample may have high levels of need for achievement in other entrepreneurial goals, such as improved performance, quality, higher profit margin, etc., rather than promoting employment growth. Another possible explanation could be the interplay with other trait variables. For instance, entrepreneurs who have a high level of need for achievement are more likely to pursue success. Therefore, they may avoid any kind of risks and costs in order to stay success.

One of the novel findings of our empirical study is that there exists a positive relationship between growth orientation and firm growth. This finding empirically supports Stevenson's conceptualized entrepreneurial management does serve its aim: the existence and nature of management teams affect the likelihood of a positive outcome (Stevenson and Jarillo, 1990; Terrence et al., 2001). This also indicates that entrepreneurial behaviour is not solely based on personalities. There is a propensity for teaching entrepreneurial behaviour (Stevenson and Jarillo, 1986; 1990).

Furthermore, in the statistical approach of scale construction, result shows that entrepreneurial orientation overlaps with growth orientation. In order to examine whether they belong to same underlying theoretical dimension, a separate factor analysis was performed only on the items belonging to entrepreneurial orientation (5 items) and growth orientation (3 items). All items loaded on one factor with a vast majority of the loadings that are higher than 0.60. 47% of total variance can be explained (see Table 6.4). Compared to separate factors, this one factor has the highest reliability with Cronbach alpha of 0.84. This indicates that all items share a high degree of variance with their respective construct. In the regression analysis, we also observed that entrepreneurial orientation alone does not affect firm growth. The positive effect only appears to be significant when including an additional dimension named growth orientation. We thus suggest that growth orientation might be an important dimension for entrepreneurial orientation when accounting for measurement and operationalization issues.

Table 6.4. Factor analysis for Stevenson's growth orientation and Lumpkin & Dess's entrepreneurial orientation

Factor (expl. Var)	Factor 1 (47%)
Items	
Entrepreneurial orientation	
- We search actively for innovative product/service concept and new production processes.	0.61
- We undertake the actions to which other companies must react	0.69
- Our slogan is "defeating our competitors"	0.69
- Compared to other business, we take a lot of risk	0.72
- We react strongly and offensively to the actions of competitors	0.73
Growth orientation	
- We are prepared for a strong growth of our business.	0.75
- With the current organization structure and business resources, we can easily grow with 20%	0.53
- Within our company, everyone knows that we want to grow fast.	0.74

The limitations of the present chapter are the following: *first*, we develop a simple model which does not account for moderating and mediating effects. Several other studies that use a limited number of explanatory variables indeed indicate an existence of moderating or mediating effects between different determinants (Baum et al., 2001; Wiklund et al., 2007).

Second, we use employment growth as a dependent variable. This limits the explanatory power of this study. It has been argued that sales growth would be a better initiating factor for growth (Flamholtz, 1986). Future study should also include sales growth as a dependent variable. Furthermore, it will be more insightful if the interlinks between different growth indicators can be investigated. *Third*, the cross-sectional nature of the data does not allow for dynamic aspects. The current setup can be extended to a longitudinal setup in future research.

To conclude, this chapter shows that firm growth is a complex phenomenon that can not be explained by one particular dimension or one determinant. The most important determinants have been identified from the individual and organizational dimensions. Organizational determinants have the greatest influence on firm growth. A firm's past financial performance and an entrepreneur's growth motivation are most important determinants among other significant ones, followed by a firm's entrepreneurial-growth orientation. Our findings indicate that besides sufficient resource and ambitious, a firm-level entrepreneurial attitude is the key to actual growth. Most of our empirical results are consistent with previous studies except for the *need for achievement*. This chapter also indicates that growth orientation might be an important dimension for entrepreneurial orientation.

Though the current chapter has its limitation, it makes an empirical contribution to the growth literature in following ways: *First*, next to the extensive literature review, this chapter is one of few studies that integrate many known determinants and test them empirically; *Second*, we identify seven most important determinants – growth motivation, specific skills, need for achievement, firm age, financial performance, extra finance, and grow orientation. The finding on growth orientation constitutes a first link between Stevenson's entrepreneurial management and growth literature; *Third*, we identify the correlation between entrepreneurial orientation and growth orientation. This might suggest an additional and crucial dimension for entrepreneurial orientation for practices. Nevertheless, our empirical findings should be interpreted as a starting point which provides empirical supports to develop a more complex model to test the determinants of firm growth.

Appendix 6.1. Definition of regression variables in the conceptual approach (Cont.)

