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SME Performance and Its Relationship to Innovation

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Abstract

Small and medium-sized enterprises (SMEs) play a vital role in the economic development of nations. Therefore, it is vital to evaluate the performance of SMEs to support that role. Current SME performance models suffer from a number of disadvantages. They intensively use a business ratio approach, thus neglecting important non-financial parameters. They look at SMEs as a homogenous group, downplaying the variations in size, age, location, and business sector. They consider firms to be closed systems, and undermine the significance of networking mechanisms in the promotion and enhancement of SME performance. They do not directly incorporate the impact of an enterprise's innovation activities. Finally, their complexity and reliance on sophisticated statistical refining methods make these models unpractical for use by SME managers.

The thesis addresses three major questions (1) What are the advantages and disadvantages of the existing models used in evaluating SME performance? (2) What characterizes a comprehensive model for measuring SME performance with acknowledgement of the firm's innovation activities? (3) How can a firm's innovation activities be enhanced in relation to the firm's external environment? In this dissertation, I tried to address these questions using a conceptual analysis, as well as empirical investigation utilizing a case study approach.

A number of challenges arise when one tries to build SME performance models that lack the deficiencies stated above. There are four major challenges. The first challenge is that the desired performance evaluation model must optimally incorporate both quantitative and qualitative input. The second challenge is that the model must incorporate non-financial input parameters, such as firm size and age (among others), in the performance evaluation models. The third is that the model must consider the variety of SMEs as concerns their business sectors, nationalities, sizes, and ages. The final challenge is that the model must be able to utilize existing limited information available from the SMEs bookkeeping practices in an optimal way.

To construct a model that copes with these challenges, I used a literature-based selection of parameters as well as a theory-based selection. I used both a conceptual approach and an empirical approach to discuss and propose a model, the Survival Index Value (or SIV) model, as an alternative to the existing performance models for SMEs. Although the SIV model focuses on the firm's internal environment, it also relates to the firm's external environment via input parameters such as firm size ratio and the average firm age in a given sector. The technology intake parameters measure both the inward as well as the outward

contributions of the innovation activities in the firm. Although I did not propose a specific model to handle SME performance in relation to companies' external environments, I presented indicators, in the form of various types of capital, which can be used to build such a model. Among these indicators are: human capital, financial capital, system capital, and open capital. All are aggregated under one concept: innovation capital.

The major contributions of this thesis to the field of SME performance can be summarized in three outcomes: the SIV model as a new model of SME performance evaluation, the ASPEM as a new tool for strategic utilization of SME performance models, and a new approach to account for innovation in relation to the external environment of the firm using the IBAM tool. The work adds to the theory of the firm, as it presents a new way of evaluating firm performance. It also contributes to bridging the theory of the firm to organizational theory, by elevating the significance of networking and its impact on SME efficiency.

The thesis also discusses the implications of my findings on economic development policies, both regional and national. At the closing of the dissertation, I propose some future research tracks in the field of SME performance evaluation.

Keywords: *SME performance, performance evaluation, firm efficiency, SIV model, SMEs, innovation capital, human capital, financial capital, system capital, open capital, open innovation, innovation, entrepreneurship, business models*

List of abbreviations used in the thesis

ANT	Actor-Networks Theory
ASPEM	Arena of SMEs Performance Models
HTSF	High Tech Small Firm
IBAM	Innovation Balance Matrix
ICTs	Information and Communication Technologies
IT	Information Technology
KEV	Knowledge Embedded Value
KEVAM	Knowledge Embedded Value Margin
SI	Survival Index
SIC	Survival Index Curve
SID	Survival Index Diagram
SIE	Survival Index Equation
SIV	Survival Index Value
SME	Small and Medium-sized Enterprise
SMEs	Small and Medium-sized Enterprises
SPI	Survival Progression Indicator

Parameters of the SIV Model

Symbol	Parameter
SI_{ij}	Survival index
SI_{oi}	Operating conditions survival index
SI_{ti}	Technology intake survival index
SI_{tii}	Inward-focused technology intake index
SI_{tio}	Outward-focused technology intake index
Y_i	Years of operation of the firm
L_j	Average life span
E_i	Number of employees of the firm
E_x	Maximum number of employees (according to SME definition)
F_i	Sales (or Turnover)
C_{3i}	Total costs of production
P_i	Profit margin
C_{1i}	Initial investment capital
C_{1si}	Self-financed initial capital
C_{2i}	Costs for the intake and absorption of new technologies
A_a, A_b, and A_c	Proportionality coefficients
Φ	Survivability coefficient
θ	Survivability angle
υ	Survival factor
$\Phi^{\perp}$	True survivability coefficient
$\theta^{\perp}$	True survivability angle
N^s	Number of original firms in the sample
N^d	Number of firms added to the original sample
N^a	Accumulative number of firms
N^t	Total population of the selected business sector
L_j^s	Sample average life span

Parameters of the SIV Model (continue)

τ^s	Age increment of the samples' firms relevant to reference date of SIV analysis
L_j^u	Ultimate average life span
L_j^a	Accumulated average life span
n_s	Number of segments in the SIC
n_s^o	Segment number
n	Number of points of data making the SIC
n^o	Data point number
n_p	Number of periods of SIV analysis
Ω	Periodicity coefficient
η	Periodicity compression coefficient
Ψ_i	Prediction power of SIV analysis
T_i	Actual age of the firm
D^r	Registration date of the firm
D^0	Reference date at which the SIV analysis starts
D^e	Evaluation date of SIV analysis
$Y_i(D^e)$	Years of operation of the firm at the evaluation date
$Y_i(D^r)$	Years of operation of the firm at the registration date

The Dissertation's Papers

Paper 1: Abouzeedan, A. and Busler, M. (2004). Topology analysis of performance models of small and medium-size enterprises (SMEs). *Journal of International Entrepreneurship* 2(1–2), 155–177.

Paper 2: Abouzeedan, A. and Busler, M. (2005). ASPEM as the new topographic analysis tool for small and medium-sized enterprises (SMEs) performance models' utilization. *Journal of International Entrepreneurship* 3(1), 53–70.

Paper 3: Abouzeedan, A. and Busler, M. (2004). Analysis of Swedish fishery company using SIV model: A case study. *Journal of Enterprising Culture* 12(4), 277–301.

Paper 4: Abouzeedan, A. and Busler, M. (2006). Innovation balance matrix: An application in the Arab countries. *World Review of Entrepreneurship, Management and Sustainable Development* 2(3), 270–280.

Paper 5: Abouzeedan, A. and Busler, M. (2007). Entrepreneurial policies and the innovation balance matrix: The case of the Arab countries. In Allam Ahmed (ed.), *Science, Technology and Sustainability in the Middle East and North Africa*, Vol. 1, 158–175.

Paper 6: Abouzeedan, A., Busler, M. and Hedner, T. (2009). Managing innovation in a globalized economy—defining the open capital. In Allam Ahmed (ed.), *World Sustainable Development Outlook 2009: The Impact of the Global Financial Crisis on the Environment, Energy and Sustainable Development*, Part VII, Chapter 30, 287–294.

Paper 7: Abouzeedan, A., Klofsten, M. and Hedner, T. (2011). Implementing the SIV model on an intensively innovation-oriented enterprise: The case of Autoadapt AB. *Working paper*, presented at the International Council for Small Businesses (ICSB) Conference, Stockholm, Sweden, 15–18 June.

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Adli Abouzeedan
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1 Introduction

In this first chapter, I describe the background of the thesis and discuss its aim and the overall research questions. In the end, I present my research approach and the structure of the thesis.

Why study small firms?

Small and medium-sized enterprises (SMEs)[1] are crucial economic actors within the economies of nations (Stanworth and Gray 1993, NUTEK 2004, Wolff and Pett 2006). They are a major source of job creation (Storey et al. 1987, Castrogiovanni 1996, Clark III and Moutray 2004) and they represent the seeds for future large companies and corporations (Castrogiovanni 1996, Monk 2000). SMEs are more innovative than larger firms, due to their flexibility and their ability to quickly and efficiently integrate inventions created by the firms' development activities (Acs and Yeung 1999, Qian and Li 2003, Verhees and Meulenberg 2004, Timmons 1998). Research supports the notion that SMEs that engage in innovation activities are better performers (Gerorski and Machin 1992, Soni et al. 1993, Freel 2000, Vermeulen et al. 2005, Westerberg and Wincent 2008, Qian and Li 2003, Verhees and Meulenberg 2004). Studying SMEs can enhance our understanding of their needs in respect to growth and development. Such understanding would enable scientists, practitioners, and policy-makers to formulate sound support strategies for SMEs (Norrman 2008).

Due to the significance of SMEs to local economies, it is necessary to study and evaluate their performance (Acs 1999). Such study helps to design governmental and non-governmental SME support programs. Therefore, it is important that the performance evaluation methods used can deliver a thorough understanding of SME efficiency.

I use the terminology "the efficiency of the firm" in the context of this thesis to emphasize the firm's ability to optimize and maximize output in relation to input delivered.

SME models must be able to assess the progress in a firm's growth and development through different phases such as the start-up phase, reaching and maintaining a state of stability and maturity, further growth, and eventual decline and closure (Klofsten 1992a). The nature of the term "performance" implies utilization of different ways to describe performance-related situations (e.g. survival, growth, success, failure, and bankruptcy) (Newbert et al. 2007, Audretsch and Mahmood 1994).

Several studies have shown that there is a clear connection between innovation and the creation of an entrepreneurial economy (Schumpeter 1934). Studies related to the

[1] SMEs are defined as firms with less than 250 employees (NUTEK 2004, p. 15)

performance of SMEs with a central focus on innovation capacity are limited (Siqueira and Cosh 2008). Our understanding of the innovation processes of the firm is poor as relates to SME efficiency; it lags due to the lack of a ground theory in SME performance studies (Davidsson and Klofsten 2003).

There are different types of innovation (Trott 2008). In their study, Mazzarol and Reboud (2008) considered innovation to be related to new products or services, new production processes, new marketing techniques, and new organizational or managerial structures. Innovation may also involve technology, intellectual property, business, or physical activity (Sundbo 1998). It is seldom that an organization engages in one type of innovation without affecting other innovation areas (Damanpour et al. 1989).

Disadvantages of current SME performance models

The models used to study and evaluate SME performance suffer from a number of deficiencies. The current models are non-comprehensive, and deal with a single perspective of firm performance, such as bankruptcy or failure, using a few core input parameters (Altman 1968, Altman et al. 1977, Cadden 1991, Jain and Nag 1997). The models rely on statistical analysis and an intensive utilization of the business ratio approach, which has been criticized by scholars in the field as being inadequate (Klofsten 2010, Davidsson and Klofsten 2003). In selecting the parameters for the intended model, I tried to avoid this classical approach. Instead, I looked at relevant parameters that can deliver values other than the ones given in traditional accountancy reports. Examples of such parameters are technology input, firm age, firm size, and employee turnover, which are expressed differently in the intended model than the existing ones.

The existing models are complex tools and are, for the most part, difficult for SME managers to use (Klofsten 2010, Keasey and Watson 1987). Current SME models look at firms as closed systems and, as a result, neglect the impact of networking on firm activities. Accounting for networking is essential if one wishes to incorporate the influence of a firm's external environment on that firm's performance (Jovanovic 1982, Hopenhayn 1992, Nelson and Winter 1978, Inman 1991, Peel et al. 1985, 1986, Chen and Shimerda 1981, Argenti 1976). The models do not have clear pinch-marking, as they are designed and developed in isolation from the impact of the external environment and from other existing evaluation models (Caves 1998, McPherson 1995, Allison 1984, Waring 1996, McGahan and Porter 1996).

SME performance models view all SMEs as a single, homogenous group, neglecting the apparent variations among them (Bolton 1971). It is not appropriate to treat this group of firms under a single category, however. Because the term "SME" is already used widely in research, however, it is also used in this work in order to align the research text with existing practices. Furthermore, the models do not present performance in a dynamic way, where one can see the development of the firm and its progression in relation to years of operation (Keasey and Watson 1991a, Storey et al. 1987). The current models have no specific focus on the impact of acquiring new technologies on firm performance (Rothwell 1989, Romano 1999). An SME model that is able to deal with the above issues requires a set of selected parameters. The input parameters of interest in relation to the internal environment of the firm include: the number of employees**,** the maximum number of employees distinguishing the different categories of enterprises, firm age, and the average life span of firms in the business sector. These are qualitative parameters. The quantitative parameters of interest to this work are: sales, turn-over, intake, and absorption of new technologies indicated by investments in these technologies and total costs of production. All these parameters are calculated per periodicity unit. I used "periodicity unit" to indicate the time unit of the analysis. Other quantitative parameters include: initial investment costs, self-financed initial capital of investment, and profit margin (a neutral percent figure).

At the external environment level, the input indicators that could be used in performance evaluation are the four components of innovation capital: human capital, financial capital, system capital, and open capital. The overall argument is that if evaluation performance models are to be used in helping SMEs plan their survival and growth activities, then one needs to address the above issues.

The selection of the parameters mentioned above is based on an intensive literature review coupled with new thinking as to how different inputs can be expressed in order to emphasize their roles in elevating firm performance. The classical performance literature contributed to the selection of a standard set of parameters such as firm size, age (Argenti 1976, Keasey and Watson 1987), profit margin, turnover, production costs, initial investment figures, and total investment (Altman 1968, 1983, Altman et al. 1977, 1994, Caves 1998).

Although I utilized these input indicators when constructing the intended model, I integrated them differently than the classical ones. I tried to relate them to each other in a way that emphasizes the efficiency aspects. For example, I related the turnover to the production cost, so as to express the necessity of looking at the output coming from spending

on production. The higher such ratios are, the more efficiently the firm capitalizes on its production. Also, the firm's age and size in classical literature are internally-focused and not connected to the situation of other firms in the same business sector. That also goes for the initial investment, which the classical performance models do not include. I used a ratio between the self-financed initial capital and the initial investment capital. The technology intake costs are devised out of my understanding of the value of innovation in elevating firm performance. This argumentation is not directly extracted from the existing literature, but it is implicit in its findings. The logic behind choosing and selecting the mentioned input parameters relates to the internal environment of the firm. As for the external environment of the firm, I selected financial capital and human capital from the literature review. Regarding the system capital, I proposed that capital due to the realization that institutions and players' ability to promote innovation activities in society play an important role in supporting SME activities. Meanwhile, open capital is a reflection of the emphasis on firms' networking capacities and the issue of firm performance and innovation.

Defining firm smallness

SME is a holistic term that implies an ambiguity in relation to a firm's categorization and positioning, as firm size is expressed in many different ways (Atkins and Lowe 1997, Cross 1983, Ganguly 1985, Keasey and Watson 1993, Storey et al. 1987, Australian Bureau of Statistics 1988, Bolton 1971, NUTEK 2004). The term "SME" clouds the fact that firm size is also related to the industrial sector it belongs to, just as firm age should be considered relative to the age of the sector. The word "size" expresses either the number of employees or the amount of turnover. It is a misleading term, however, due to the realities of the current, dispersed economy (Polenske 2002).

In this thesis, I used the EU definition of SMEs (NUTEK 2004) when I selected the firms. It is important to discuss "smallness" in the context of the new economy, since this economy is influenced by the Information Technology (IT) revolution. When assessing the current system, the numerical, clear-cut, artificial borders used in the past should be downplayed; they are confusing and probably not reflective of the economic realities of today. Today's firms can mature rapidly and become global actors within a very short time (Oviatt and McDougall 1994, Katz et al. 2003). Thus, it is more appropriate to use other ways to categorize SMEs. An alternative nomenclature for SMEs can be, for example, young firms or potential growth firms who have attained a business-platform (Klofsten 1992a).

The focus of this work is to discuss SME performance evaluation while accounting for the impact of innovation on firm efficiency in relation to both the firm's internal and external environments. Although I did not empirically treat the technology input at the external environment of the firm in this thesis, I did suggest some feasible input indicators that could be used to develop sound models in the future.

Theoretical relevance of the thesis

Performance evaluation theories in relation to SMEs have been influenced by the traditional accountancy and financial approaches (Altman 1968, Altman et al. 1997). That reflects in itself a reliance on the business ratio approach (Davidson and Klofsten 2003) and the intensive use of statistical refining methods (Keasey et al. 1990, Keasey and Watson 1991a, McKee and Greenstein 2000). This work attempts to alert scholars working with firm performance research that a better approach is needed. Performance evaluation theories and models need to begin with an understanding of how the firm can elevate and improve its efficiency and relate that analysis to the theory of the firm (Penrose 1959) more than classical accountancy and financial reporting. Such thinking stems from strategic management theory in relation to competitiveness (Porter 1980, 1991) in combination with organization theory (Scott 2003) and networking issues (Wincent and Westerberg 2005, Wincent et al. 2009). There is a strategic value in connecting an enterprise's internal environment to its external environment, because a firm's efficiency relates to more than just its size and the sector within which it is active (Abrahamsson and Brege 1997, Abrahamsson et al. 2003).