Regression variables [(a)]	Questions in the questionnaire
INDIVIDUAL DIMENSION	
Need for achievement (3 items, α=.70)	- Even if I have achieved something, I want to become better - I like to compare myself with others - I do everything in order to reach my goal
Risk taking propensity (3 items, α=.78)	- I love gambling - I dare to take action, even though it will be risky - I am ready to take risk
Internal locus of control	- Result of my business is strongly dependent on my own effort
Sociability	- After working time I often meet professionally relevant persons (customer, advicer, etc)
Extraversion	- Talking to strangers is easy for me
Self efficacy (8 items, α=.87)	- I can make good strategic choices - In discussions I come up with the important part - I am open for new and non-traditional ideas. - I usually lead the implementation of new ideas, products/services and processes - I ask questions that nobody else asks - I set up goals for myself and work according to these goals - In my work I concentrate on the work that has to be done to achieve my goals or the company goals - I am goal oriented
Experience (4 items, α=.75)	- How many years of working experience do you have in the industry in whcih your current business is engaged? - How many years did you work in this business? - How many years' working experience do you have? - Do you have entrepreneurial experience before you come to work in this business?
Specific skills	- Technical education
Managerial skills	- Management/economics education
Individual age	- What is your birth of year?
Gender (Male=1)	- What is your gender?
Education	- What is the highest degree you obtained?
Growth motivation	- If your business can develop as you expected in the coming years, what do you expect the increase of employment in 2007

a. If a variable is constructed by factor analysis, it is formatted in **bold** and the Cronbach alpha is in parentheses. Only factors with an alpha about 0.7 are taken into the regression analysis.

Appendix 6.1. Definition of regression variables in the conceptual approach (Cont.)

Regression variables	Questions in the questionnaire
ORGANIZATIONAL DIMENSION	
Firm age	- In which year do you start your business?
Firm size	- How many full time employees in your business in 2005? (Categorical variable)
Centralization	- Most decisions have to be made by managers
Standardization	- The intended result of the work is specified in advance
Formalization	- Working procedure is written down
Specialisation (tasks)	- Every employee does some specific tasks
Specialisation (skills)	- Employees have function which only they can fulfill
Departmentalization	- How many management levels within your business?
Market orientation (8 items, α=.85)	- We measure customer satisfaction structurally and periodically. - Helping and satisfying customers is the most important for us. - We often discuss about how competitors do - Management team often discuss the strong point of competitors - We often share information about client wishes internally. - All our internal procedures and rules are focused on fulfilling the needs in the market. - We are always busy with customer needs that will emerge after some years. - We focus on acquiring new customers with new needs.
Entrepreneurial orientation (5 items, α=.78)	- We search actively for innovative product/service concept and new production processes. - We undertake the actions to which other companies must react - Our slogan is "defeating our competitors" - Compared to other business, we take a lot of risk - We react strongly and offensively to the actions of competitors
Grow orientation (3 items, α=.74)	- We are prepared for a strong growth of our business. - With the current organization structure and business resources, we can easily grow with 20% - Within our company, everyone knows that we want to grow fast.
Organizational learning (6 items, α=.81)	- Everyone here agrees with the common goal - We have a strong team feeling - Employees' training is an investment, its not a cost - Learning is according to us the key to make things better - We make enough free time to learn from the mistakes we made - We study the successful and unsuccessful business activities and discuss with each other about it
Past financial performance (3 items, α=.70)	- How would you describe the profitability of your company on average in the last five years? - How did the turnover develop in the last five years - How do you judge your financial performance compare to the important competitor in your sector?
Extra finance	- Do you think that you need extra finance in the coming 2yrs
Financial bottleneck	- Do you experience bottlenecks in the financing of your business?
Human resource development	- How many training hours have your employees had in the last 2 years

Appendix 6.1. Definition of regression variables in the conceptual approach

Regression variables	Questions in the questionnaire
ENVIRONMENTAL DIMENSION	
Competitive intensity	- Our maket share is threatened by intensive competition
(2 items, α=.87)	- Our market is characterized by strong competition.
Market Dynamism	- Customers constantly look for new product/service
(2 items, α=.71)	- Products and services become old very fast in our market
Technology turbulence	- In our market, you must often update technology in order to stay in the market.
Technology stability	- The technology that our business is based on, is not subject to large changes
Munificence	- There is uncultivated market potential in our market
(3 items, α=.69)	- In which degree are there profit and growth opportunities in your market?
	- Our most important market grow fast
Uncertainty	- Questions and preference of customers are unpredictable
Heterogeneity	- Customers differ strongly in buying behaviour
GROWTH BARRIERS	
Growth barriers	- Attract and keep qualified personal
(17 items, α=.90)	- Getting the cash flow
	- Access to new market
	- Keep up with technological development
	- Difficulties with inventory and suppliers
	- Increase management workload
	- Find right advices
	- Get right knowledge/suitable technology
	- Degree of competitiveness
	- Development of market volume
	- Set up suitable organization structure
	- Get the access to relations and relevant networks
	- Lack of support from banks
	- Difficult to obtain the capital
	- Find a right (production/sales) location
	- Legalization
	- Lack of support from government
CONTROLS	
Merge experience	- Did your company merge with others in the past 2 years?
Division structure	- Which one of following does describe the internal organization of your
Hierarchy structure	business? Division structrue, hierarchy structure, function structure or
Function structure	direct structure. (Dummies, using direct structure as reference group)
Manufacture	- Which sector does your business belong to? Manufacture, construct,
Construct	trade, transport&communication or service. (Sector dummies, using service
Trade	as reference group)
Transport & communication	
New market	- Which market does your business engage in? New market, grow market,
Grow market	mature market or shrink market. (Dummies, using mature market as
Shrink market	reference group)

Appendix 6.2. Definition of different regression variables in the statistical approach