The effort manifested in this thesis aims to contribute to existing firm theory knowledge (Cyert and Hedrick 1972, Moss 1984, Amess 2002, Jacobides and Winter 2007, Ricketts 2003) and, in particular, the area of SME performance (Keats and Brackers 1988). An objective of the work is to correlate organization theory (Scott 2003) to the theory of the firm by considering the impact of networking on SME performance and incorporate that impact into the SIV model.

Practical relevance of the thesis

This thesis and the outcome of its findings is of relevance to three groups of potential users of SME performance evaluation models: managers of SMEs who want to monitor the performance of their firms, consulting firms who are engaged in helping SMEs deal with their efficiency and performance issues, and policy-makers designing support mechanisms and schemes to promote the creation and growth of small firms.

It is important to emphasize that this work aims to communicate its message to two types of individuals. The first group consists of those dealing with the issue of SME performance in relation to the internal environment of the firms, such as firm managers, SME consultants, and individual researchers. The second group consists of individuals who hold key-positions and deal with SME performance issues in relation to the firms' external environment at an aggregate level. Politicians and administrators who are members of major institutions working with economic growth issues, such as Tillväxtverket and Näringsdepartementet, as well as those working with innovation activities such as VINNOVA, are included in this second group.

Aim and overall research questions

This thesis is an explanatory study that aims to construct an SME performance evaluation model that is able to deal with the current deficiencies of existing models. It seeks to develop a general model that can indicate the impact of input parameters such as innovation (expressed as technology-intake), on firm performance. It is important to analyze the deficiencies and strengths of existing SME performance models in order to develop more responsive tools of efficiency analysis. Financiers and bank managers, for example, could become more effective in their credit allowance policies toward smaller firms if they could better understand the true situation of the firms. An improved model could create a better anchor for the strategic management practices of SMEs.

The current SME models are non-holistic and tend to be more quantitative in nature (Davidson and Klofsten 2003). The financial information provided by SMEs is often less reliable than that provided by larger firms (Storey et al. 1987). Existing SME models often confuse the strategic thinking of the managers of smaller firms, who are thus unable to utilize the models due to their complexity. In that case, the models cannot be used as action-planning tools for managerial purposes (Davidson and Klofsten 2003).

SMEs are more innovative today than when the models were created, partly due to recent advancements in ICTs (Awazu et al. 2009). The existing performance models were created in a classical economic context (Storey et al. 1987, Altman et al. 1994), and thus are not suited to account for the innovative capacities of today's SMEs. Studying the advantages and disadvantages of SME evaluation models will enable me to incorporate the innovative aspects of firm activities in the intended model.

These factors lead to the first research question (RQ 1):

What are the advantages and disadvantages of the existing models used to evaluate SME performance?

In order to judge an economy, a firm performance model that considers the innovative input within SMEs is required. Furthermore, one must understand what should go into such a model. That means the actual outcomes of a performance evaluation model should be related to the expected goals of the support programs and actors (c.f. Bergek and Norrman 2008). It is therefore beneficial to analyze the internal/external environment aspects of firm performance and couple that analysis with the firm's innovation activities (Mazzarol and Reboud 2008); this would also assist in forming an understanding of the impact of innovation on firm efficiency.

The different types of innovations are non-exclusive in their nature and, commonly, they exist side by side in the organization (Damanpour et al. 1989). However, innovation studies in SMEs tend to look at each type of innovation by itself in isolation from the other types. The desired model should be interactive and should reflect the interconnectivity between various forms of innovation. The way to ensure the model is capable of this is to beforehand study the characteristics of the desired model. A model that claims to account for general performance while acknowledging innovation needs to be based on a true understanding of the desired functionality of the model while considering the heterogeneity of SMEs. These factors lead to the second research question (RQ 2):

What characterizes a comprehensive SME performance measurement model that acknowledges the innovation activities of the firm?

Since performance is a broad concept that incorporates both qualitative and quantitative aspects, one must be sure that incorporating innovation activities in a performance measurement model is reflective of that fact. One way to do that is to express innovativeness as financial resources spent on absorption and generating new technologies. This input is known collectively as technology-intake, and it is one of the parameters of the intended model. In the intended model, R&D is a part of the technology intake parameter. R&D expenditure measures the innovative orientation of the firm (Newbert et al. 2007). The qualitative aspects of innovation need also to be reflected in the model, even if only by indirect means.

Networking has a positive impact on firms' innovation activities, primarily by enhancing them via the absorption of new technologies and exchanging resources and ideas through the open innovation paradigm (Wincent and Westerberg 2005, Wincent et al. 2009,

Chesbrough 2003). The networking capacity of the firm and its operational activities are enhanced by advances in ICTs (Globerman et al. 2001). Analysis of the productivity concept has given a central role to "knowledge" in economic growth (Neale 1984). Empirical evidence shows that countries with higher R&D activities per employee have higher levels of total factor productivity growth (Coe and Helpman 1995). The evidence emphasizes the significance of the external environment to the innovativeness of the firm.

Since networking was not accounted for in classical performance modeling, one needs to study the implementation of the model's innovation aspects in relation to performance while keeping networking in mind. The intended model must attend to externally-related variations, such the type of sector where the firm is functioning. Technology can be either adapted to by or created in the firm. An alternative performance model should account for both contingencies. These factors lead to the third research question (RQ 3):

How can innovation activities of firms be enhanced in relation to their external environment?

To answer the above three questions, one must have the correct balance between theory-building (i.e. the conceptual approach) and empirical testing (i.e. the case study approach). Since the theory-building aspects of the research questions weighed most heavy, I used more papers of a conceptual nature (five, in total) and was satisfied to use only two papers to test the intended model. That, I believe, has strengthened the theoretical base of the intended model and given it a reasonable robustness.

My research approach

The classical approach to dissertation writing would be to separate the methodological aspects in a separate chapter and not discuss them in the introductory chapter. However, I felt that using such an approach for this particular thesis would not convey the story behind the study and the nature of the path that lead to its creation. My work on this thesis started before this text was formulated, and the input of the papers included in it came from a number of earlier contributions of mine. To understand the objectives of the thesis and method of answering the research questions, it is necessary to bring the reader to my research approach at an earlier stage than what is usually practiced in dissertation writing.

Motivation and pre-understanding: Why I wrote this thesis

Before I discuss the research process design, I feel that it is essential to explain how this work has developed, because the journey was far from conventional. This thesis started a long time ago, back in the early 1990s, after I finished a study at Chalmers University of Technology in Gothenburg. At that time, I started a small trading firm, called "Amana," which was meant to be a commercial broking enterprise. The company, which I started in 1993, came into existence almost at the same time as the IT revolution began to gain momentum through the launching of the Internet, the rapid decrease in computer prices, and the increased availability of the personal computer. I noticed clearly the impact of these new IT tools on the managerial and operational aspects of the activities of my trading entity.

The main problem I had to tackle was the high costs coupled to the communicative and managerial parts of company activities. I saw clearly the obvious advantages that IT tools brought to my small firm, and realized that I could multiply my firm's capacity many folds by using the fax, the modem, and, later on, the Internet. This in turn inspired my keen interest in the issue of smaller firm performance and the impact of IT on that performance.

I translated that interest into studying the various methods used to evaluate performance of the category of firms known in this thesis as SMEs. The result of that study, which was limited in its scope, was a document submitted to Washington International University (WIU), USA in 2001. The document was the first stage in proposing an SME firm performance model that deals with the deficiencies of the current ones. Based on that work, the university awarded me, in accordance with its standards, a PhD degree. I am aware that WIU is an unaccredited institution and that its degree standard does not meet established norms.

I was particularly interested to know if the new models can account for new technology absorption by firm management, or what I call now "inward-focused technology intake," and whether they allow for such technology absorption and development through a firm's innovativeness and inventiveness, or what I designate now as "outward-focused technology intake." By inward-focused technology intake, I mean "expenditures on technologies that would enhance the managerial and operational activities of the firms." Current examples of such technologies include: computers, computer networks, Intranet structures, Internet technologies, and similar tools. By outward-focused technology intake, I refer to "expenditures on developing new products, new methods of production, new markets, new raw material, and new organizations which would enhance innovativeness and

innovation activities of the firm" (c.f. Schumpeter 1934). I argue that R&D would be incorporated in these types of expenditures, but that outward-focused technology intake encompasses more than just expenditure on R&D. It also includes all costs related to facilitating innovation activities in the firm.

My science philosophy

My background is in chemistry and chemical engineering; in such disciplines, one learns to approach science from a system analysis context. The system analysis approach tries to observe the phenomena under study in a holistic way, where the components of reality are interconnected and categorized (Keefe et al. 2005). That is one reason why I did not feel comfortable with the existing approach to firm performance evaluation, which is more fragmented and takes the components out of the context (or what I call "the system environment"). Another component of my philosophy of science that stems from my educational background has to do with the cause-effect relationship. In engineering fields especially and in natural sciences in general, the causality relationship is a straight-forward one, and thus one tends to be simplistic, seeking clear-cut relationships between cause and effect. Mathematical models in natural sciences are there to simplify our understanding of the real world. In engineering, the emphasis is on descriptive mathematics and predictive models, not on speculative and probabilistic ones. That is why I wanted to approach the selection of the parameters out of the theoretical base first and work with a predictive platform rather than seeing the problem as probabilities of failure, as most existing firm performance models do. I believe that one should build his or her understanding of reality from the bottom up and refine models only after they have shown ability to predict outcomes. Top-down methods of model creation could easily eliminate parameters of importance just because within a specific context of time and space those particular parameters are not activated due to exogenous or endogamous factors. The technology-intake parameter could be easily eliminated statistically if one wanted to build the model within the context of a traditional business sector, and use it as a general platform for performance evaluation.

On the other hand, I acknowledge with full awareness the limitation of the empirical tools and the resulting models, which try to describe and predict realities within the social sciences (Silverman 2001). In natural sciences, the subject is "non-living material." In social sciences, the subject is "living material." The subject in natural sciences is very predictable and always repeats its behavior when other factors are the same. In social science, the subject is not that predictable and it interacts, at a deep level, with the observer (Midgely

2008). Even as we do our best to distance ourselves from the subject of our studies in social sciences, objectivity cannot be fully realizable. These problems in social sciences will always exist, and we must try to minimize their impact on our research conduct.

A theory build-up perspective

Another important point is that the approach I used to build the intended model is based on financial and non-financial parameters' selection originating from theory build-up. That is why I did not call upon specific financial theories in this process. Researchers have done a lot of work in relation to performance within the finance discipline, but their work is not related directly to the way I tried to build the SIV model.

Modern finance theory assumes a perfect market (Simkowitz 1972). Such an assumption cannot be taken at face value if one desires to look at firm performance in real market conditions. The financial theory of the firm evolved rapidly in the 1950s and 1960s (Simkowitz, 1972); almost at the same time, the first performance models were proposed (Altman 1968, Hart and Paris 1956, Jovanovic 1982). Modern finance theory postulates that a good decision is one that increases the wealth of the stockholder (Simkowitz 1972). In relation to firm performance and especially to SMEs, the goodness of any decision is mostly related to an increase in the efficiency of that firm. Increased efficiency requires greater transfer of resources to spend on innovation.

The efficient markets hypothesis (EMH) is the defining element of modern financial theory (Poitras 2002). According to Simkowitz (1972), there are three conditions for a perfect market: non-transaction costs, non-barrier to entry, and inability for any one buyer or seller to influence the price of any given commodity. These conditions are unfeasible to satisfy for SMEs. SMEs often work as suppliers to larger corporations, and as thus transaction costs are highly relevant to their situation. SMEs have difficulty entering new markets. They also can not affect market prices, as this is achieved through the interference of the larger firms. The only exception for this last factor is case of "hidden champions." Hidden champions are smaller firms that are very dominant in certain niche markets (Dolles 2010).

One issue that clearly shows the financial theory approach to studying firm performance is less than desirable is the fact that shareholders and managers have different objectives. Most financial theories hold that the objectives of the shareholders and the managers of firms are identical, as shareholders and managers are identical economic agents (Crotty 1990). The assumption that managers and shareholders have identical objectives is certainly least true in the case of SMEs. There are four main differences between shareholder

and managerial objectives. Firstly, shareholders prefer a higher debt to equity ratio, while managers try to reduce that ratio because higher debt decreases the worth of their financing portfolios. Secondly, managers seek long term growth, manifested as an increase in firm size and higher capital-accumulations. Stockholders, on the other hand, advocate for lowering the capital accumulation of the firm. Actually, the ownership structure of SMEs is different from that of larger corporations. SMEs are often owned by a small number of partners or they are family businesses, unlike the publicly owned larger firms. Thirdly, managers advocate long-term investments that tolerate fluctuation and short-term risks, while shareholders advocate an avoidance of any risk. This is particularly problematic, because investments in innovation and new projects involve higher short term risks. Fourthly, managers meet competitive threats by increasing their cost-cutting investments to rationalize on the firm's resources and by pushing for innovation in management and operational aspects. The shareholders tend to think mostly of selling the firm to get the best possible return on invested capital, especially upon the slightest indication of trouble. In the process, shareholders tend to induce failure of the firm (Crotty 1990). All the above issues indicate that the financial theory approach is not the most accurate, and that researchers should focus on performance theory using only value creation perspectives.

Research concerning SMEs is often placed within the social sciences field. Since my background is in chemical engineering, I have experienced at a personal level the differences in research methodology between natural sciences and social sciences. One area of differentiation between the two types of sciences is in the definition of the research problem. A common problem faced by researchers is a failure to distinguish between research problems and social problems (Silverman 2001). There is a clear tendency in research to glide into superficial analysis by looking no further than the first layers of reality (ibid). Researchers should aim for a higher level of analysis to a focused issue and avoid the temptation to accept a lower level of analysis on a larger number of issues (ibid).

The way we regard the reality surrounding us is strongly connected to our view of science and research. The same goes also for the fields of social sciences (Norrman 2008). In trying to construct a new model to reflect reality as objectively as possible, researchers cannot claim that they can detach themselves and their personal experiences from the formulation of the research problem and the raised research questions. This is due to the fact that research problems in social sciences, such as issues of experimental design and planning, insuring validity and reliability of the method, analysis of the results, and ability to generalize from the produced data, have different requirements and limitations than in other disciplines. For

example, the subject in natural sciences can be manipulated and altered, freely, to fit the desires of the researchers, while in social sciences there are moral and ethical issues to consider. Furthermore, while in natural sciences the researcher's influence on the subject and ability to affect its behavior is limited, such influence is a major issue in social sciences. According to Silverman (2001), this should not be a problem of concern; as German sociologist Weber (1946) pointed out, all research is contaminated to some extent by the values of the researcher. Only through those values are certain problems identified and studied in particular ways (Silverman 2001).

It is vital that researchers match suitable research methods to the research questions asked. My cover of the ontological aspects of the research design is demonstrated by my choice of research questions raised in this thesis. I used the case study method to confirm the functionality of the intended model and its ability to indicate the success or failure of the firm. That necessitated a discussion of the axiological and epistemological aspects of the research performed in this thesis.

The initial work to build the desired model (Abouzeedan 2001) applied a textual/statistical analysis method to existing basic information from a Swedish database (Affärsdata), but a case study approach was necessary to confirm the ability of the model to indicate performance profile in depth. The first section of this chapter discusses the epistemological dimension of the study; it is based on personal conviction as well as a call in the literature for better models to study SME performance. Regarding the axiological aspects of this study, the case study method was chosen because it can provide a deeper insight into the internal conditions of individual firms. In short, a well-structured approach to the problem of matching research technique to research questions will specify what techniques of investigation (the choice-of-methods or the epistemological aspects) are appropriate to what key questions in the field (the ontological aspects), and will also explain why particular methods should be used (the axiological aspects) (Hindle 2004). I followed this strategy while proceeding in my research.

Developing this work made it clear to me that there is already a lot of gained experience in the area of building performance models of SMEs, starting from as early as the 1930s (Altman 1968). This early generated knowledge of building SME performance models can be utilized to structure new ones. That is why, when discussing issues of SME performance, it is important to connect old knowledge with new. Concerning the value of utilizing existing knowledge, Hindle (2004, p. 579) stated: "Deep knowledge of established

wisdom has two virtues: it prevents wasteful re-invention of the wheel and it encourages diversity of approach to core issues."

In order to develop the intended model, I needed to build on knowledge accumulated through the years. That is why I ran a topology analysis of existing SME performance models as the opening phase of this thesis. This approach is referred to as "canonical development approach" (Hindle 2004, p. 576). I used the older knowledge to update and address the concerns expressed about the functionality of existing SME performance models and their ability to meet the challenges described previously.

There are two contemporary social science theories of importance relating to this thesis: Ethnomethodology (Garfinkel, 1967) and Semiotics (Saussure 1974). The two theories belong in this discussion because I focused on exploring the nature of SME performance evaluation rather than emphasizing the hypothesis testing approach. I preferred to utilize existing data without pre-structuring. Although I relied on existing accounting data for the financial parameters, there were no pre-determined requirements on how the data would be displayed. Finally, although the major outcome was an empirical model, verbal descriptions and explanations (i.e. narrative-textual analyses) were used in a number of papers that addressed the issue of performance in relation to the external environment of the firm, rather than quantification and statistical analysis. These features of my research are connected to the nature of ethnographical research (Silverman 2001). Semiotics, on the other hand, relates to the analysis of literary text. I relied heavily on analyses of the literature to develop my case, for such purposes as discussing the deficiencies in existing SME performance models.

Combining a firm-perspective with a societal perspective

This discussion should also clarify why the reader will see works in this thesis that are more focused on the firm-perspective (paper 1, 2, 3 and 7) while the rest of the papers are focused on the aggregate, societal economic perspective. The logic behind this discrepancy is related to how innovation activities are conducted. Innovation activities can be generated within a single firm, wherein the internal environment determines how resources are used and delegated in the organization. However, innovation activities can occur in cooperation among a group of firms, in a networking setting (Wincent 2005, Wincent et al. 2009), through innovation systems (Malinen et al. 2009), and even through the economy of an entire region (Etzkowitz and Klofsten 2005) or a country. These activities can even take place on a global scale. That is why, in my opinion, it is necessary to look at both perspectives if one wishes to tackle the issue of SME performance and relate performance to the topic of innovation.

Research process and structure of the thesis

The overall objective of this thesis is to build a general SME performance model that addresses the concerns raised during the previous discussion of the three research questions. The first step toward achieving this goal is to look at what has been done already in this area. Thus, the first research question tackled the issue of the existing models used to evaluate SME performance, considering the models' advantages and disadvantages.

The second part of the research process discusses the development of an adopted SME performance model. I needed to understand the desired characteristics of such a model in relation to innovation. Thus, the second question discusses how one can remedy the deficiencies existing in the current performance models and then build a better SME performance model that accounts for innovation input into firm activities and the impact of that innovation on firm efficiency. In this case, innovativeness is expressed as financial resources spent on absorption and generation of new technologies. This input is known collectively as technology-intake, and it is one of many parameters in the adapted model. In the adapted model, R&D is a component of the technology-intake parameter. In due course, one must also look at the innovation process in relation to the external environment of the firm. Availability of resources and the general conditions at the external environment outside the firm have an impact on the firm's innovation activities. This is accounted for by the introduction of the concept of "Innovation Capital," covered by the third part of the thesis.

The thesis starts with an introductory chapter, in which I discuss why we should study SMEs, why we should study SME performance, why studying performance while considering firm innovation input is important, and how one can relate the innovation activities of the firm to its external environment.

The first chapter ends with a discussion about the research model used in compiling this thesis. The second chapter reviews the four topics raised in the introduction and issues related to these topics (such as the nature of the open organizational structure compared to that of the closed structure). The chapter explains and defines the concepts and paradigms that are of particular significance to this study. In the third chapter, I discuss the research method. The fourth chapter contains a summary of each of the papers, presenting their histories and pointing to their individual contributions to the thesis. In chapter five, I discuss and analyze the research questions and relate them to the general idea flow of the papers. In chapter six, I present my overall conclusions and discuss their implications both in terms of research as well as in policy-making, in respect to support programs and schemes directed to SMEs. I also reflect on some possible future research extensions to this work.

As a closing note to this introductory chapter, it is worth mentioning that the three research questions displayed previously can also be modified and investigated in relation to building performance models for technology input in relation to the external environment of the firm. This can be a subject for a future thesis. Although such a task was not pursued in this work, it is believed that the foundation for it is already laid. In reality, the thesis implicitly proposes some input indicators for possible future investigation of an externally-focused performance model's build-up.

2 Frame of Reference

In this second chapter, I discuss the issue of SME performance and the challenges associated with assessing that performance. I then look at the issue of innovation as one of the major components of the intended performance evaluation model. I close this chapter by displaying a comprehensive approach to constructing an SME performance measurement model.

It is worth noting the understanding among researchers that literature related to innovation in small firms tends to follow one of three thematic lines: how research and development (R&D) or new product development (NPD) processes are managed; how to best measure innovation and technology management; and how small firms secure competitive advantages by using innovation (Motwani et al. 1999). This thesis is related to the general framework of the last thematic concept.

SME performance

Research challenges in measuring SME performance

Measuring SME performance presents a couple of research challenges. The four major challenges in measuring SME performance are the following:

- Both the quantitative and qualitative input parameters must be incorporated in an optimal way in the performance evaluation models.
- Non-financial input parameters, such as firm size and age (among others), must be incorporated in the performance evaluation models.
- The variations of SMEs in regard to firm nationality, business sector, firm size, and firm age must be taken into consideration when building performance evaluation models.
- The existing limited information available from the SMEs' bookkeeping practices must be utilized in an optimal way in the performance evaluation models.

The first of these four major challenges is to have both quantitative and qualitative input parameters incorporated in an optimal way in the model. SME performance models have traditionally relied on a business ratio approach. This business ratio focus caused previous models of firm performance to be concerned mostly with the failure outcome (bankruptcy or solvency) of the enterprise life cycle (Storey et al. 1987, Keasey and Watson 1986a, b, 1987, and 1988). The current models lean toward pre-selected business ratio parameters stemming

from the traditional accountancy literature (Altman 1968, 1983, Wood and Piesse 1988, Peel et al. 1985, 1986, Peel and Peel 1987).

The second challenge is to incorporate non-financial input parameters such as firm size and age (among others) in the performance evaluation models. The financial parameters played an important role in the structure of these models (Storey et al. 1987, Keasey and Watson 1987, Keasey and Watson 1993), as they are more easily found in standard accountancy records. However, some researchers have adopted non-financial approaches to assess SME performance (Argenti 1976).

In the past, firm performance studies leaned strongly on statistical analysis and modeling (Keasey et al. 1990, Keasey and Watson 1991a, McKee and Greenstein 2000). Among the statistical methods used to build traditional performance models are LOGIT regressions and multiple discriminant analysis (MDA) (Altman 1968, Altman et al. 1977, Gilbert et al. 1990, Koh and Killough 1990, Ohlson 1980, Platt and Platt 1990, Zavgren and Friedman 1988). Libby (1975) used principal components analysis followed by a varimax rotation to identify the five independent sources of variation within fourteen financial ratios. He labeled these sources: profitability, activity, liquidity, assets balance, and cash position. Statistical techniques, such as principal component analysis, can be used to reduce that number of variables (McPherson 1995). In the cash flow model, the firm's financial parameters are the only determinants of firm failure probability (Beaver 1966, Gentry et al. 1985). Keasey and Watson (1993) showed a clear skepticism toward models that rely heavily on a statistical approach.

There are a number of reasons why failure prediction models based on financial ratios are not suitable for the evaluation of small companies' performance (Keasey and Watson 1987). Statistical methods are sensitive to assumptions of normality, model specifications, correlated variables, and noisy data sets (Jain and Nag 1997). Furthermore, decisions based on financial failure prediction, which is statistically-driven, may actually trigger a bankruptcy. This induced bankruptcy is a major problem for SMEs (Wood and Piesse 1988, Zavgren 1983). However, quantitative models of firm performance are still far superior to using pure human judgment (Keasey and Watson 1991b, Dawes and Corrigan 1974, Houghton and Sengupta 1984).

The qualitative variables have been examined for medium-sized firms by Peel and Peel (1987) and for small firms by Storey el al. (1987) and Keasey and Watson (1986a and 1988). However, the traditional SME performance models neglected non-financial indicators (Houghton 1984, Libby and Lewis 1982). Earlier, some scholars called for a totally non-

financial approach to valuing SMEs (Lussier and Pfeifer 2001). The two input non-financial parameters that received special attentions were firm size and age (McPherson 1995, Keasey and Watson 1987, Argenti 1976). Many researchers stress that qualitative variables provide a useful addition to financial ratios. When non-financial variables are used in conjunction with financial ratios, the prediction of companies' failure is significantly improved (Storey et al. 1987, Keasey and Watson 1986a, Keasey and Watson 1987). Previous studies have found that company size is a significant predictor of corporate failure (Altman 1983, Ohlson 1980, Peel 1985, 1987, Peel et al. 1985 and 1986). Altman (1983 and 1968) used total assets as an indicator of company size. The asset value is incorporated as a denominator in most financial ratio models used to predict firm failure (Keasey and Watson 1987). Companies with larger numbers of employees have a higher survival probability (Mansfield 1962).

According to Caves (1998), firm failure rates decline with size, given age. The enterprise size, as well as the enterprise growth rate, is inversely related to the probability that the firm will close (McPherson 1995). SMEs usually fail within the first years of their lives (Altman 1983, Castrogiovanni 1996, Monk 2000). Other researchers found that the hazard rates of start-up firms decreased with age (Baldwin 1995, Audretsch 1991). That is why entrants suffer from high rates of early mortality (Churchill 1955) and their hazard rates decline with time (Baldwin 1995, Audretsch 1991). Evans (1987a, b) found that the probability of survival generally increases with the age of the firm.

A third major challenge in building SME performance models is that the model must be able to consider the wide variation in SMEs in relation to many factors, such as the business sector in which the firm belongs, the firm's nationality, the firm's size, and the firm's age, when building performance evaluation models. SMEs are actually very diverse in relation to these factors (Jain and Nag 1997, Klofsten 1992b, Castrogiovanni 1996). The models neglect this variation and deal with SMEs as a homogenous group (Luther 1998, Bigus 1996, Keasey and Watson 1991a, b, Wood and Piesse, 1988). Variations in the natures of SMEs necessitate a multi-focused approach to understanding their performance. In their model to evaluate incubators, Bergek and Norrman (2008) discussed various approaches through which incubators choose their candidate-firms. Klofsten (1992b) looked at the way in which technology-based enterprises progress in their development. His focus was on the earlier stages of their lives. In that work, Klofsten (1992b) described a couple of models that he thought would give the widest possible understanding of the firm performance concept. Some of these models are illuminated in: Adizes (1987), Greiner (1972), Miller and Friesen (1984), Kazanjian (1988), and Thain (1969).

A fourth challenge of significance, when it comes to building SME performance models, is the ability to optimally utilize existing limited information available from the SMEs' bookkeeping practices. One of the problems with using the financial ratio approach to predict company performance is the huge number of such ratios that can be deducted from the available financial data for larger firms (Chen and Shimerda 1981). Compared to that provided by larger firms, the financial information provided by small firms is often unreliable (Storey et al. 1987, Keasey and Watson 1986a). Small firms are not required to publicly disclose their financial situation (Keasey and Watson 1986a). Because it is possible to eliminate important input parameters through intensive use of statistical refining methods, I used only the most basic business ratios in a simplified form to ensure that the performance model can be used broadly.

Besides the four major challenges, there are other challenges of less significance to my work.

- The issue of innovation must be considered when constructing performance models for SMEs
- Young firms must be given special attention, as often these enterprises have not reached a stable status and tend to be more dynamic than more mature firms
- Models used by managers of SMEs should be of practical value
- The models must account for the nature of the modern economy, as Information and Communication Technologies (ICTs) drive the organizations to adapt an open structure (Globerman et al 2001)

The first of the second group of challenges is the necessity of attending to the issue of innovation when constructing performance models for SMEs. There is a broad agreement among scholars that SMEs are an important source of innovation. Rothwell (1989) outlined several advantages of small firms according to their innovation capacities, including their flexibility in responding to market changes, their ability to provide the locus for employment creation in periods of economic shifts, and their innovative contribution to structural and technological changes accompanying such economic transformation. Although there are a number of studies connecting SME performance to innovation activities (Cainelli et al. 2004, 2006, Cefis and Ciccarelli 2005, Cefis and Marsili 2005, Wolf and Pett 2006), these studies do not explicitly incorporate innovation in their evaluation models (Siqueira and Cosh 2008).

The second challenge is the necessity of carefully studying young firms, as these enterprises have often not yet reached a stable status, and they tend to be more dynamic than more mature firms. Klofsten's (1992b) work focuses on the earlier stages of firm life. He distinguished between two groups of firm models: The first group of models gives special attention to the development processes, such as birth and maturity. A second group pays less attention to these processes. Both groups consider the life cycle of the firm, but most of the models in these groups do not discuss the issues surrounding firm death (Table 2.1).

Firm age must be accounted for when building performance models. Davidson and Klofsten (2003) pointed to two deficiencies in the existing models in relation to studying younger firms' development. Firstly, the models are non-holistic and tend to be more qualitative in nature. Secondly, they lack the ability to be transformed into action tools for managerial purposes, as they are not well-anchored in research.

Table 2.1 Nature of the SME models in relation to the early stages of firm life

The focus of the model	Examples of models
Group (1): Models that focus on the early stages of firm life.	Adizes 1987, Churchill 1982, Cooper 1981, Galbraith 1982, Kazanjian 1988, Kimberly and Miles 1980, Miller and Friesen 1984, Quinn and Cameron 1983, Van de Ven et al. 1984, and Webster 1976.
Group (2): Models that have limited focus on the early stages of firm life.	Blake et al. 1966, Chandler 1962, Cowen et al. 1984, Greiner 1972, Kroger 1974, Maidique 1980, Smith et al. 1985, and Steinmetz 1969.

The requirement that models be practicable is not restricted to young SMEs—it is a problem for firms of all ages. This opens the discussion for the third challenge: namely, producing models of practical value for use by managers of SMEs. Few models are easy to utilize by managers who lack in-depth knowledge of finance theory and accounting. Among these is the "business platform model," which came into use in the nineties (Klofsten 2010). Other models were created to meet the needs of traditional users of performance evaluation models, such as banks and financial institutions (Altman 1968, 1983, Wood and Piesse 1988, Peel et al. 1985, 1986, Peel and Peel 1987). These models are not suitable to use as a basis for managerial policies (Klofsten 2010, Davidsson and Klofsten 2003). Managers can use the business platform model to decide what issues to focus on and to use the eight stone corners in order to bring their firms to a mature, stable status.

The fourth challenge stems from the nature of the modern economy, and has to do with the kind of enterprise structure generated in company build-up. In general, Information and Communication Technologies (ICTs) drive organizations to adapt an open structure (Globerman et al. 2001) over the classical, closed structure that characterized the older organizations (Scott 2003). The structural nature of SMEs affects the kind of model required to evaluate performance. Therefore, it is necessary to study the environment within which SMEs operate and understand how that environment is reflected in their performance (Gnyawali and Park 2009). As the modern economy becomes increasingly diffused (Polenske 2002), the agility and flexibility of SMEs gives them a competitive edge over larger firms. Organizations can benefit from utilizing information technologies (IT) in their daily operations (Fink and Kazakroff 1997). As thus users of failure prediction models need to closely examine both the relevance of the assumptions and the methodologies used to construct their models (Keasey and Watson 1991b). This implies that they also need to account for the networking impact on firm performance (Wincent and Westerberg 2005, Wincent et al 2009).

Existing SME performance models

One way to classify SME performance models is by examining their natures. The models related to small businesses can be classified into two broad groups. The first group consists of firm growth models that present soft performance measurement. The business models in this group focus on how firms proceed from their inception period to become fully-grown, functioning entities. These models are mostly qualitative in nature (Table 2.2).

The second group of business models focuses on performance prediction, which uses a hard approach to measure firm performance. The models in this second group can be divided into two subgroups: firm dynamics theories and financial failure prediction models. These models are usually quantitative (Table 2.3). When building firm performance models, a variety of viewpoints provides a better theoretical penetration of the issue.

Table (2.2): “Soft” SME performance models

Model	Category / Nature	Basic Idea
Life cycle models	Firm growth models Soft, qualitative	The models emphasize that firm development does not occur in a single stage but rather happens through a sequence of stages (Bhide 2000, Churchill and Lewis 1983).
Evolutionary models	Firm growth models Soft, qualitative	The models postulate an open-ended nature of firm progression in its life (Bhide 2000, Helms and Renfrow 1994, Nelson and Winter 1978).
Business strategy models	Firm growth models Soft, qualitative	The models focus on the importance of rules or policies to the firm’s survival and growth (Bhide 2000, Griggs 2002, Sashittal and Tankersley 1997, Schwenk and Shrader 1993, Klofsten 1992a, 2010).