Variables [a]	Definition
INDIVIDUAL DIMENSION	
Industrial experience (3 items, α=.85)	Three questions from the factor of experience in the conceptual approach *- How many years of working experience do you have in the industry in which your current business is engaged?* *- How many years did you work in this business?* *- How many years' working experience do you have?*
Entrepreneurial experience	One question from the factor of experience in the conceptual approach *- Do you have entrepreneurial experience before you come to work in this business?*
ORGANIZATIONAL DIMENSION	
Market orientation_S (9 items, α=.85)	Questions from the factor of market orientation in the conceptual approach plus the following one: *- We are well known for our product/service introduction*
Entrepreneurial-growth orientation (8 items, α=.84)	Combination of the factor of entrepreneurial orientation and the factor preparedness to growth in the conceptual approach
Organization learning_S (4 items, α=.80)	Four questions from the factor of organizational learning in the conceptual approach *- Employees' training is an investment, its not a cost* *- Learning is according to us the key to make things better* *- We make enough free time to learn from the mistakes we made* *- We study the successful and unsuccessful business activities and discuss with each other about it*
ENVIRONMENTAL DIMENSION	
Dynamism and complexity (5 items, α=.77)	Combination of the factor of market dynamism, technology turbulence and the factor of heterogeneity in the conceptual approach
GROWTH BARRIERS	
Non institutional/finance barriers (12 items, α=.89)	Twelve questions from the factor of growth barriers in the conceptual approach *- Attract and keep qualified personal* *- Getting the cash flow* *- Access to new market* *- Keep up with technological development* *- Difficulties with inventory and suppliers* *- Increase management workload* *- Find right advices* *- Get right knowledge/suitable technology* *- Degree of competitiveness* *- Development of market volume* *- Set up suitable organization structure* *- Get the access to relations and relevant networks*
Institutional barriers (3 items, α=.66)	Three questions from the factor of growth barriers in the conceptual approach *- Find a right (production/sales) location* *- Legalization* *- Lack of support from government*
Finance barriers (4 items, α=.68)	Two questions from the factor of growth barriers, combining with extra finance and financial bottleneck in the conceptual approach *- Lack of support from banks* *- Difficult to obtain the capital* *- Do you think that you need extra finance in the coming 2yrs* *- Do you experience bottlenecks in the financing of your business?*

a. If a variable is constructed by factor analysis, it is formatted in **bold** and the Cronbach alpha is in parentheses. Only factors with an alpha about 0.7 are taken into the regression analysis.

Summary (English)

In the last few decades, economists, scholars and policy-makers have realized that the traditional resources of a managed economy, that is, capital and labor, are not the only inputs to economic competence and growth; *knowledge* and *entrepreneurship* are recognized as new twin driving forces for economic growth in an entrepreneurial economy (Audretsch and Thurik, 2001, 2004). These twin forces and their consequences for economic performance are the focus of this book.

Recent studies suggest that neither knowledge nor entrepreneurship alone is sufficient to drive growth. Investing in new knowledge is only a necessary condition; new knowledge needs to be exploited and put into commercial use such that it can lead to a higher level of competitiveness and economic growth, in turn. Entrepreneurship is acknowledged to play an important role in this process. It is thus essential for economists and policy-makers to understand *how* knowledge and entrepreneurship relate to each other and *why* they lead to economic growth.

The five empirical chapters included in this book provide new insights into the aforementioned issues. Firm- and country-level analyses are applied to address the following research questions that are of interest to economists, policy-makers and owner-managers of small and medium sized enterprise (SMEs): how entrepreneurship facilitates the process of turning knowledge into innovative products; how SMEs foster innovation performance through managing their knowledge assets; and what determines the growth of SMEs.

Chapter 2, which is based on a country-level analysis, identifies the moderating role of entrepreneurship in turning knowledge into innovation which in turn may lead to economic growth. Chapters 3 through 5, by taking a firm-level perspective, investigate how SMEs manage their knowledge assets (including organization knowledge and human resources) to stimulate innovation performance. Chapter 6 is devoted to understanding the determinants of SME growth.

The main conclusions and implications of the chapters are presented as follows:

1) *Entrepreneurship serves as a moderator between new knowledge and innovation performance* (Chapter 2). A higher rate of entrepreneurship facilitates the process of turning knowledge into innovative products, which in turn may lead to economic growth. Chapter 2 of

this book shows that countries with a high rate of entrepreneurship perform better in terms of innovation performance than countries with a low rate of entrepreneurship. This implies that promoting the production of new knowledge (e.g., by means of R&D subsidies or university education) is not sufficient; it is equally necessary to have entrepreneurs who turn this new knowledge into innovative products (subsequently leading to economic growth). In order to have proper returns on investments in new knowledge, policy-makers may want to promote entrepreneurship through subsidized loans, regulatory exemptions or tax benefits for high-tech entrepreneurs or innovative start-ups. A complementary long-term strategy could promote entrepreneurship education to increase the number of qualified and risk-taking entrepreneurs.

2) *SMEs focus more on people-centered informal KM practices* (Chapter 3). People-centered informal knowledge management (KM) practices emphasize individual involvement and socialization of employees. This suggests that owner-managers of SMEs should be aware of the need to develop competencies of their employees by nurturing their knowledge base as well as by retaining key (e.g. knowledgeable) employees through the right incentives. Furthermore, family-oriented SMEs are found to be less likely to externalize and codify their knowledge. However, acquiring external knowledge as well as codifying and storing knowledge brings large benefits for a firm's long-term competitiveness. Thus it may be helpful to stimulate owner-managers of family-oriented SMEs to be more open to outside influences and to be aware of the benefit of codifying and storing knowledge for fostering innovation and change.