Another approach to categorizing firm performance models is to look at their analytical perspectives. In essence, firm performance can be understood from a growth perspective (firm growth models) (Table 2.2), from the perspective of dynamics related to performance (firm dynamics theories), and from the financial prediction aspect (financial prediction models) perspective (Table 2.3).

FIRM GROWTH MODELS

Growth models postulate that firm development does not occur in a single stage, but rather takes place through a series of stages (Bhide 2000). Growth models comprise three model subgroups: life cycle models, evolutionary models, and business strategy models. The different life cycle models vary in the number of stages used to explain a firm’s life. For example, Churchill and Lewis (1983) proposed that small businesses have a five-stage life cycle. Evolutionary models, such as the ones proposed by Helms and Renfrow (1994) and Nelson and Winter (1978), postulate that firm progression follows an open-ended growth pattern.

Table 2.3 Hard performance SME models

Model / Category / Nature	Basic Idea
The Stochastic Theories of performance prediction models Hard Quantitative	The stochastic theories are based on the fact that firm growth and firm size are independent (Mansfield 1962, Hart and Paris 1956, Caves 1998, Simon and Bonni 1958, Evans 1987a, b, Hall 1987, Kumar 1985, Boeri 1989, Wagner 1992, Segarra and Callejon 2002, McPherson 1995).
The Learning Model Theory of performance prediction models Hard Quantitative	In the learning model theory, firms are assumed to possess a cost parameter. As each period passes, a firm revises its beliefs about its true performance based on the previous period's profits and costs. Inefficient firms which are unable to learn decline and exit, while efficient firms survive and grow. The model comes in two variations: active and passive (Jovanovic 1982, Hopenhayn 1992, Cabral 1993, Ericson and Pakes 1995, Nelson and Winter 1978).
Duration or Hazard Modeling Theory of performance prediction models Hard Quantitative	Hazard models assign hazard rates for firms. The rates are an expression of the probability that the firms will shut down, given that they were alive when the analysis began. Hazard models can be set in discrete or continuous time, and parametric or non-parametric approaches are possible (Caves 1998, McPherson 1995, Allison 1984, Waring 1996, McGahan and Porter 1996).
Z-Score ZETA Score Performance prediction models Hard Quantitative	Z-Score is a failure prediction model that combines traditional financial ratio analysis with discriminant analysis. The discriminant analysis classifies a company into one of two groups: failed or non-failed (Altman 1983, Altman et al. 1977, Altman 1968, 1983, Inman 1991, Wood and Piesse 1988, Keasey and Watson 1991a, Peel et al. 1986, Chen and Shimerda 1981, Argenti 1976).

Table 2.3 Hard performance SME models (continue)

Model / Category / Nature	Basic Idea
Neutral Networks (NN) performance prediction models Hard Quantitative	Neutral networks (NN) consist of a potentially large number of elementary, interconnected processing units; each unit is able to perform relatively simple calculations. The network's processing result derives from its collective behavior (Altman et al. 1994, Jain and Nag 1997, Luther 1998, Bigus 1996, Cadden 1991, Bell et al. 1990, Dutta and Shekhar 1994, Swales and Yoon 1992, Wong et al. 1992, Trippi and DeSieno 1992, Liang et al. 1992, Kryzanowski et al. 1993, Kryzanowski and Galler 1994, Gritta et al. 2000).

The third subgroup of models—the business strategy models—stress the importance of rules and policies for firm survival and growth (Bhide 2000). Business strategy models are generally used to assess larger corporations, but there is also a need for smaller firms to plan strategically (Griggs 2002, Sashittal and Tankersley 1997, Schwenk and Shrader 1993). One model that has both theoretical and practical value is the Business Platform model. Klofsten (1992a, 2010) theorized that eight "cornerstones" must be in place to support a business platform. These cornerstones are: idea, product, market, organizational development, core group expertise, prime mover and commitment, customer relations, and other firm relations. All of these are qualitative in nature, with the market being both a quantitative and qualitative dimension of analysis, depending on how one uses it.

PERFORMANCE PREDICTION MODELS

Performance prediction models can be divided into two subgroups: firm dynamics theories and financial failure prediction models. The first subgroup is more concerned with the study of firm entrance and exit dynamics, while the second subgroup focuses on predicting firm performance. The first subgroup is more concerned with the external environment of the firm, while the second group is more focused on the internal environment of the firm. Actually, a majority of the prediction models deal with financial failure.

The stochastic theories are based on the fact that firm growth is independent of firm size. That fact is expressed as Gibrat's law (Caves 1998), which stipulates that if the growth rates of firms in a fixed population are independent of their initial sizes, the variance of growth rates shows no change with size (ibid). Gibrat's Law is a theoretical extrapolation stemming from frequent observation of stochastic model behavior (Hart and Paris 1956).

Scholars found that firm survivability is positively correlated to firm size (Mansfield 1962, Caves 1998). In the learning model theory of Jovanovic (1982), firms are assumed to possess a cost parameter reflecting performance. Although each firm knows the distribution of this parameter for all other firms, it is unsure of its own true cost. Inefficient firms decline and exit, while efficient firms survive and grow.

Duration or hazard modeling is an attractive method for analyzing the performance of firms and examining their survival. The model anticipates a hazard rate, which can be thought of as the probability that a firm will close given that it was alive at the beginning of the analysis period (McPherson 1995).

Z-score is a failure prediction model that combines traditional financial ratio analysis with discriminant analysis. The Z-score model combines five financial measurements to arrive at an overall credit score (Z), which is the basis for estimating the financial viability of a firm (Altman 1983). Later on, the model was developed into the ZETA Score model (Altman et al. 1977), which includes seven financial ratios.

Neutral networks (NN) consist of a number of elementary, interconnected processing units, where each is able to perform relatively simple calculations. The processing results of the network derive from the units' collective behavior (Altman et al 1994).

This section screens the existing literature on SME performance and tried to categorize the literature in a systematic way. The review's objective is to increase my understanding of the natures and structures of the currently used models. Such knowledge is essential to grasping the characteristics desired in the intended model. It also helps me to avoid the weaknesses and deficiencies of the older models. The end result is that the intended model will become more responsive to SMEs actual needs in the current economic context.

Innovation and the intended performance evaluation model

The significance of innovation to SME performance

Despite the wealth of research on the connection between small firm performance and innovation (Verhees and Meulenberg 2004, Qian and Li 2003, Gerorski and Machin 1992, Soni et al. 1993, Freel 2000), more information is needed (Siqueira and Cosh 2008). The way in which innovation activities are run in smaller firms differs from the way they are conducted in larger firms (Rothwell 1991, Rothwell and Dodgson 1994, Vossen 1998, Hadjimanolis 2000). The growth potential effect related to innovation in SMEs comes from three input parameters: technology, R&D, and generation of competitive edge (Romano 1999). Vertically integrated organizational company structures facilitate innovation activities

that are internally-focused, while newer forms of organizational structures are more fluid and open. As such, newer structures allow for the integration of internal and external sources of innovation (Allarakhia 2009). However, studies of innovation in SMEs are still limited compared to similar studies focusing on larger firms (Vermeulen et al. 2005).

SMEs have limited resources at their disposal, but the lack of resources in SMEs can be compensated for by flexibility, agility, and innovativeness (Qian and Li 2003, Acs and Yeung 1999). That is why studying SMEs' performance in various contexts becomes a central issue when discussing the topic of innovation (Mazzarol and Reboud 2008, Vermeulen et al. 2005, Wolff and Pett 2006).

The term "innovation"

Innovation is regarded as the instrument through which entrepreneurial economies are realized (Drucker 1985). Schumpeter (1934) identified five sources of innovation: the introduction of a new good or a new quality of good, the introduction of a new method of production, the opening of a new market, the conquest of a new source of raw materials or half-manufactured goods, and the process of carrying out a reorganization of any industry. Also, Schumpeter (1934) emphasized the role played by the entrepreneur in the innovation process (Freeman and Soete 1997). OECD (2004, p. 9) defined innovation as, "The introduction of new or improved processes, products or services based on new scientific or technical knowledge and/or organizational know-how."

Mazzarol and Reboud (2008) saw innovation as the realization of new products or services, new production processes, new marketing techniques, and new organizational or managerial structures. Innovation may also involve new technology, intellectual property, and business and physical change (Sundbo 1998, Damanpour et al. 1989, Aiken and Hage 1971, Daft 1982, Zaltman et al. 1973).

The origin of the word "innovation" comes from the Latin words "innovatio" or "innovo." Both words mean to "renew or to make something new" (Norrman 2008, p. 9). The innovativeness of an economy can be augmented through a system of specialization where larger or more mature firms acquire innovative and successful smaller firms (Lindholm 1994). This approach was proposed first by Williamson (1975) and advanced by others (Jacobson 1984, Granstrand and Sjölander 1990, Lindholm 1990).

To connect societal input to innovation in relation to the external environment of the firm, early studies assumed that growth in the short run was largely driven by capital investment, while long-term growth was attributed to exogenous technological change

(Corley et al. 2002). Higher productivity of economies was attributed to "investment in capital," which is mainly related to knowledge (Schultz 1959). Romer (1986) postulated that R&D leads to the creation of knowledge, which may have a direct impact on technological change.

Types of innovation

Innovation can come in different forms, including: product innovation, organizational innovation, management innovation, production innovation, commercial/marketing innovation, and service innovation (Trott 2008). The different types of innovations and their uniqueness may lead to different impacts on strategy, structure, and performance of the organizations (Damanpour et al. 1989, Daft 1982, Damanpour and Evan 1984, Ettlie and Rubenstein 1987). Damanpour et al. (1989) looked at the impact of adapting administrative and technical innovations to the performance of organizations. Administrative innovations are innovations that occur in the administrative component and affect the social system of the organization (ibid). The social system of an organization consists of the organizational members and their relationships (Trist and Bamforth 1951).

Administrative innovation is more coupled to management innovation, while technical innovation is more related to product and process innovations. An administrative innovation does not provide a new product or a new service, but it may indirectly influence the introduction of products or services, or the process of producing them (Kimberly and Evanisko 1981). This also highlights the potential value of management innovation to a firm's well-being. In order to attain higher performance, the social structure of an organization must change to meet the requirements of the technical system (Blau et al. 1976, Miller and Rice 1967, Woodward 1965). Technical innovations are better absorbed and adapted in organizations that incorporate both technical and administrative innovation (Nord and Tucker 1987). Damanpour and Gopalakrishnan (1998) investigated the relationship between organizational structural variables and innovation. Instead of a simple innovation theory, a number of approaches are proposed to deal with the various types of innovation-based predictive variables (Downs and Mohr 1976).

Innovation can also be clarified as either incremental or radical (Cooper 1998, Ettlie et al. 1984, Damanpour 1991, 1996, Camison-Zornoza et al. 2003). Cabrales et al. (2008) studied the relationship between radical innovations and team diversity. Radical innovation generally involves more risk (Green et al. 1995, Rice et al. 2001, O'Conner and

McDermott 2004). Creation of new knowledge in a firm involves risks (Teece and Pisano 1994, Howells and Michie 1997, Lei 1997), which are difficult to assess.

Open innovation

The IT revolution has helped firms to gain capacities in various areas of their operations (Turban et al. 1999). As a result, old, closed innovation systems have gradually altered into new, open innovation systems (Chesbrough 2001). Open-source R&D is another approach to conducting research, which allows scientists and academicians to join forces across organizations (Munos 2006).

The emergence of the open innovation concept is a result of the increasing complexity of innovation processes, and also the result of innovation management's methods of coping with this complexity (Teirlinck and Spithoven 2008). Open innovation is linked to the usage of open business models (Chesbrough 2003, Melese et al. 2009). Hedner el al. (2011) argued that the open innovation paradigm may alter the way that drug discovery and new product development occur in the pharmacy industry. Lakhani and von Hippel (2003) listed different types of incentives that drive the firm to use open source management. A variety of novel concepts have been introduced into the innovation literature as relates to the rise of open organizations, including innovative environments (Aydalot 1985), clusters (Porter 1990), innovative milieu (Camagni 1991), regional innovation systems (Cooke 2001), and learning regions (Morgan 1997). Laven (2008) identified the three concepts of innovation systems, clusters, and the triple helix, stating that they were novel, innovation-producing arrangements. The new innovation concepts emphasize the interaction between organizations.

Awazu et al. (2009) described how ICTs are being used to support distributed and open innovation. According to Fredberg et al. (2008), open innovation has merged into a system model, where enterprises commercialize their internal and external ideas, and their technologies and use, to improve both their external and internal capacities. In open innovation, external knowledge relations are considered vital elements and are complementary to internal research (Cohen and Levinthal 1990, Veugelers 1997, Chesbrough et al. 2006, Teirlinck and Spithoven 2008).

Innovation capital

Two types of capital are often mentioned in relation to innovation capacity: human capital and financial capital (Abouzeedan and Busler 2004). In addition to these two, there is also a third: system capital (ibid). System capital should not be confused with structural capital. Structural capital, in its classical context, is an embedded component in the intellectual capital concept (Allee 1999, Zangoueinezhad and Moshabaki 2009, DePablos 2004, Sveiby 1997). Intellectual capital relates to the intangible assets of an enterprise (Sveiby 1997, Sveiby and Risling 1986, Edvinsson and Malone 1997, Roos et al. 1997). Structural capital, as well as human capital and external capital, may be discussed in respect to an enterprise's intangible assets (Allee 1999). Allee (1999, p. 126) defined structural capital as, "Systems and work process that leverage competitiveness." According to him, it is "the competencies delivered as codified knowledge in the internal environment of the firm and that is why it is also referred to as internal capital" (ibid).

Based on the definition above, it is evident that structural capital is different from the "system capital" used in papers 4, 5, and 6 of this thesis. There are two main aspects of that difference. Firstly, system capital is more related to existing input from the external environment. Such input comes from societal and governmental organizations and institutions. Secondly, system capital indicates both tangible as well as intangible assets supplied to the firm as external input.

Technical change may increase the relative productivity input of human capital if education and other skills assist in rapidly applying new technology within the firm (Adams 1980, Nelson and Phelps 1966, Welch 1970, Schultz 1971). One way to express the quality of human capital in a country is to look at labor productivity (Adams 1980). Mankiw et al. (1992) introduced human capital explicitly in his production function. People constitute any organization's core resource for competitiveness (Rastogi 2000). On the other hand, if an increase in labor-productivity is related only to an increase in working hours and not to a net production output, then the increase in productivity will add little or nothing in respect to competitiveness as measured by income per capita (Corley et al. 2002).

In knowledge management literature, R&D and human capital are typically merged under the categories of "receiver competence" (Eliasson 1990), "knowledge base," and "absorptive capacity" (Cohen and Levinthal 1989, 1990). In general, human capital is transferable and facilitates the accumulation of specific human capital (Ballot and Taymaz 1997). Such mechanisms lead to competence-building, thus emphasizing to the researchers the importance of receiver competence (Eliasson 1992). Abouzeedan and Busler (2004)

argued that innovation expressed as R&D can be incorporated with human capital in relation to intangible assets.

Financial capital is often coupled with R&D and innovation activities. Lichtenberg's (1992) study of the manufacturing sector's productivity in relation to R&D investments did not consider cross-country effects. This contrasts with other studies, which have shown that even when tangible and intangible investments are considered, there are still cross-country differences in productivity. These differences indicate the effects of the firm's external environment. Hall and Jones (1999) found that such tangible and intangible factors may be institutional and relate to differences in social structures.

Jorgenson and Griliches (1967) focused on issues related to measuring tangible investments in an attempt to reduce the size of the unexplained portion of growth due to exogenous changes. Later studies attempted to explain the determinants of growth by taking intangible investments, such as R&D, into consideration (Corley et al. 2002). Acs and Yeung (1999) indicated that product and process improvements in SMEs can be directly attributed to increased creativity and innovativeness in the firm.

This section discussed the topic of innovation and screened the basic knowledge related to the relationship between innovation and firm performance. The review has enhanced my understanding of the desired characteristics of the model. The discussion assisted my grasp of how the intended model should be structured to recognize the significance of these activities to SMEs' survival and growth.

A comprehensive approach to constructing an SME performance model

Organizational theories are concerned mainly with the ways we view the organization and its structure. SME performance lectures have developed from a traditional understanding that treats firms as closed organization systems. However, there are other ways to look at organizations and analyze their organizational behaviors. According to the classification used by Scott (2003), these methods comprise four lines of thinking: rational closed system, natural closed system, rational open system, and natural open system (ibid). The closed system approach looks at the organization in isolation from its environment. This is in contradiction to the open system view which involves the interaction of the organization with its external environment in the analysis. The rational aspect focuses on the operational and administrative functions of the organization while the rational aspect stresses the significance of the human relationship in the organization and how the employees are related

to the functions of the firm. The four lines of thinking show the progression of the way organizations have been viewed by scholars over time.

THE RATIONAL CLOSED SYSTEM

The rational approach of organizational structure emphasizes the legal, task-oriented perception of organizational analysis. As Scott (2003) attests, the rational system perspective emphasizes that organizations are instruments designed to attain specific goals. One of the earliest representative theories of the closed rational system perspective of organization analysis is that of scientific management. This model is strongly attributed to Fredrick W. Taylor (1911). According to Taylor's (1911) approach, each worker is specially trained to perform a single movement or subtask in the manufacturing process. Taylor (1911) looked only at the internal processes of organizations, and neglected any interaction that might occur between an organization and its external environment (Shenhav 1995, 1999, Cole 1994, 1999).

Parallel to the introduction of the scientific management school, a second approach was developed—the administrative theory. The administrative theory emphasizes the function of management in organizations. It attempts to generate administrative principles, which serve as guidelines for the rationalization of organizations and their activities (Scott 2003). One of the earliest scholars to apply this philosophy to management was the French industrialist Henry Fayol (1949). American advocates of the administrative management approach included Mooney and Riley (1939) and Gulick and Urwick (1937). Other scholars contributing to the development of this theory included Massie (1965), Simon (1997), and March and Simon (1958).

The bureaucratic theory was postulated by one of the most influential sociologists and political economists of the modern era, the German writer Max Weber. The bureaucratic theory is actually a limited contribution to a much more encompassing work of analysis of the German writer to Western civilization as a whole. Weber (1968) believed that the most important feature distinguishing Western civilization from the rest of the world was the cultural significance of rationality and the authority that stemmed from it (Scott 2003). Weber (1968) proposed a topology of three types of authority: traditional, rational-legal, and charismatic (ibid). Although the Weberian bureaucratic theory has been influential in the way scholars understand organizational structures, it has drawn criticism based on various arguments (Thompson 1961, Dalton 1950, 1959).

THE NATURAL CLOSED SYSTEM

Natural analysts are more concerned with the informal organizational structures of the mode and values of participants, rather than of formal organizational structures (Scott 2003). The theory of cooperative systems emphasizes the cooperative nature of organizing. The school of natural closed system perspective is attributed to Chester I. Barnard (1938), who looked at each organization as a framework to integrate the contributions of its individual participants.

The human relations school of organizational thinking emphasizes and recognizes the complexity of human motivation and the importance of informal structures. The school originates from the thinking of Elton Mayo (1945) of Harvard Business School, who based his works on analyzed data collected by Roethlisberger and Dickson (1939). Social psychologists such as Likert (1961) and Katz et al. (1951) developed Mayo's (1845) analysis using a social/psychological approach. Another famous sociologist to embrace the human relations closed system was Whyte (1951, 1959).

The conflict models school of analysis argues that formal organizations, like all other social groups, have a core overriding objective—that is, to survive (Gouldner 1954, 1959). According to this school, the internal conflicts appear when organizational goals differ from those of the organization's participants (ibid). Two giants of European social thinking had great interest in the conflict aspect of organization, Max Weber and Karl Marx (Scott 2003). Marxists argue that organizational structures are not rational systems for performing work in the most efficient manner; rather, they are power systems designed to maximize control and profits (ibid). Collins (1975) combined Weberian and Marxian themes on social conflict to arrive at a general critical theory of organizations.

THE RATIONAL OPEN SYSTEM

The rational open system considers the organization's interaction with its surroundings. This approach emphasizes the rationality of organizational processes, as well as the interdependence and exchange between the organization and its environment. Within the bounded rationality theory, March and Simon (1958) called for a view of the organization that showed it being more open to its environment. The theory emphasizes the need to take that in consideration when taking decisions and called for the institutionalization of the innovation activities of the firm.

In relation to the contingency theory, Lawrence and Lorsch (1967) were first to use the terminology "contingency theory." The contingency school of organizational analysis

emphasizes the existence of multiple numbers of environments corresponding to different types of organizations (Lawrence and Lorsch 1967). This requires the usage of a variety of solutions and decisions to correspond to the different types of environments. An organization's adaptability to its environment is the core concept in this theory (ibid).

The combination of rationality and openness in organizational systems is made clear in James D. Thompson's (1967) work. Thompson was among the first to recognize the importance of the environment for the structure and performance of organizations. Using a similar approach to Dill's (1958), Scott (2003, p. 197) defined the task environment as those features of the environment relevant to the organization when viewed as a production system. These features include the sources of input, markets for output, competitors, and regulators. Several theoretical frameworks provided guidance to empirical studies of how organization relates to the task environment. Among these are the contingency (Thompson 1967, Donaldson 2001), strategic choice (Child 1972, Baum 1998), competitive strategy (Porter 1980), resource dependence (Pfeffer and Salancik 1978), transaction cost (Williamson 1981), and knowledge base (Nonaka and Takeuchi 1995) theories.

Simultaneous to the proposal of bounded rational and contingency concepts, other scholars looked at variations of organizational structures in an empirical way, introducing the comparative structure approach to organizational build-up (Scott 2003). These efforts were performed by such researchers as Udy (1959), Woodward (1958), Pugh et al. (1969), Pugh and Hickson (1976), and Blau (1970). The core concept in this approach is to look at the organization as a production system trying to maximize its output (Scott, 2003).

The transaction cost theory tries to address why organizations are formed, and it postulates that the reduction of transaction cost is the driving force of organizational build-up. The theory was first proposed by Coase (1937), but was revived and extended by Williamson (1975, 1985, and 1994). Earlier works on the competitive advantage of organization emphasized tangible resources, such financial capital and location (Scott 2003). However, recent efforts focused on the utilization of intangible resources, such knowledge, as a competitive source. That led to the proposal of the knowledge-based theory (Scott 2003, Nonaka and Takeuchi 1995, Polanyi 1967, Nelson and Winter 1982, Badaracco 1992).

THE NATURAL OPEN SYSTEM

The natural open system emphasizes the values and motivations of the participants. The organizing models pay greater attention to the cognitive processes involving trial and error, chance, superstitious learning, and retrospective sense making (Weick 1979).

The socio-technical system approach to organization argues that individuals, as well as social units or organizations, should be considered in regards to technical adjustment. This school of thinking is based to a great extent on the work of scholars at the Tavistock Institute of Human Relations, in England. The institute developed a typology of organizational environments and used that typology to study larger firms (Miller and Rice 1967). The socio-technical analysis attempts to understand the connection between the human and inhuman sides of organizational activities (Jaques 1951, Emery 1959, Trist 1981). The first two models of the open natural system idea (the organizing approach [Weick 1979] and the socio-technical systems [Miller and Rice 1967]) utilize the social/psychological and the structural levels of analysis, respectively.

The other schools of the natural open system analysis use an ecological approach. The first of these was the organizational ecology theory, and was influenced by the Darwinian era (Hofstadter 1945, Hannan and Freeman 1977, 1989, Aldrich 1979, 1999). In contrast to organizational ecology, which emphasizes selection process, the resource dependence school promotes adaptation as a method of undertaking organization of activities and organizations. The approach of adaptation to environment has been labeled “resource dependence” (Pfeffer and Salancik 1978), “political economy” (Zald 1970, Wamsley and Zald 1973), and “power dependency” (Thompson 1967).

The Institutional Theory approach is a major natural open system theory that uses the natural analogy concerning the interaction of an organization with its external environment (Scott 2003). The difference between it and the contingency theory is that the institutional approach is more focused on the impact of the macro institutional actors of society on organizations (ibid). Early work in this field recognized the extent to which organizations were shaped by political and legal frameworks, the rules governing market behavior, and the general beliefs predominant in the economic system (Burgess 2009, Commons 1924, Cooley 1956, Weber 1968, Powell and DiMaggio 1991).

The open system paradigm of organization analysis has been in use since the 1960s. However, this view was neglected when the issue of firm performance was tackled, perhaps because the performance models were constructed from a finance/accounting perspective, without incorporating issues of efficiency. A firm’s efficiency is not isolated from its structural build-up and networking capacity. The empirical research conducted through the years about networking brings to light a number of points about the subject (Pittaway et al. 2004). Firstly, networking can have a positive impact on innovation within all organizational contexts, including established larger organizations, small enterprises, and

entrepreneurial start-ups. Secondly, networks are complex and there is no clear evidence to suggest specific network configurations that more effectively support innovation in a particular context. Thirdly, there are a range of identifiable factors that either promote or prevent the establishment of business networks (ibid).

The concept of external environment is intended to include those forces and elements external to the organization (Covin and Slevin 1991). The external environment is affected by an organization's actions as well as more general economic, socio-cultural, political-legal, and technological forces (ibid). The IT revolution has had an impact on the management aspects of organization. Products are becoming modular, and knowledge is distributed among organizations (Baldwin and Clark 1997). The main element in the innovation system is no longer the individual or the firm, but rather the network (Powell et al. 1996).

Innovations tend to increase in open environments (Malinen et al. 2009). Modern production requires a new approach to management, as the process is becoming more complex, with a lot of detailed parts delivered from a variety of resources (Pittaway et al. 2004). Biotechnology in the UK is a sector that exemplifies the relationship between networking activities and innovation (ibid). As the methodology has shifted from a closed to an open system approach, the focus in innovation process has moved away from input (i.e. R&D) toward output (i.e. realized innovations) (Klomp and van Leeuwen 2001).

Several scholars have conducted research that demonstrates the inseparability of the external environment from the entrepreneurial processes (Covin and Slevin 1991). For example, Bruno and Tyebjee (1982), drawing heavily on the resource exchange model proposed by Pfeffer and Salancik (1978), discussed the various environmental conditions that stimulate or impede entrepreneurial activity. Environmentally-focused population ecology diagrams (Hannan and Freeman 1977) have been used to explain new venture creation and survival (Penings 1982). As argued by Covin and Slevin (1991), certain environmental characteristics may elicit entrepreneurial behavior on the part of organizations.

Similarly, researchers have found dynamic environments to encourage entrepreneurial firm-level behavior (Miller et al. 1988). One new work in this area is the Actor-Networks Theory (ANT). The theory advises us to look at events, actions, and processes in the organizing phenomenon, unlike networking theories, which care more about who the organizers are (Czarniawska 1998, 2005, Czarniawska and Hernes 2005). However, one cannot really treat the actor and the actions as two separate spheres; rather, they are impacting each other. Organizations often respond to challenging environmental conditions,

such as those present in high-tech or dynamic environments, by taking risks, innovating, and exhibiting proactive behaviors, and by adopting entrepreneurial postures (Khandwalla 1987). In a highly competitive environment, entrepreneurial postures appear to promote high levels of firm performance (Covin and Slevin 1989). On the other hand, the relationship between entrepreneurial posture and performance may be less positive or may even be negative in non-hostile environments (Miller and Friesen 1983). Laforge and Miller (1987) studied the moderating effects of firm size on the relationship between several environmental and strategic variables.

Selecting the core parameters of the intended model: The literature-driven phase

SELECTION OF NON-FINANCIAL VARIABLES

Qualitative variables provide a useful addition to financial ratios. Storey et al. (1987) and Keasey and Watson (1986b), found that when non-financial variables are used in conjunction with financial ratios, predictions of companies' failure were significantly improved. For small firms, the predictive content of financial ratios is considerably less, which gives qualitative variables more weight (Keasey and Watson 1991b). Since a number of characteristics are specific to small firms' reporting practices, some researchers raised doubt regarding whether an adequate predictive model could be based solely upon financial ratios (Keasey and Watson 1987). Some small firm failure prediction researchers recommend that future work should broaden the scope of small firm performance predictors to include additional non-financial variables (Peel and Peel 1987). Keasey and Watson (1987) found that models containing non-financial ratio information were robust; they significantly out-performed models utilizing financial ratios alone.

According to Altman (1983), the incidence of failure is much higher in the early years of firms' lives than in later years. Argenti (1976) saw the companies' ages and sizes as important determinants of the type of company failure. While he incorporated age as a separate, non-financial explanatory variable of failure, he avoided incorporating company size into his model. Argenti (1976) used company assets as a size indicator. The asset value is incorporated as a denominator in most financial ratio models used to predict firm failure.

Other researchers use total assets as an indicator of company size (Caves 1998, Altman 1983, 1968). Assets may be a good indicator of the company size of larger firms, but for small firms the assets value is usually low. Statistically, there was no significant difference between the failure and non-failure subgroups of small firms as regards their assets (Keasey

and Watson 1987). Keasey and Watson (1987) used age as one of the non-financial variables in their prediction study. Company size was found in a number of previous studies to be a highly significant variable in predicting corporate failure (Altman 1983, Ohlson 1980, Peel 1985, 1987, Peel et al. 1985, 1986). Researchers found that the hazard rate of entrants (start-up firms) decreased with age (Baldwin 1995, Audretsch 1991). A reduction in firm size does not in itself indicate that a firm is in decline, as enterprises may reduce their size in the short-term to boost profitability for a subsequent market expansion (Paasio et al. 1994).

The defining size of firms varies from one business sector to another (Bolton 1971). In the manufacturing sectors, SMEs tend to have greater numbers of employees, while in consultancy and other service sectors; SMEs tend to have fewer employees. An alternative approach is to talk about smaller firms and larger firms in a relative sense; so that the relative size of firms is described in relation to the sectors they operate in. Thus, a better tool for describing the smallness of a firm is to use the ratio of the size of the company, expressed as the number of employees, to the average size of firms in the sector at that point in time. An alternative approach, used in this thesis, is to relate the firm size to the optimal size of the firm in accordance with the definition of SMEs for a particular country or business sector. A parallel approach can be used when it comes to describing firm maturity. The age of the firm can be expressed as a ratio between the age of the firm at a particular point and the average age of all firms composing the sector at that specific point of time. Both approaches consider the variation between business sectors.

SELECTION OF THE PERFORMANCE MODELS' FINANCIAL VARIABLES

The financial healthiness of the firm can be directly correlated to its failure (Keasey and Watson 1991a). There are a number of indicators related to performance, including profitability, activity, liquidity, assets' balance, and cash position (Libby 1975). Keasey and Watson (1987) used financial ratios, such as profitability, liquidity, and gearing, to cover various aspects of company performance. I used the financial parameters most commonly reported by Swedish small firms (Abouzeedan 2001). A number of researchers (for example Beaver [1966]) and Gentry et al. [1985]) used a cash flow model of firm failure that views the firm as a pool of liquid assets that is drained and fed by the activities of the firm.

One implication of the passive learning models utilized by Jovanovic (1982) and Ericson and Pakes (1987) is that such models state that the firms will have a more rapid departure rate (i.e. failure) as their cost disadvantage incurred grows greater. The intended model selected financial variables that reflected the firms' profitability, gearing, enhancement,

and financial-pressure (Abouzeedan 2001, 2002). In order to use a measure for sales output, the model relates sales to production costs. This creates a ratio that reflects the amount of sales generated from spending a specific sum of money. Firms that introduce new processes and technologies were shown to have a better probability of survival and a higher rate of growth (Mansfield 1962). Innovative activities enhance the survival of new firms (Audretsch 1991). Therefore, investing in technological activities has a positive impact on the survival of SMEs. Abouzeedan (2001) used dimensionless variables, such as the profit margin, in the intended model.

I defined the research problem by focusing on "performance" as an expected outcome derived from a selected number of input parameters. To develop the parameters for the intended model, I not only relied on the analysis of existing literature regarding the relation of parameter to performance, but I also tried to build an analytical framework to describe what performance in relation to these parameters would mean. I looked at the value added by the parameters and did not stop at the literature review phase.

Selecting core parameters of the intended model: The theory-driven approach

Existing performance models treat firms as closed systems in isolation from their external environments. One must choose the parameters in relation to their efficiency and capacity to respond to the requirements of an open system. The intended model selected two groups of parameters. The first group captures the efficiency of the firm as reflected by its operational aspects. The first two of these parameters are the number of employees and the firm's age. These are qualitative parameters related to firm performance. The way I approached the usage of the two core parameters was to relate them to the external environment of the firm through two concepts: maximum number of employees distinguishing the different categories of enterprises (for the firm size parameter) and the average life span of the business sector (for the age of enterprise). The reason for this is that firm efficiency is not isolated from the firm's external environment. Classical firm performance models were built at a time when the closed perspective of organizational structure was the dominant theorem (Scott 2003, p. 108, Table 5-1).

The first three quantitative parameters of interest to this work are the turnover (or sales), production costs, and profit margins. All three parameters measured the efficiency of the firm. However, factors have indirect effects incorporated in these measurements. For example, profit margin is not only a difference between turnover and cost—it is also an indication of how efficiently the firm management extracts values from each dollar spent as

cost and how it utilizes firm resources. One needs to look at the explanations behind these numbers rather than viewing them strictly as mathematical figures. All the financial parameters mentioned are calculated per periodicity unit, including the profit margin, which is a neutral percent figure.