3) *External knowledge acquisition is an important means for SMEs to innovate* (Chapter 4). External knowledge acquisition contributes positively to innovation orientation of a SME. This in turn enhances innovation performance of a SME. Chapter 4 of this book suggests that SMEs innovate in different ways than their larger counterparts. Instead of building new knowledge and creating innovation opportunity in-house, SMEs often seek opportunities and acquire new external knowledge through social ties and interaction with external sources. Policy-makers who want to stimulate SMEs' innovation performance may promote a favorable external communication system for SMEs and assist SME directors in making better use of their external environment by learning how to network more effectively.

4) *Numerical flexibility is good for imitation performance, but it is not an option for those market leaders who have a need for continuity in learning and for preventing knowledge from leaking to competitors* (Chapter 5). SMEs that rely on numerical flexibility (i.e. hiring employees on fixed-term contracts) may have high sales of *imitative* new products but perform

low on sales of *innovative* new products ("first on the market"). Functional flexibility of internal labor markets (i.e., the percentage of employees that changed their function and/or department within the firm) has advantages for the continuity of (organizational) learning and strengthens the historical memory of firms, which is necessary for 'true' innovation. The findings of chapter 5 in this book warn against the unconditional plea by neoclassical economists for the deregulation of labor markets. Furthermore, the findings underline the importance of "insider-outsider" labor markets for retaining knowledge in the firm and investing in the loyalty and commitment of employees while allowing for flexibility. In order to reach the goal of achieving a strong competitive position in the global market and to build a dynamic economy, policy-makers of European countries may need to rethink the policy of deregulation of labor markets, which may decrease the amount of market leaders who contribute to 'true' innovation in Europe.

5) *Entrepreneurs' specific skills and firm-level entrepreneurial orientation are important determinants for the growth of SMEs* (Chapter 6). The entrepreneurs' specific skills, in particular the technical background, have a significant impact on firm growth. From a learning perspective, entrepreneurs with a technical background can learn managerial skills via daily operations. This supports the view that technical competency is an important expertise which facilitates the implementation of the entrepreneur's vision and strategy (Baum et al., 2001). Furthermore, it is observed that firm-level entrepreneurial attitude consisting of entrepreneurial orientation and growth orientation is a key to actual firm growth. The exhaustive analysis of many determinants covered in chapter 6 of this book serves as a first step to develop a more systematic analysis for future research on the determinants of firm growth.

To conclude, the findings of this book provide empirical support for the conclusion that knowledge and entrepreneurship are important sources of competitive advantage and economic performance. Entrepreneurship catalyzes the transformation of new knowledge into innovation on the one hand; on the other hand, knowledge plays a significant role in innovation performance and growth of SMEs.

Nederlandse Samenvatting (Summary in Dutch)

Dit boek onderzoekt de onderlinge relaties tussen kennis, ondernemerschap en economische prestaties. Kennis en ondernemerschap zijn van belang voor economische groei. Recente studies wijzen erop dat noch kennis noch ondernemerschap alleen voldoende is om groei te stimuleren. Nieuwe kennis moet worden benut en vercommercialiseerd zodat het kan leiden tot een betere concurrentiepositie en hogere economische groei. Ondernemerschap wordt een belangrijke rol toegedicht in dit proces. Daarom is het essentieel voor economen en beleidsmakers inzicht te krijgen in het verband tussen kennis en ondernemerschap en hoe zij in onderlinge samenhang kunnen leiden tot economische groei.

De vijf empirische hoofdstukken in dit boek zijn gewijd aan het creëren van meer inzicht in bovengenoemde kwesties op zowel land- als bedrijfsniveau. De volgende onderzoeksvragen worden beantwoord: 1) Hoe beïnvloedt ondernemerschap het proces van het omzetten van kennis in innovatieve producten? 2) Hoe wenden MKB's hun kennis (van organisatie en personeel) aan om hun innovatieprestaties te stimuleren? 3) Wat bepaalt de groei van MKB's?

Hoofdstuk 2 is gebaseerd op een analyse op landniveau en identificeert een modererende rol van ondernemerschap in het omzetten van kennis in innovatie, hetgeen kan leiden tot economische groei. De analyses in de volgende hoofdstukken spelen zich af op bedrijfsniveau. Hoofdstuk 3 onderzoekt de verschillende Kennismanagement (KM) praktijken binnen MKB's. Daarnaast wordt in dit hoofdstuk de relatie tussen deze KM-praktijken en de organisatiecontext (zoals de grootte van de onderneming, familie-oriëntatie en strategie) geanalyseerd. Hoofdstuk 4 bestudeert hoe MKB's hun KM gebruiken om hun innovatieprestaties te stimuleren. In Hoofdstuk 5 staat menselijk kapitaal als een proxy voor kennis centraal en wordt onderzocht wat het verband is tussen flexibele arbeid en innovatie. In Hoofdstuk 6 wordt aandacht besteed aan de determinanten van de groei van MKB's.