There are two other financial parameters within the group of factors included in the operational aspects of firm activities: the initial investment cost and the self-financed initial capital of investment. One does not find these parameters in the classical models, although they are important in measuring the efficiency of the firm's operations. When it comes to SMEs, it is optimal for entrepreneurs to rely on their own resources at the first stage of company building. Actually, entrepreneurs' self-reliance makes them strive to be as independent as possible when it comes to financing their ventures. The ratio of self-financed initial capital of investment to initial investment costs provides a good indication of the degree to which the entrepreneur relied on his or her self in establishing the company. Ideally, that ratio would be a unity or would at least approach unity. Later on, the entrepreneur may need to go for more external financing, especially when the firm should have reached a business platform. At this stage, the enterprise has the potential to grow or it may stay at the same level of performance for an extended period (Klofsten 1992a, 2010). Such status of stability and the potential to grow makes it easier to convince capital providers to invest in the company. The intended model groups parameters into two subsets, although they all impact the operational setting of the firm in a classical context. The second subset of parameters includes the initial investment costs and the self-financed initial capital of investment; all the rest are clustered in the first subset.

The second part of the intended model looks at firm efficiency outside of its investments in innovation activities and its innovation acquirements. The intake and absorption of new technologies are indicated by the ratio between investment in innovation and technology acquirements and the total costs of production, or the technology-intake index.

Innovation's positive impact on the efficiency and performance of firms requires clarification on two points. The first point is that investments in innovation and technology intake should be treated as positive inputs into the efficiency of the firm rather than as cost figures that exhaust the firm (as they are often treated in the classical approach of finance and accountancy). The second point is that such investment needs to be related to the production costs to reflect the true utilization of the firm's resources. A higher ratio is an indication of the firm management's high level of commitment to investment in innovation and absorption of

new technologies, while a lower figure indicates the reverse and actually points to an old-style, non-innovational approach to firm development strategies.

The clustering I chose for the parameters in the intended model is based on the understanding that the parameters in each subset are closely interconnected. There was no statistical verification for the parameters' selection, because I preferred to base the general model on theory understanding. It leaves the statistical refining work to be performed when analyzing variations of the model in specific contexts of sector and locality.

The new economic giants are thriving on the role played by smaller firms. In China, small manufacturing enterprises have launched the country into its new economic era. Without SMEs, China could not have developed the export-based economic model that transformed the country. Furthermore, measuring the economic input of SMEs at the aggregate level requires a better understanding of the factors contributing to high performance of SMEs and the mechanisms leading to such high performance (Acs 1999, Reid and Xu 2009). The importance of accounting for the firm's external environment in models and theories of entrepreneurship is evident (Covin and Slevin 1991, Cooper 1986, Bruno and Tyebjee 1982). Organizational-level variables also appear to be essential. Various business strategies, organizational structures, and organizational cultures, for example, can affect the ability of a firm to engage in entrepreneurial activity (Maidique and Hayes 1984, Zahra 1986).

This section focused on reviewing the way organizations are built and how the open nature of firms facilitates better exchange of resources and enhances the networking possibilities between enterprises. Furthermore, I evaluated the way the parameters were selected for the intended model based both on the literature review and the theory-driven approach. This section is strongly connected to the previous two sections. The reader can see a line of logical propagation through all three sections that supports the main objective of this thesis, which is to present a model of SME performance that solves the problems of older models and acknowledges innovation in its construct.

3. Methodology

In this chapter, I discuss research methods in social sciences. I close the chapter by looking at issues of validity, reliability, and generalization of research methods.

In this thesis, I used the single firm as the unit of analysis. I use the term "internal environment" to mean the internal conditions of the firm as concerns the issue of business performance. By "external environment," I mean the conditions surrounding the firm that impact its performance. The same logic is also applicable to my analysis of a population of firms, for this is also embedded in the concept of the external environment of a single firm.

Research methods in social sciences

Qualitative versus quantitative research

From a research point of view, it is important to consider the methods used. Two contexts are valid: the first is the context of enquiry or research design, and the second is the context of justification, where data are analyzed and interpreted (Brannen 2005). Traditionally quantitative methods are more concentrated on input issues. Today, modern social sciences have shifted toward a focus on the output or the outcome of programs (Welch and Comer 1988). The SIV model utilizes an output indicator that is the Survival Index Value, to express firm performance.

The quantitative methods have dominated social research for a long time. Recently, qualitative research has gained more momentum (Gubrium and Holstein 1997). Qualitative methods are more suitable than quantitative ones to handle the complex realities tackled by social sciences (ibid). The dominant method in my qualitative research approach was to compile data into review articles and conceptual papers.

There are some areas of debate in respect to qualitative research. The first is that qualitative research uses words, while quantitative research uses numbers. This is an overly simplistic claim. Another false claim is that qualitative studies focus on meanings while quantitative research is more concerned with behavior. This is also a misunderstanding of the nature of qualitative research. Actually, both methods may be concerned with people's views and actions (Brannen 2005). The association of qualitative research with an inductive logic and the quantitative research with hypothetic-deduction could also be challenged, since that association can be reversed in practice. In the end, both methods of research may employ both forms of logic, depending on the research questions (ibid).

That is why I saw, in the case study, a methodical approach to retrieve empirical data and to satisfy both forms of logic. In quantitative research, observation is not generally

considered a very important method of data collection for two reasons. The first is that it is difficult to conduct observational studies on large samples. The second is that there may be problems since different observers may record different observations (Silverman 2001).

Observation is a major method of qualitative analysis, and it is an element of the case study methodology. Textual analysis is used within the context of quantitative research to analyze the content of gathered text about a subject (Silverman 2001, p. 12, Table 1.2). Bryman (1988) stressed that the major advantage of the content analysis methodology is the reliability of the measures obtained. In qualitative research, textual analysis is related to a single subject or a few subjects, although in great depth. Textual analysis is a very important component in the case study approach. Two of the papers (3 and 7) of this thesis used case study methods with textual analyses and analyses of accounting data.

Qualitative methods such as case studies allow for multiple data-collection methods under the same study, unlike quantitative research studies (Chetty 1996). They are able to produce usable theories. Some scholars in fact entirely reject the suggestion that qualitative research only can "describe" or "explore" the social world (Mason 1996).

The first critique of qualitative research has to do with the method's reliability. Reliability is concerned with how a researcher categorizes the events of activities described in the study (Silverman 2001). The second critique of qualitative research has to do with the soundness of the explanations provided by the researcher based on the qualitative research conduct (known as the problem of anecdotalism). The complaint of anecdotalism questions the validity of the research method. One can use a dual approach to overcome the second critique. Brannen (2005) stressed that there is a strong support among researchers for using the dual approach in both qualitative and quantitative methods. I used a dual approach for my research in this thesis.

Methods of qualitative research

Within qualitative research, small numbers of texts and documents may be analyzed to understand the participants' categories and see how these are used in concrete activities, like telling stories (Propp 2003, Sacks 1974), assembling files (Gubrium and Buckholdt 1982), or describing family life (Gubrium 1992, Silverman 2001). Interview analysis is an important qualitative method. In qualitative research, it is important to use open-ended questions to small samples of participants (Silverman 2001, p. 12, Table 1.2). Interviews are commonly used in both methodologies. Open-ended questions are used in interviews conducted by qualitative researchers. Open-ended questions produce answers that

need to be subsequently coded (ibid). Qualitative interview studies are often conducted with small samples, and the interviewer relationship to participants may be defined in political rather than scientific terms (Finch 1986). One of the best methods of collecting data is in-depth interviews (Welch and Comer 1988). Interviewing is often the only way to collect the information needed in a short period of time (ibid).

Case studies can be either single or multiple studies (Chetty 1996). Yin (2009, p. 18) defined the case study method as: "an empirical inquiry that investigates a contemporary phenomenon within its real life; when the boundaries between phenomenon and context are not clearly evident." Case studies can help us overcome specific problems of importance to social research. But the use of case studies requires two major considerations. The first is the small size of the sample, which hinders the creation of statistics. The second is the over researching of firms, which occurs often when using traditional survey methods (Chetty 1996). Both of the aforesaid are true problems in SME research in general, and particularly apply to performance studies.

Although Yin (1989) and Strauss and Corbin (1990) mentioned multiple case studies when they discussed research methods in social sciences, Eisenhardt (1989) wrote in detail about theory-building properties of multiple case studies. Eisenhardt (1991) found that the multiple-case approach encourages researchers to study patterns common to many cases and theory building while avoiding chance associations. Data can be analyzed using different techniques (Chetty 1996). The writer recommended using a single case study method in SME research. In this thesis, I used a single case study approach. Single case studies enable the researcher to penetrate deeply the conditions of the firm. That is well-needed if I wanted to answer the research questions covered by this thesis. The multiple case studies can be used on the future research to compare the performance of SMEs from different sectors within regions and countries.

Validity, reliability, and generalization of research methods

There are three issues to consider when discussing the research methodology of this thesis: validity, reliability, and generalizability. In Table 3.1, I present and discuss the extent to which these issues are addressed in the papers of the thesis.

Table 3.1 Validity, reliability, and generalization issues in research methods used in the thesis

Paper	Validity issues	Reliability issues	Generalization issues
1	Screening the existing literature produced the desired topology. However, one cannot claim that one has covered all the important literature in the field. Besides, there are contradictory findings when it comes to firm size impact on growth, although most of the literature agrees that failure probabilities decrease with the increasing size of firm.	The available literature granted that analysis can be repeated without any restriction. The only threat to reliability is finding new literature that contradicts the existing findings.	The argumentation and reasoning carried in the paper is general in its nature (d).
2	Coverage Intensity and Information Intensity Requirements are valid measures for the SME performance models' output. There is, however, a problem when one uses a non-numerical scale because the positioning of the different models on the platform is somewhat arbitrary.	The ASPEM tool was developed out of the existing literature on SME performance. The same analysis can be reproduced without any difficulty. The only thereat to reliability is finding new literature that contradicts the existing findings.	Same as in (d).
3	The firms studied have less than 250 employees; the data was taken directly from the accounting reports of the firm and the analysis was performed while I was working in the company. The major validity concern in this paper relates to the robustness of the model, as it was not tested for a long time. Intensive statistical testing was avoided to prevent an early exclusion of important factors.	Input information exists in any result or balance calculations. Information about the initial investment in the firm as well as the extent to which the firm was self-financed is not hard to find. The technology intake data can be taken directly from the financial records or deducted from this information. The model's robustness is questionable because it has not been well tested. However, this issue can be dealt with as the model is repeatedly tested (b).	The firm fulfills the characteristic of Swedish SMEs. The firm resides in the same region in Sweden (Gothenburg area). However, because the model is not very well-tested, there is a possibility that it is not robust. On the other hand, I used a generalized platform and avoided using statistical refining at this early stage of model development. That secured a level of confidence in the generalizability of the model (e).

Table 3.1 Validity, reliability, and generalization issues in research methods used in the thesis (continued)

Paper	Validity issues	Reliability issues	Generalization issues
4	The paper is based on reviewing the existing literature and discussing the components that impact innovativeness in relation to the firm's external environment. The IBM analysis was performed on Arab countries where the level of differentiation between the intensity of innovation capital components is exaggerated. The IBAM, although a very good conceptual platform, does not quantify the levels of the various components of the innovation capital (a).	The IBAM was developed out of the existing literature. The application was performed in the Arab countries, where all the components are exaggerated. Less differentiated regions would be easier to discuss (c).	Same as in (d) above.
5	Same as in (a) above.	Same as in (c) above.	Same as in (d) above.
6	The discussion about open capital stems from the open innovation concept advanced by Chesbrough (2001, 2003). It also draws from general discussion about the impact of information and communications technologies on firm activities. These parameters are in need of quantification, however.	The analysis based on open innovation and IT impact on firms can be re-reproduced repeatedly. The only threat to reliability is finding new literature that contradicts the existing findings.	Same as in (d) above.
7	The firm studied falls within the definition of SMEs, as: it had less than 250 employees; the data was delivered from the firm management for the period of the analysis; and I have good access to the situation of the firm. Again, the robustness of the model is in need of confirmation through continuous testing.	Same as in (b) above.	Same as in (e) above.

The validity issue

Validity is an important criterion of good measurement. A valid measurement tool should measure what it is designed to measure (Welch and Comer 1988) and the research is considered valid if it measures the factors intended (Norrman 2008). My structuring of the intended model measures the intended factor of SME performance. While problems of validity (or lack thereof) are an issue of concern in most natural scientific studies, they are especially grave in the social sciences, as policy research is largely based on results from this discipline (Welch and Comer 1988). There are some widely accepted methods for developing evidence of validity, although each constitutes a separate form of validity (ibid). Common sense can be used as a way of checking validity, and is also called face validity (ibid). I relied on existing literature that used common sense to check validity, and thus I relied on the face validity approach.

Another way to utilize face value is to consider whether the measure has been used before by other researchers. If it has, and there is acceptance of the measure's outcome in the research community, then this is an indication that the measurement is valid (Welch and Comer 1988). In construct validity, one chooses a test with a pre-known common result and confirms validity based on that (ibid). For example, I expected the intended model to produce graphic presentations in a specific way in the case studies I conducted, because I had some knowledge about the general performance of the firms. In the case of the firm object used in paper (3), I knew that the company was unsuccessful and might fail. The reverse can be said about Audoadapt AB, which is clearly a success story as far as firms go (paper 7). In both cases, factors that would enhance performance were selected based on their relevance to the issue of firm efficiency, as confirmed in previous literature.

The last type of validity is predictive validity. Predictive validity, in the context of this study, means that the expected model should be able to predict whether a firm is successful or failing.

Paper 1 is a general review of SME performance models. The method utilized in the paper is valid in the sense that the screening of existing literature produced the desired topology. In paper 2, I categorized existing SME performance models in relation to two parameters: their coverage intensity (the vertical axis), and their information intensity requirements (the horizontal axis). Both of these parameters are valid measures for the nature of the output generated from the different SME performance models.

In paper 3, the validity of the data used in the analysis of the firm stems from two facts: the firm studied falls within the definition of SME, as it had less than 250 employees,

and the data was taken directly from the accounting reports of the firm for the period of the analysis. Also, the analysis was performed while I was working on a project in the company, so I had continuous contact with the management team of the firm.

Paper 4 is valid because it is a review of existing literature that discusses the components that impact innovativeness in society in relation to the external environment of the firm. These components are human capital, financial capital, and system capital. The validity is also enhanced, as the group of countries analyzed using the IBAM tool are located in the Arab World. The countries of that region have wide variations in the availability of the three components of innovation capital. Paper 5 connects the discussion of innovation to the entrepreneurial policies needed to enhance such activities in relation to the external environments of the firm.

The Arab World was chosen because the difference between the levels of the three components of capital is highly exaggerated. The level of differentiation between the intensity of innovation capital components enhanced the validity of the study's analysis. The discussion about open capital originated in paper 6, through its introduction of the open innovation concept advanced by Chesbrough (2001, 2003). The paper also drew from the general discussion about the impact of information and communication technologies on firm activities. This secured the validity of the analysis used in the paper. In paper 7, the data used in the analysis of the firm is valid for three reasons: the firm studied falls within the definition of SME, as it had less than 250 employees; the data was delivered from the firm's management for the period of the analysis; and the owner of the firm is a close friend of mine and thus had good access to the situation of the firm. Actually, I have been following the development of the enterprise for years.

Although other models such Z-Score and ZETA have their disadvantages, they are more robust than the SIV model. The classical firm performance models have been in use since the sixties, and have been tested in many situations. The SIV model is still in its early stages, and only two case studies were performed beyond the larger sample of Swedish SMEs investigated in Abouzeedan (2001). Thus, the robustness of the SIV model is less than that of the older models. This is naturally a weakness until the SIV model has been tested enough to prove robust. However, having said that, it is expected that the robustness of the SIV model will improve with time, as it is a theory-driven model and responds better to the true conditions of SME.

Another weakness when it comes to the validity of my research is the fact that for some firms the slope of the Survival Progression Indicator (SPI) is near the zero value (paper

3). It is hard to get rid of the transitional region between successful firms and failing ones. Therefore, a practical approach is required to define the borders of this transitional area. I used the term “transitional” instead of “grey” to emphasize that this is not an area where we lack information but rather a region where the firm’s future can move either to a more secure or to a more critical condition. Contrary to the SIV model, traditional models such the Z-Score and ZETA Score have developed over time a solid understanding of this transition area and have defined its limits within a specific context determined by the data input. In the case of the SIV model, two approaches can be used to address the transition area. The first is to use the slope of SPI (expressed either as the true survivability coefficient or the true survivability angle) to form an approximate value based on the results from the original working papers of 2001, 2002, and 2003 (Abouzeedan 2001, Abouzeedan and Busler 2002, 2003) and papers 3 and 7 in this thesis, and draw a general approximation (which requires further verification in more empirical work).