De belangrijkste conclusies en praktische implicaties van de hoofdstukken kunnen als volgt worden samengevat:

1) *Ondernemerschap vervult een modererende rol tussen nieuwe kennis en innovatieprestatie* (Hoofdstuk 2). Ondernemerschap vergemakkelijkt het proces van het omzetten van kennis in innovatieve producten, wat vervolgens kan resulteren in economische

groei. Landen met een hoge mate van ondernemerschap zijn beter in staat kennis om te zetten in innovaties dan landen met een lage mate van ondernemerschap. Dit houdt in dat het creëren van kennis door middel van bijvoorbeeld R&D-subsidies of universitair onderwijs niet voldoende is. Het is evenzeer noodzakelijk de groei van (nieuwe) ondernemers te stimuleren, die deze kennis kunnen omzetten in innovatieve producten. Dit kan bijvoorbeeld gedaan worden door middel van gesubsidieerde leningen, regelgevende vrijstellingen of fiscale voordelen voor jonge innovatieve bedrijven. Een aanvullende strategie op de lange termijn is het bevorderen van onderwijs in ondernemerschap om zodoende het aantal gekwalificeerde ondernemers te verhogen.

2) *MKB's maken gebruik van informele mensgerichte KM-praktijken* (Hoofdstuk 3). Informele mensgerichte KM-praktijken benadrukken individuele betrokkenheid van werknemers. Dit suggereert dat de eigenaar-manager zich bewust moet zijn van de noodzaak om (1) competenties van werknemers te ontwikkelen door het stimuleren van kennis en (2) hoger opgeleide werknemers te behouden door middel van de juiste prikkels. Bovendien is gebleken dat het in familiebedrijven minder gebruikelijk is om kennis te externaliseren en te codificeren. Dit terwijl het verwerven, codificeren en opslaan van externe kennis grote voordelen heeft voor de competitiviteit van een onderneming op de lange termijn. Het kan derhalve nuttig zijn om de eigenaar-managers van familiebedrijven te stimuleren meer open te staan voor invloeden van buitenaf en voor de voordelen van het codificeren en opslaan van kennis ter bevordering van innovatie en verandering.

3) *Het extern verwerven van kennis is een belangrijk middel voor een MKB om te innoveren* (Hoofdstuk 4). Het extern verwerven van kennis levert een positieve bijdrage aan de innovatieoriëntatie van een MKB, hetgeen ook de prestatie van een innovatie bevordert. Hoofdstuk 4 van dit boek suggereert dat MKB's op andere wijzen innoveren dan hun grote tegenhangers. In plaats van het creëren van nieuwe kennis binnenshuis, grijpen MKB's vaak mogelijkheden aan om externe kennis te verwerven door bijvoorbeeld het aangaan van sociale banden. Beleidsmakers die de innovatieprestaties van MKB's willen stimuleren, doen er goed aan de waarde van een goed werkend extern communicatiesysteem voor MKB's te benadrukken. Daarnaast moeten eigenaar-managers gewezen worden op het belang van netwerkactiviteiten.

4) *Numerieke flexibiliteit is gunstig voor de innovatieprestatie van bedrijven, maar het is geen optie voor marktleiders die behoefte hebben aan continuïteit en lerend vermogen en die willen voorkomen dat ze kennis kwijtraken aan concurrenten* (Hoofdstuk 5). MKB's die

vertrouwen op numerieke flexibiliteit (bijvoorbeeld het inhuren van mensen op basis van tijdelijke contracten) halen misschien een hoog omzetaandeel met '*imitative*' nieuwe producten, maar blijven achter als het gaat om het omzetaandeel van innovatieve nieuwe producten die voor het eerst op de markt komen. Functionele flexibiliteit op de 'interne arbeidsmarkt' van een bedrijf (dat wil zeggen het percentage medewerkers dat van functie of afdeling verandert binnen een bedrijf) heeft voordelen voor de continuïteit van de lerende organisatie en versterkt het historisch geheugen van bedrijven, hetgeen noodzakelijk is voor 'echte' innovatie. De resultaten in Hoofdstuk 5 suggereren dat de onvoorwaardelijke steun van neoklassieke economen voor het dereguleren van arbeidsmarkten nuancering behoeft. Verder onderstrepen deze resultaten het belang van 'insider-outsider-arbeidsmarkten' voor het behouden van kennis binnen een bedrijf en het investeren in loyaliteit en toewijding van werknemers terwijl er ruimte blijft voor flexibiliteit. Om het oogmerk van een sterke concurrerende positie in de wereldmarkt te behouden en van een dynamische economie op te bouwen, moeten beleidsmakers van Europese landen de deregulering van arbeidsmarkten heroverwegen, omdat deze deregulering wellicht het aantal marktleiders dat bijdraagt aan 'echte' innovatie in Europa reduceert.