If one considers a 45 degree slope to be the lower limit for an SPI indicator pointing to higher growth rates and a 30 degree slope as the lower limit of growth for a normal firm, then a range covering a survivability angle limit of +30 to -30 degrees may represent the transitional zone. To be more exact, a survivability coefficient limit of exactly (+0.6, -0.6) will correspond to survivability angles (-30.9638, +30.9638) degrees. I choose 45 degrees as the border between strongly growing and normally growing firms, because it corresponds to 50% of the maximum value of the theoretical possible survivability angle. This was an arbitrary choice, and a lot of empirical work is required to determine a more accurate location for these borders. Furthermore, the borders of the transitional area depend on the nature of the sector in which the firm is active and on the internal dynamics of firm growth in such a sector.

The other approach is to use graphical statistics to determine the transition area. Here, some caution is necessary. The SPI line can be problematic depending on the researcher’s visual estimation of its slope, because the survival index value corresponds to the vertical axis, and has large variations in its scale depending on the firm tested. In the 2001 paper, some SIDs had almost a straight line because their range of variation in the SI value was many times less than those of other firms. I thus do not recommend comparing firms based only on the appearance of their SPI lines; rather, visual comparison should be accompanied by calculating the true value of the slope (i.e., the true survivability coefficient).

The graphical statistics are quite helpful in another way, however. The survival factor graph indicates the change in a firm’s SI value between individual, consecutive years.

If the number of data-points on the negative side of the horizontal axis is larger than the number of the data-points on the positive side, then that indicates a firm that is performing badly. If most of the points are on the positive side, then one can be assured that a firm is performing well. If most of the points are at the horizontal axis or very close to it, that indicates that a firm is in the transition zone (paper 3, figure 1b). The same can be said about the graph for the survivability coefficient diagram (paper 3, figure 1c). So, the SIV analysis can benefit from using both visual and mathematical approaches to be sure that the diagnosis of the firm under consideration is accurate.

The issue of reliability

An important criterion of measurement is the tool's reliability. A reliable measurement is a one that, if applied time after time, will yield the same results (Welch and Comer 1988). As Norrman (2008) states, reliability can be understood to indicate the extent to which measurement procedures generate the same results on repeated measurement occasions.

The intended model used in the two case studies proved its ability to differentiate a successful firm from an unsuccessful firm. It will be interesting to re-evaluate the same companies that I used in the two studies again, after some time has passed. Such evaluation should utilize the existing data and complete it with more new data reflecting the additional years of analysis incorporated. It is important to highlight that reliability should be understood in relation to the research method used—in this case, qualitative. In qualitative research, the issue of focus is "authenticity" rather than "reliability." The aim of qualitative research is to gather an authentic understanding of the participants' experiences. That is why open-ended questions are more suitable for this type of research (Silverman 2001). However, open-ended questions are not the best method for performance research aimed at constructing viable models. For this, a combined qualitative and quantitative approach to the issue is necessary. Because of the nature of performance measurement, the model's reliability must be asserted by repeating the SIV analysis of the firm several times.

It is also very important to choose measures that are understandable to the potential audience. Measures that are too esoteric, no matter how reliable and valid, will not be practicable (Welch and Comer 1988). A sound SME performance model should therefore be both easy to comprehend and a reliable measurement.

In paper 1, the reliability of the topology analysis performed is granted by the availability of the literature used to develop the paper; the analysis can be repeated without any restriction. In paper 2, the ASPEM tool was developed using the existing literature on

SME performance. Thus, the tool can be reproduced without any difficulty. In paper 3, the SIV analysis reliability is confirmed by the fact that the input information required are standard parameters that exist in many standard result or balance calculations. Information about the initial investment in the firm and the extent to which the firm was self-financed is not hard to find. The technology intake data can be taken directly from the financial records or deducted from the accountancy information, thus securing the reliability of the analysis in paper 3. In this case study, the technology intake was not an issue because the firm did not invest in development.

The IBAM tool was developed in papers 4 and 5, out of the existing literature about the components of human capital, financial capital, and system capital. Therefore, the same analysis can be reproduced without difficulty. The application was performed on firms located in Arab countries. This granted a test for an extreme case, where all the components are exaggerated. Logically, less differentiated regions would be easier to discuss. Thus the reliability of the analyses in these two papers is secured.

In paper 6, the discussion about open capital is originated through the introduction of the open innovation concept advanced by Chesbrough (2001, 2003). The paper drew also from the general discussion about the impact of information and communication technologies on firm activities. This discussion can be regenerated, which secures the validity of the analysis used in the paper. In paper 7, the SIV analysis reliability is confirmed by the fact that the input information required are standard parameters that exist in many result or balance calculations. Information about the initial investment in the firm as well as the extent to which the firm was self-financed is possible to deduct from the firm's accountancy information. The technology intake data can be taken directly from the firm's financial records. In this particular case, the management of Autoadapt AB was very generous and provided all the necessary input data. This secured the reliability of the analysis in paper 7.

There are problems related to granting reliability of measurement in the papers of the thesis. Basically, the SIV model is not very robust, as it has not been tested many times. It might not make the expected predictions across the whole scope of variations in business sectors and geographical locations. Repeated tests of the model should elevate its degree of reliability. Any threat to reliability in papers 1, 2, 4, 5, and 6 would come from the introduction of new research that contradicts the findings in the literature I relied on to build my case in these papers.

The issue of generalizability

Generalizability can affect experiment design and cause the investigator to give preference to a quantitative research method (Welch and Comer 1988). Often, the term "generalizability" is coupled with the statistical representativeness of a sample, which is characteristic for quantitative research. Qualitative research findings can be generalized in a different sense. They may be generalized to other similar settings or contexts, or they may involve theoretical generalization. In theoretical generalization, findings are extrapolated in relation to their theoretical applications (Ritchie and Lewis 2003). The theoretical approach to generalizability is of key significance when applying qualitative methods in SME research.

This section addresses the generalizability of the research method for all the papers in the thesis and explains how generalization is achieved. The group of papers used in this thesis is conceptual in nature. The generalizability of their analyses stems from the fact that the argumentation and reasoning used to produce them is general in its nature.

Papers 3 and 7 differ from the rest, as they are case studies performed on two firms. Both deal with Swedish SMEs, and firms used in both studies even reside in the same region in Sweden—the Gothenburg area. Due to the aim of the comparison, the most relevant difference between the two companies is that one of them works in a classical economic activity (fishery), while the other works in healthcare technology. It is possible to generalize these two case studies to assess the ability of the SIV model to address the stated challenges that face SME performance models.

In the papers, I used the SIV model to conduct two case studies. The SIV model is much more recent than other performance measurement models for SMEs. The other models have been tested more times, which makes them more robust. Thus, their generalizability is more granted than that of the SIV model. However, I believe that my structuring a more generalized framework of the SIV model without using statistical refining at the early stages of development should clear a reasonable level of generalizability.

I am more confident in the generalizability of papers 1, 2, 4, 5, and 6, as the literature I used has a generalized nature. I tried to avoid sources that were more specific in nature and those that do not deal with the issues of innovation and performance in a generalized way.

It is important to point out that, in the construction of this thesis, I used a sample of 39 Swedish small firms in the IT sector to create and test the SIV model (Abouzeedan 2001). Within the thesis, I studied two individual small Swedish firms in-depth, to illustrate the capacity of the SIV model to deliver a full analysis of the firm situation. I conducted the

first case on a small firm, in the fishery industry. I performed the second case study on an SME that is active in the healthcare sector. In the thesis, I used both the conceptual qualitative approach (in papers 1, 2, 4, 5, and 6) and the empirical quantitative approach (in papers 3 and 7).

4. The Process of the Papers

In this chapter, I review each of the seven papers of the thesis. I discuss each paper's history, provide a summary of each paper, and describe each paper's contribution to the purpose of the thesis.

Paper 1: "Typology Analysis of Performance Models of Small and Medium-sized Enterprises (SMEs)"

This paper was published in the Journal of International Entrepreneurship 2(1–2), 155–177, Abouzeedan, A. and Busler, M. (2004).

History of paper 1

The origin of this paper goes back to 2002, when we tried to map the existing knowledge of SME performance models. To do that, we performed an extensive review of existing literature in this area. At that time, we found no paper that had accumulated the research effort in terms of building firm performance models. The existing work handled the issue from various other aspects, such as business strategy and management practices. But there was no single publication that presented all available information. Our reviewing effort produced basic material that we incorporated in a single review article. The resulting working paper was presented at The Third Biennial McGill Conference on International Entrepreneurship, which took place in Montreal, Canada on September 13–16, 2002. The theme of that conference was "International Entrepreneurship: Researching New Frontiers." We used the comments from the conference participants to further develop the paper. After a final assessment of the paper, it was submitted to the Journal of International Entrepreneurship, where it was published in a final version in 2004. This journal version improved upon the original discussion surrounding performance theoretical models of SMEs, as displayed in the working paper.

Summary of paper 1

There are a number of firm performance models available. Some of these models focus on the internal environment of the firm, while others consider the firm's external environment, investigating a population of firms rather than a single enterprise. Reviewing these models and discussing their individual strengths and weaknesses would help academic researchers as well as professional users to become more efficient and to better understand

and appreciate how and when these various models should be used. The theoretical models for SME performance are divided into two categories: firm dynamics theories and performance prediction models. In the first part of the paper we discussed our point of view relevant to firm dynamic theories, including discussion on stochastic theories, learning model theories, and hazard modeling theories. In the second part of the paper, I examined the failure prediction models of SMEs, which included Z-Scores, ZETA Scores, and Neural Networks (NN). The strengths and weaknesses of each model were exposed and discussed. I found that the traditional performance models are more concerned with bankruptcy and insolvency than with performance in general. In order to address this shortcoming, an alternative SME performance model is needed. The intended model should be accessible and should have a more direct approach in terms of evaluating SME performance.

At the end of the paper, we presented a strategic approach for future development of firm performance models of all categories, including SMEs. Our view is that the most urgent need exists at the polar extremes of the firm size spectrum, which are not well-researched due to the complexities of their dynamism. Start-up businesses lack the cumulative knowledge needed to build models, while Multinational enterprises (MNEs) have a higher degree of operational complexity and need stronger performance predictors. In the paper, we stressed the need for new models that apply to these categories of firms. We pointed out that there is no need to further develop new models for SMEs while more research is needed to develop the intended model so that it accounts for the specificity of a firm's business sector and geography. In the paper, we stressed that the intended model could be extended to cover an even larger spectrum of firms than those studied in the paper. There are a lot of benefits to be gained if the adapted concept is extended to cover additional categories of firms, as deficiencies exist in the current performance models used for these firms. Also, the intended adaptive model can be used to study possible scenarios of company development.

Contribution of paper 1 to the purpose of the thesis

The paper displays a topological analysis of SME performance models. There are basically two groups of SME performance models: firm dynamic theories and financial failure prediction models. The models of the first group are related to the external environment of the firm, making them unsuitable to the internally-focused performance evaluation of single firms. The models of the second group focus on the internal environment of the firm, and thus are more suitable to the investigation of single firm performance. However, with the exception of the SIV model, all models rely heavily on business ratios, give preference to

quantitative variables, neglect the important issue of innovation, and are unpractical to use as management tools. The models do not account for variations in firms due to different business sectors and other external factors, although they do present better performance analysis tools than that of pure human judgment.

The paper discusses important characteristics to consider in crafting the desired model for SME performance evaluation. Among these is the need to obtain a balance between quantitative and qualitative factors when selecting input variables for the models. There is also an emphasis in the literature criticizing the intensive usage of business ratios and the tendency of models to be complex and non-practical for use. When, for example, ZETA Scores are used to judge allowances for new loans, banks tend to exclude potentially successful firms, thus inducing the bankruptcy of those firms. The literature evidence provides a clear criticism against using complex statistical refining methods to select the input parameters, and calls for a more simplistic approach.

The paper uses existing literature to stress the role of innovation in enhancing firm survival and growth (Mansfield 1962, Audretsch 1991). The survival index is split into two parts: one covers the operating conditions and another covers the technology intake. The SIV model looks at the issue of the firm's external environment and that environment's impact on firm performance in general, but also considers the external environment in relation to the firm's innovation activities. Such parameters as sector age, the definition of SMEs and the firm's input into the innovation activities of others require that the external environment of the firm be accounted for in relation to the firm's innovation activities. The paper makes a clear distinction between financial failure prediction (or bankruptcy) models, which are internally focused, and firm dynamics theories, which focus more on the firm's external environment.

Paper 2: "ASPEM as the New Topographic Analysis Tool for Small and Medium-sized Enterprises (SMEs) Performance Models Utilization"

This paper was published in the Journal of International Entrepreneurship 3(1), 53–70, Abouzeedan, A. and Busler, M. (2005).

History of paper 2

The reason for this paper was our need to have a clear strategy for using the existing SME performance models in different situations related to analysis, as well as in

relation to information availability about the studied enterprises. Such a strategy, to the best of my knowledge, did not yet exist in the literature; whenever SME performance models were discussed, the discussion was restricted to a purely operative level, without an overall strategic perspective of the issue. The paper originated as a single-authored work, wherein I tried to establish a strategic approach for the usage of SME performance models. It was first presented in the 7th Nordic-Baltic Conference in Regional Science, Regional Integration and Transition, which took place in Ystad, Sweden during October 2–5, 2002. The meeting was organized by the Nordic Centre of Spatial Development (http://www.nordregio.se). The paper was developed and published in the Journal of International Entrepreneurship in 2005.

Summary of paper 2

A couple of models are used to evaluate the performance of SMEs. These models vary in nature. They can be related to the external environment within which the firm resides or to its internal environment. Hazard, stochastic, and learning models are examples of models that relate to external factors, while Z-Scores, ZETA Scores, and Neural Networks are examples of models that relate to internal factors.

Utilizing SMEs indiscriminately will negatively affect the outcome of the majority of SME studies. However, using diverse firm performance models in an effective way requires strategic thinking. In this paper, we re-introduced a tool called the Arena of SMEs Performance Models (ASPEM) diagram. The horizontal axis in the diagram indicates the information intensity requirement of the model. The vertical axis indicates the coverage intensity of the model, varying from an individual firm up to a whole group of firms. By allocating each of the SME performance models to the suitable region of the ASPEM diagram, researchers can better build a sound strategy for the application of these methods. The diagram guides the researchers into possible future performance models development work.

The ASPEM diagram is flexible and practical. Therefore, any new SME performance model could be found a place within the diagram. The diagram indicates clearly that there are areas where new models are needed. The first area is actualized in situations where researchers consider a larger group of SMEs while having detailed information about all of the firms. The second situation arises when researchers consider a larger group of SMEs and have only a moderate degree of information available at the single firm level. In both cases, the models focus on the external environment of the firm, and investigate how the firm performance of a single company relates to the general population of enterprises in a certain

sector or geographical area. A third situation occurs when the researcher focuses on a single firm and has very low information availability about the firm's start-ups or pre-start-up phases. In this last case, the focus is on the internal environment of the enterprise.

Contribution of paper 2 to the purpose of the thesis

Paper 2 introduces a strategic tool, the Arena of SMEs Performance Models (ASPEM) diagram, for the selection of suitable performance models. The horizontal axis of the graph indicates the information intensity requirements. The vertical axis indicates the coverage intensity of the model. The first parameter considers the information requirements of the models, while the second describes the level of analysis covered by each model, from single firm to a population of firms. As the diagram indicates, traditional models that function at a single firm level, such as the ZETA and Neural Networks models, require a high level of information intensity. That implies the need for detailed data, which is something that SMEs generally lack.

The desired model requires a reasonably moderate data input to counter the issue of SMEs' accounting and reporting techniques, which provide less intensive information input than those of large firms. The SIV model has a moderate information level. The ASPEM diagram functions as a map to indicate the extent to which the different models relate to the internal and external environments of the firm. As the coverage intensity (the vertical axis) becomes lower, the analysis becomes more focused on the internal environment of the firm. Examples for such models are the ZETA model, the Neural Networks model, and the SIV model. The difference between these is that the SIV model connects the internal environment of the firm to the external environment, due to the way in which the different qualitative parameters are expressed. When coverage intensity is high, the models have more focus on the external environment. Examples of those models include the stochastic models and Hazard modeling. The learning model has a relatively intermediate level of coverage intensity, indicating a dual focus.

Paper 3: "Analysis of Swedish Fishery Company Using SIV Model: A Case Study"

This paper was published in the Journal of Enterprising Culture 12(4), 277–301, Abouzeedan, A. and Busler, M. (2004).