5) *Specifieke vaardigheden van de ondernemer en de bedrijfsspecifieke oriëntatie op ondernemerschap zijn belangrijke factoren voor de groei van MKB's* (Hoofdstuk 6). De specifieke vaardigheden van een ondernemer – in het bijzonder zijn/haar technische achtergrond – hebben een aanzienlijke invloed op de groei van het bedrijf. Vanuit een leerperspectief kan gesteld worden dat ondernemers met een technische achtergrond zich managementvaardigheden kunnen eigen maken door middel van hun dagelijkse bezigheden. Dit bevestigt de opvatting dat technische competenties belangrijk zijn bij de implementatie van de visie en strategie van de ondernemer. Het hoofdstuk laat bovendien zien dat de houding ten opzichte van ondernemerschap (bestaande uit bedrijfsspecifieke oriëntatie op ondernemerschap en groei) erg belangrijk is voor het realiseren van groei. Hoofdstuk 6 dient als een eerste stap naar een meer systematische analyse voor toekomstig onderzoek naar de determinanten van de groei van MKB's.

Tot slot, de empirische resultaten van dit boek rechtvaardigen de conclusie dat kennis en ondernemerschap belangrijke bronnen zijn van economische prestaties. Aan de ene kant is ondernemerschap een belangrijke katalysator voor het transformeren van nieuwe kennis in innovatie; aan de andere kant speelt kennis een belangrijke rol in het stimuleren van innovatie en de groei van MKB's.

中文摘要 (Summary in Chinese)

近几十年来，在新的创业经济的模式下,经济学家及决策者们认识到经济增长的主要因素不仅包括我们所知的传统的资源--资本和劳动力，知识和创业资本作为新的经济增长因素逐渐得到了各方面的关注。最近的研究提出知识和创业资本作为新的经济增长因素缺一不可。投资新知识只是经济增长的一个必要条件，但新的知识仍需被开发和商业化，这样才能更有效的提升竞争力和促进经济增长。一方面，创业资本在知识商业化过程中起到了非常重要且不可或缺的作用；另一方面，新的知识也为创业资本提供了新的机会。因此，理清知识和创业资本之间的相互关系以及了解其对经济增长的影响对经济学家和决策者而言至关重要。本书主要围绕上述课题，从企业和国家两个层面通过实证分析来讨论知识和创业资本的关系，以及这种关系对企业业绩和国家经济增长的影响。

本书由六章组成。第一章是介绍和结论篇，包含了课题的研究背景，研究问题及方法论，各实证分析章节的概括和研究结果总结。第二章至第六章是实证分析。为了更有效的分析知识、创业资本和经济发展之间的关系，本书使用创新水平和企业成长水平代替经济增长作为主要输出变量。创新水平的提升能促进区域的多元化和竞争力。企业成长能减少区域的失业率。这些进而能促进区域的经济增长。

本书的第二章主要从国家层面进行分析，研究知识和创新水平之间的关系，及创业资本在其中所起的催化作用。第三章至第五章，从企业的角度,实证研究中小企业如何通过组织管理知识资本（包括企业知识和人力资源）来提升企业的创新水平。第六章对企业成长因素的文献进行全面的整理总结，并且实证分析哪些是影响

中小企业成长的关键因素。

通过实证研究，本书得到以下主要结论：

(1) 创业资本在知识转化为创新的过程中起着重要的催化作用。第二章的研究结果显示创业资本（也就是创业行为）可以有效的促进更多的知识转化为商业化的创新产品，从而可以促使经济增长。从国家的角度来看，一个国家的创业资本越高，即创业率越高，这个国家将知识转化成创新产品的比率也相对于创业资本低的国家要高。这意味着仅仅投资新的知识，例如通过发放研究发展基金或大学教育，是不够的。一个国家必须促进创业行为，这样才可以使更多的新知识转换成创新产品，进而促进经济发展。为了更有效的使知识投资得到回报，决策者可以通过对高技术企业或创新创业者提供补贴贷款，监管豁免或税收优惠等方法来促进创业率。另外，长远的策略可以是通过推动创业教育来培养更多的合格的创业者和企业家。

(2) 中小企业更加重视以人为本的非正式知识管理实践。以人为本的非正式知识管理实践强调个人参与和员工之间的互动。第三章的研究结果建议中小型企业的管理者应该注意发展员工的核心竞争力，同时给与适当的奖励来留住这些核心员工。此外，第三章的研究结果还发现以家族式企业为主体的中小型企业对外部知识持保守态度，不愿意将知识公开并进行存档。然而获取外部知识和对知识进行整理存档对企业的长期竞争力是有利的。因此，家族式中小型企业的管理者应该对外部知识持更开放的态度，并意识到对知识的整理存档对企业长期利益的重要性。

(3) 获取外部知识是中小型企业创新的重要途径。第四章的研究结果表明获取外部知识会影响中小型企业对创新的态度，从而影响到企业的创业绩效。中小型企业使用一种不同的，更适合他们的方法进行创新。当大型企业倾向于在公司内部进行

新知识的研发的同时，中小型企业更倾向于通过社交网络和人际关系从外面来获取创新的机会。因此，决策者可以通过建立更完善的外部交流系统，帮助并教育中小型企业的管理者如何更有效的来利于社交网络，来提升中小型企业的创新能力。

(4) 数量弹性化(numerical flexibility)劳动力组合有利于企业的模仿能力，但对真正的市场先导者的创新能力是不利的。真正的市场先导者需要长期的知识积累并预防知识泄漏以保证其领先的位置。第五章的研究证明依赖于数量弹性化劳动力组合（例如使用大量定期合同工）的中小型企业可能有不错的模仿能力，但自有的创新能力却比较低。利用内部劳动力市场的功能弹性化(functional flexibility)劳动力组合对企业的知识积累和记忆有利，而知识积累和记忆是提高企业的创新能力所必须的。此外，第五章的研究结果也对新古典经济学者要求进一步放宽欧洲劳动力市场的建议提出了质疑。同时，研究结果也显示了内部劳动力市场对企业的知识积累，并且在提高员工对企业的忠诚度方面起着至关重要的作用。欧洲国家的决策者应该重新思考关于进一步放宽劳动力市场的策略。为了在国际市场上建立强有力的竞争力，欧洲国家的决策者应该鼓励更多的真正创新的市场先导者。

(5) 企业家技能和企业家导向是决定中小型企业成长的关键因素。第六章的研究发现具有技术背景的企业家对企业成长至关重要。从学习的角度来看，具有技术背景的企业家可以通过企业日常运作学习管理技能。这证实了技术竞争力有利于实施企业发展战略的观点。同时，企业层面的创业精神，包含企业家导向和企业成长导向，对企业的实际成长也发挥了重要作用。另外，第六章对过去的企业成长因素文献进行了全面的整理总结，这为将来对企业成长因素进行更系统地分析提供了平台。

本书各实证分析章节的研究结果论证了知识和创业资本是核心竞争力和经济表现的重要来源。一方面，创业资本促进了知识转化为创新产品的过程；另一方面，知识对中小型企业的创新绩效和成长起了至关重要的作用。

日本語概要 (Summary in Japanese)

　　この数十年の間に、経済学者と政策担当者は、資本と労働だけでなく、「知識」と「企業家精神」が経済成長の重要な源泉であると認識するようになってきた。実際に、近年の研究では、新しい知識への投資は経済成長に欠かせない条件であることが示されている。新しい知識は、利用されて、さらに商業化されることにより、高いレベルの競争力や経済成長を促進するものと考えられる。企業家精神は、知識が商業化されるプロセスにおいて重要な役割を果たす一方で、新しい知識は企業家精神の機会を生み出すであろう。したがって、経済学者と政策担当者にとって、どのように知識と企業家精神が関係しているのか、また、なぜそれらが経済成長に影響を与えるのかについて理解することは重要なことである。本書では、これらの問題について議論して、新たな知見を提示する。特に、ヨーロッパにおける企業および国レベルの分析を通して、知識と企業家精神の関係およびそれらの企業パフォーマンスや経済成長への影響について分析する。

　　本書は六章から構成され、第一章では、まず研究の目的を紹介し、次に五つの章について簡潔に説明を行い、最後に本書の結論を述べる。第二章では、国レベルの分析を通して、新しい知識とイノベーション・パフォーマンスの関係及びこの関係において企業家精神が果たす役割について分析する。第三章から第五章までは、オランダにおける中小企業を対象に、企業レベルの分析を通して、中小企業がどのように知的財産（企業知識と人的資源を含む）による経営を実施して、企業のイノベーション・パフォーマンスを更に促進するかについて明らかにする。第六章では、中小企業の成長を決定する要因について分析する。

本書の結論とインプリケーションは、以下の通りである。

　(1) 企業家精神は、知識が商業化されるプロセスにおいて重要な役割を果たすと考えられる。企業家精神は国の開業率として測られ、開業率が高い国は開業率が低い国に比べて、知識から革新製品への発展プロセスを促進し、イノベーション・パフォーマンスが高いことが明らかになった。したがって、政策担当者にとっては、知識を革新製品へと発展させるためには新しい知識への投資をしながら、企業家精神を促進する必要がある。知識への投資からのリターンを確保するために、政策担当者は、ハイテク企業家と革新的スタートアップを支援し、例えば開業支援金や優遇税制という方法を通じて、企業家精神を促進することが考えられる。補完的な長期的戦略としては、企業家教育を促進し、能力のある企業家を養成することが挙げられる。

　(2) 中小企業は、人的資本中心のインフォーマルな知識経営施策を重視している。中小企業はたびたび従業員の暗黙知に依存している。暗黙知は、自身の直接的な経験の基づいて得られた、つまり体得された、言葉や文章による客観的な表現が難しい主観的知識で、他者への移転が困難な知識をさしている。インフォーマルな知識経営施策は、従業員の関与および社会的な相互作用を強調し、暗黙知を形式知として洗い出す重要な施策である。第三章の結論によれば、中小企業の所有経営者は、従業員の能力を向上させることを重視すべきであることが示唆される。そして、企業は能力のある従業員を留めるために従業員に適切なインセンティブを与えるべきである。また、第三章の研究によって、ファミリービジネスとしての中小企業が外部の知識に保守的な態度を持っていて、企業内の知識を共有化あるいは体系化する可能性が低いことが明らかになっている。しかし、外部からの知識獲得及び内部知識の共有化と蓄積は、企業の長期的な競争力のための多大な利益を生み出すと考えられる。したがって、フ

ァミリービジネスとしての中小企業の所有経営者は、外部からの影響を受け入れることが有益であり、外部知識及び知識の共有化と蓄積が企業の長期利益において重要な役割を果たすということに気づくべきだろう。

(3) 外部知識の獲得は中小企業にとってイノベーションのための重要な手段である。外部からの知識獲得は、中小企業の革新志向に影響を与える。また、企業のイノベーション・パフォーマンスに対して更に影響を与える。大企業が企業の内部で知識創造するのと違って、中小企業は社会的なネットワークと外部資源との相互作用を通じて外部からの知識を求めて獲得すると考えられる。したがって、政策担当者は、中小企業にとって望ましい外部ネットワークシステムを促進して、外部環境を利用する上で効果的にネットワークを構築させることで、中小企業のイノベーション・パフォーマンスを向上させることができるだろう。

(4) 数量的柔軟性 (Numerical flexibility) は、模倣パフォーマンスにとって望ましい一方で、マーケット・リーダーのイノベーション・パフォーマンスに関しては良いものとはいえない。労働市場の柔軟性（Labor flexibility）は数量的柔軟性と機能的柔軟性（Functional flexibility）に分けられる。まず、数量的柔軟性は、外部市場から労働摂取または従業員の数の調整をさしている。固定期間契約の従業員を雇用するような、数値的柔軟性に依存している中小企業は、模倣した新製品の売上は高い一方で、イノベーティブな新製品の売上は低いと考えられる。他方で、企業内の従業員の配置転換のような、内部労働市場における機能の柔軟性は、組織の学習の継続性や企業の歴史的な記憶を強力なものにする。このようなことは、企業のイノベーションにとって欠かせないものである。したがって、数量的柔軟性に依存している中小企業にとっては、模倣パフォーマンスは高いかもしれないが、企業のイノベーション・パフォーマンス

は高くないだろう。第五章の研究の結論は、労働市場の規制緩和に関するこれまでの新古典派経済学者による主張に対して疑問を投げかけるものとなっている。さらに、本章は、企業内で知識を蓄積させて、柔軟性を保持したまま従業員が忠誠心や責務を持つような労働市場の重要性について強調している。グローバル・マーケットでの競争力をもつ地位を獲得し、ダイナミックな経済を築くために、ヨーロッパの政策担当者は、真のイノベーションを生み出すマーケット・リーダーを減らすような労働市場の規制緩和政策を見直す必要があるかもしれない。(5) 企業家の専門技能と企業の起業家的志向 (entrepreneurial orientation) は、中小企業の成長にとって重要な決定要因である。企業家の専門技能、特に、専門的な経歴は、企業成長に有意な影響を与える。学習の観点からは、専門的経歴を持つ企業家は、日々の活動を通して経営技能を学習すると考えられる。したがって、企業家の専門能力は、企業家のビジョンや戦略の実行を手助けする上で重要なものである。それと同時に、起業家的志向と成長志向からなる企業レベルの起業家的な姿勢は、企業の成長において重要な役割を果たすことが示されている。本書の第六章において包括的に扱われている企業成長の要因分析は、企業成長の決定要因に関する将来の更なる研究にとって、より系統的な分析へと発展させるための第一歩としての重要な貢献をしている。

　以上のように、本書は、知識と企業家精神が競争力と経済成長の鍵を握る源泉であることが示された。一方で、企業家精神は、知識がイノベーションを導く発展プロセスにおいて触媒作用として機能していて、他方で、知識は、中小企業のイノベーションや成長において重要な役割を果たしていることが示唆された。

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Haibo Zhou (1977) was born in Shanghai, China. She obtained her Bachelor of Engineering degree from Shanghai University of Engineering Science in 1999 with a major in Automobile Engineering. After having worked as a consultant in automobile industry in China for four years, she came to the Netherlands in 2003 and joined the Master program in Management of Technology at Delft University of Technology. In 2005, she successfully obtained her Master of Science degree (Dutch title: Ir). Papers based on her Master thesis have been included in the conference proceeding of the 5th International Symposium on Management of Technology (ISMOT) and published as a book chapter.

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This book investigates the interrelations between knowledge and entrepreneurship, and their consequences with regard to economic performance. Both knowledge and entrepreneurship are recognized as new twin driving forces for economic growth. Recent studies suggest that neither knowledge nor entrepreneurship alone is sufficient to drive growth. Investing in new knowledge is only a necessary condition; new knowledge needs to be exploited and put into commercial use such that it can lead to higher levels of competitiveness and economic growth. Entrepreneurship is acknowledged to play an important role in this process. It is thus essential for economists and policy-makers to understand how knowledge and entrepreneurship relate to each other and why they lead to economic growth.

The five empirical chapters included in this book provide new insights into aforementioned issues on the firm- and country-level. Chapter 2 is based on a country-level analysis and identifies the moderating role of entrepreneurship in turning knowledge into innovation, which may ultimately lead to economic growth. Chapters 3 through 5, taking a firm-level perspective, investigate how small and medium-sized enterprises (SMEs) manage their knowledge assets (including organization knowledge and human resources) to stimulate innovation performance. Chapter 6 pays special attention to the determinants of SME growth. The findings of the chapters indicate that entrepreneurship catalyzes the transformation of new knowledge into innovation on the one hand; on the other hand, knowledge plays a significant role in stimulating innovation performance and SME growth.

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