History of paper 3

The origin of this article stems from three working papers that were merged together. The first is a short work published in 2001, in which we presented the concept of the SIV model (Abouzeedan 2001). We then wrote another version of the paper, which was published in a conference at the University of Durham in 2002 (Abouzeedan and Busler 2002). A third version was developed, and was published in 2003 at the ISBA 26th National Small Firms Policy and Research Conference at the University of Surrey, Surrey, U.K. (Abouzeedan and Busler 2003). By that time, we felt the need to test the SIV model in the context of understanding the performance of a Swedish SME company.

We wrote this paper while I was practicing at the object firm in 2001/2002. The enterprise is a family business based in the traditional fishing industry in Sweden. The enterprise was started in 2001—thus a young company then. The tested firm worked with fish filets within a business sector defined as the "fish preparation industry." The enterprise had poor performance throughout its short life, and so the owners asked me to investigate the performance. We suggested that they use the SIV model.

The aim of this study was to test whether the SIV model could reflect the true performance of the firm. The analysis indicated that the company had an uncertain future, and resulted in an empirical paper which was published in the Journal of Enterprising Culture in 2004. This paper presents the first published empirical work, excepting the working paper of 2001 (Abouzeedan 2001), in which the SIV model was used to analyze SME performance.

Summary of paper 3

The original work upon which paper 3 was based proposed a new parameter of the SIV model (Abouzeedan 2001, Abouzeedan and Busler 2002)—the Survival Index (SI). The new parameter is calculated using an equation known as the Survival Index Value Equation (SIE). We knew that this particular firm was performing badly before we began the analysis. We expected that if the SIV model was unable to predict the firm's behavior, then it would not be an effective tool in differentiating firms that perform well from those that do not.

The results indicated that the SIV model can be used to correctly predict and evaluate the performance of the object firm. The firm had a majority of negative survival factor values during its years of operation, and also had a majority of negative survivability coefficient values. The SIV model thus confirmed its functionality. The test showed that the model is worth developing and fine-tuning. However, there are risks and limitations of instability imbedded in the model, when input information is not intense enough. Such a situation can arise when the analyzed firm is young and the researcher uses longer periodicities with lower periodicity coefficients. That is why it is important to run a prediction power test before performing the analysis.

The case study presented in this work indicated the analytical power of the new model, as it succeeded in giving a reasonable indication of the worsening situation of the enterprise. During the SIV analysis of the Swedish firm, new concepts were introduced to increase the practicality and analytical capacity of the model.

Contribution of paper 3 to the purpose of the thesis

The analysis was performed on a small Swedish fishery that had 6–12 employees. The analysis covered two fiscal years, 1999–2000 and 2000–2001. In comparison to the existing models, which require a larger number of business ratios, the SIV analysis uses basic accountancy data, without advanced statistical methods of variable elimination.

Due to the flexible nature of the SIV model, one could run the analysis at periodicity coefficients of two months to six months. Different coefficients produced variations in the value of the true survivability coefficient, from -5.859 to +8.451, reflecting the dynamics involved in the SIV model. A good model should respond to variations in firm age. Having different periodicities enabled us to run a reasonably good analysis on a firm only slightly older than two years. The model was also able to account for the type of financing used to start the firm via the ratio of self-financing to initial investment. A good model for SME performance evaluation should be realistic when it comes to how entrepreneurs rely on their resources to initiate a firm when necessary, as this is something not accounted for in classical models. A graphic representation using the Survival Index Diagram (SID) helps managers to easily visualize and comprehend the performance history of their companies. The Survival Progression Indicator (SIP) can be used to project the future development of the firm, under a certain level of uncertainty, not counting for unforeseen events. Using a two-month analysis, one can see that the slope of the SPI line is expressed as the true survivability coefficient +5.845 (compared to a maximum theoretical value of infinity). We anticipate that

hyper growth firms will have higher true survivability coefficient values than firms with classical rates of growth.

The technology intake in this case study was considered to be zero, as the firm had no development activities. In that sense, innovation aspects were considered, but could not be assigned a value other than zero. Three considerations determined the level of technology intake for this firm. First, there was no budget assigned for R&D activities. Second, the firm was in a traditional industry. Third, the firm was very young when the analysis was done (2.176 years old) and had not yet created an R&D strategy.

The average age of a sample of businesses in that firm's industry was 22.398 years, indicating that it is a relatively a young sector. One would not expect such a young industry, because fish-related activities are a very old tradition in Western Sweden. The lower average of age in that sector clearly indicates that the processing of fish is not so old an industry as one might assume.

We used a maximum limit of 50 employees to define a "small firm" in the case study. The firm's relative size figure varied between 0.12 and 0.24. These figures allow researchers to compare the performance of firms in the same sector from different countries or regions, even if the countries have different definitions of firm smallness. By looking only at their relative sizes one can, to a large extent, reduce the distortion due to variations in definitions. Such an approach allows researchers to account for the firm's external environment in relation to its firm innovation activities.

Paper 4: "Innovation Balance Matrix: An Application in the Arab Countries"

This paper was published in the World Review of Entrepreneurship, Management and Sustainable Development 2(3), 270–280, Abouzeedan, A. and Busler, M. (2006).

History of paper 4

The first three papers deal with firm performance from the perspective of the internal environment of the firm. Paper 4 shifted the focus of the performance analysis to the firm's external environment. In the process, it introduced some ideas and concepts that can be used as technology intake indicators for performance models concentrating on the external environment of a firm. This is an essential factor to consider when looking at the impact of technology generation and absorption on economies.

We often wondered why some countries lack entrepreneurial drive and have low innovative output, while other countries have a higher level of entrepreneurial drive and innovative activities. We wanted to look at the components that present the input capital into the innovation vitality of an economy from the perspective of individual firms' needs and external environments. That led me to write the first version of this work. The first draft of this effort started as working paper, which was presented at the 7th Uddevalla Symposium at Östfold University College, Fredrikstad, Norway, June 17–19, 2004. In that paper, the concept of Innovation Capital was first introduced. One year later, in 2005, the paper was reworked and the analysis performed on firms located in the Arab World. In 2006, the resulting paper was then published in the World Review of Entrepreneurship, Management and Sustainable Development journal. In that paper, we argued that economies have different levels of entrepreneurial activities depending on the availability of tangible and intangible resources. The paper introduced innovation capital as a new concept comprising three components: human capital, financial capital, and system capital.

Summary of paper 4

This work introduced a new type of capital—innovation capital. In the paper, we argued that innovation capital can be used as an indicator for the degree of richness of the entrepreneurial environment in a region, and thus can describe the economy's general character. The paper also introduced another new type of capital as a component of innovation capital: system capital. System capital is related to the input of the society and its institutions in support of the entrepreneurial and innovation activities of firms.

To analyze the different possible scenarios resulting from the imbalance among the components of innovation capital, a new analytical tool was introduced: the Innovation Balance Matrix, or IBAM. IBAM is an analytical tool that classifies economies based on their entrepreneurial conditions. IBAM was used to look specifically at Arab countries using a general knowledge and deductive approach to the issue. We argued that the three components of innovation capital must be in balance in order for an economy to be innovative and entrepreneurial in nature. If one of the components is disproportionately larger than the other two, an unbalanced external environment exists. That in turn leads to a negative impact on the total innovative environment of the economy.

The IBAM analysis produced two types of economies, one in which firms and their founders are entrepreneurial and the other in which firms and individuals in them are less entrepreneurial. The IBAM analysis suggested an additive solution in the context of the Arab

World firms, in order to solve the lack of innovative entrepreneurial output in the region. Each Arab country enjoys an abundance of one of the three components of innovation capital but shows a clear deficiency in the other two components. The additive solution is to create a common efficient market in order to facilitate the flow of the type of capital among these countries.

Contribution of paper 4 to the purpose of the thesis

The innovation capital richness of a society is determined by its availability and that society's balance of the three components of innovation capital (human, financial, and system capital). This analysis was performed in relation to the external environment of the firm and used the Innovation Balance Matrix (IBAM). The connection of the external environment aspects to the internal environment aspects of firm performance was made clear in our study of the categorization of firm performance models.

Innovation is neglected in traditional models through their neglect of research and development input into firms. The availability of financially cheap resources is not considered in traditional methods. Financial assets are used not as indicators of the availability of financial resources to the firm but rather a substitute for firm size. Using the assets figure to determine firm size causes problems, however. Existing models also lack clear connection to system capital because they do not take in consideration the societal input. Traditional models neglect variations in the business sector such as geography, economic conditions, and age, because they do no couple firm performance with societal input (expressed as system capital).

A desired SME performance model must incorporate innovation at an internal environment level. The SIV model achieves this incorporation through use of the technology intake parameter (see page 3). However, it is also important to consider the innovation input in relation to the enterprise's external environment. Innovation activities at the external environment level affect the firm's internal environment. The IBAM tool helps researchers to assess this input by stressing the need for balance between human capital, financial capital, and system capital, so that the innovation capital levels can be enhanced.

At the external environment level, an evaluation model of SMEs that considers innovation aspects must also consider the aggregate level be it regional, national, or global. The IBAM provides for that analysis in relation to the external environment of the firm. Although the discussion about the three types of innovation capital is not meant to provide a

model for measuring firm performance in relation to the external environment of the firm, it provides potential input parameters to facilitating such analysis.

Paper 5: "Entrepreneurial Policies and the Innovation Balance Matrix: The Case of the Arab Countries"

This paper was published in Allam Ahmed (ed.), Science, Technology and Sustainability in the Middle East and North Africa, Vol. 1, pp. 158–175, Abouzeedan, A. and Busler, M (2007).

History of paper 5

The issue of the connection between economic progress and entrepreneurial environment has been researched from diverse approaches. One way to look at the question is to use deductive analysis regarding the forms of capital that contribute to the entrepreneurial external environment of firms. In paper 4, an IBAM analysis was performed to assess firms in the Arab World. It found that the best solution to the lack of individual entrepreneurial economies in that region is the "additive solution." We felt the need to continue the arguments presented in the previous paper and develop discussion about the "additive solution." This resulted in a paper with a focus on strategic issues in relation to the firm's innovation, entrepreneurship, and economic output. The paper is a good example of a policy-oriented work, and was published in a special volume entitled "Science, Technology and Sustainability in the Middle East and North Africa." The volume included works from various scholars who are interested in issues of economic development in that region.

Summary of paper 5

Paper 5 builds on paper 4 and also one working paper from 2004 (Abouzeedan and Busler 2004). Researchers have investigated the connection between economic progress and the entrepreneurial external environment of firms using diverse approaches. One way to look at the question is to apply deductive analysis to the forms of capital contributing to the entrepreneurial environment of a given society.

The paper solidifies the issue of knowledge's impact on the economic value of product development by proposing new concepts such as the Knowledge Embedded Value (or KEV) and the Knowledge Embedded Value Margin (or KEVAM). Both concepts emphasize that the true value of a product is related to how much knowledge (in the form of

research) and development effort is embedded in it. These two concepts can be regarded as input indicators that could contribute to the development of performance models that assess the external environment of the firm.

An analysis using IBAM was performed on the Arab World, and was used to argue that there are three regions in that area, if a region can be classified based on its abundance of the components of innovation capital. In all three regions, there was a single component at the right level, while the other two were disproportionately at the wrong level. That is why none of these three groups can satisfy the requirements for balanced innovation capital. We concluded that the only solution to the lack of a specific type of capital components in each of the three subgroups within the Arab world was to integrate the whole region in what researchers call an "additive balanced matrix" solution, which means creating a single Arab market. Furthermore, the paper looked at basic factors shaping the economies of the Arab countries, including the negative impact of e-globalization on Arab countries and the competitiveness of the Arab economy. The paper considered the characteristics of the Arab world economy and compared them to the characteristics necessary for an e-globalized economy. The paper was closed with a discussion about the best strategies to achieve the "additive Balance Solution." The recommendation was to begin a gradual assimilation process encompassing several steps in order to create a single Arab market. The strategies presented seek to reflect a pragmatic, action-oriented sense of the possible.

The discussion about firms in the Arab World is used as a model for the discussion of innovation with focus on the external environment of the firm in other regions of the world. Thus, the analysis suggested in the paper can be used to assess any economy or group of economies.

Contribution of paper 5 to the purpose of the thesis

A model is needed that connects the performance of SMEs in relation to the firms' external environments to entrepreneurial policy issues using the IBAM as the bridging tool. A performance model that is not functioning correctly at the internal environment level can lead to misunderstandings of the nature of a society's innovation activities, and as thus guide leaders to wrong policies. The situation in the Arab World shows how misunderstanding of a firm's situation at the internal environment level can impact the big picture. All entrepreneurial relevant characteristics such as the nature of the local economy, the high degree of fragmentation and dispersion of the economic structure, the narrow scope of some sectors, the absence of knowledge, the lack of innovativeness, the old-style methods

of operation, and the non-originality of the economic theory all stem, to a large extent, from negligence of the role played by SMEs and the need to evaluate their performance using suitable tools. Historically, economic planning in the Arab World did not care to assess SME performance so much as it cared about assessing larger firms. When the Arab countries started to look at their SMEs, they primarily used classical SME performance models, which have all the disadvantages discussed previously. These models relied too heavily on large number business ratios, subjecting them to statistical elimination. What exaggerated the problem was the fact that SMEs in Arab countries lacked the legal obligation to provide transparent bookkeeping reports.

It is vital that the desired SME performance model not only bridge the focus on the firm's internal environment to the focus on the firm's external environment. Such bridging allows for an understanding of what policies are needed to support entrepreneurial development in regions with less economic output. Understanding the entrepreneurial policy required can help us to understand the innovation dynamics in economies as relates to the external environment of the firm. The analysis provided uses the three components of innovation capital (human capital, financial capital, and system capital) and provides input indicators to build upon models of performance that consider the external environment of the firm.

Paper 6: "Managing Innovation in e-Globalized Economy—Defining the Open Capital"

This paper was published in Allam Ahmed (ed.), World Sustainable Development Outlook 2009, The Impact of the Global Financial Crisis on the Environment, Energy and Sustainable Development, World Association for Sustainable Development (WASD), Part VII, Knowledge Management and Education, Chapter 30, pp. 287–294, Abouzeedan, M., Busler, M., and Hedner, T. (2009)**.**

History of paper 6

This paper was the first article written when I joined the Innovation and Entrepreneurship unit at Sahlgrenska Academy, University of Gothenburg, Sweden. Before that paper, I performed most of my research as an external academic, in association with academicians from universities in Sweden and the USA.

Paper 4 introduces the concept of innovation capital. One of the co-authors of this paper, Head of the Innovation and Entrepreneurship unit, Professor Thomas Hedner, noted

that researchers needed to relate innovation to the degree of the openness of the innovation system itself. The realization that openness is actually a resource to consider in the discussion about innovation and innovation capital motivated us to introduce the fourth component of innovation capital: open capital. The paper was rushed into formulation and presented at the WASD conference in Manama, Bahrain during the period of November 9–11, 2009.

Summary of paper 6

In the working paper of Abouzeedan and Busler (2004), we proposed a new type of capital (i.e. innovation capital). Innovation capital was meant to serve as an indicator for the degree of richness of the entrepreneurial environment in an economy. However, the issue of accessibility and openness in the innovation process was not reflected in the innovation capital concept as first presented. Innovation activities in modern economies tend to be interconnected and open in their natures, and our understanding of the innovation process must reflect that. Paper 6 considered how to incorporate the openness dimension within the concept of innovation capital. It proposed a fourth component of the innovation capital: open capital. The paper also reflected on how the four components of innovation capital are interconnected.

To distinguish the concept of open capital from the usage of open capital in classic financial management literature, the paper introduced a number of dimensions related to open capital as a component of innovation capital.

Contribution of paper 6 to the purpose of the thesis

At the external environment level, the input indicators that are candidates for performance are the four components of innovation capital: human capital, financial capital, system capital, and open capital. Classical firm performance models were built in a period when there was limited exposure concerning firm networking and the degree of interaction and exchange of resources and knowledge among companies. This showed in the way SME performance models were built. The input parameters were defined in a way that avoided relating the performance of a single firm to other firms either within or outside the same sectors. Even the models that dealt with performance issues in relation to the external environment of the firm neglected the impact of networking and the exchange of resources and knowledge on firm survival and growth. The internally-focused models were all structured out of a single-firm perspective, and were built to consider a single firm in isolation from all other enterprises.

Neglecting the networking nature of modern economy is a major weakness in classical performance models for SME, especially as concerns innovation issues. SME performance models are less able to capture the contemporary nature of innovation processes, which tend to exist in the spirit of the open innovation paradigm (Chesbrough 2001). Networking enables SMEs to build competitive advantages, and as thus enhances their ability to develop new products despite their limited resources and without impacting their flexibility (Wincent and Westerberg 2005). To be able to capture the true nature of innovation in modern times and reflect on the open innovation paradigm, an SME performance model must consider networking issues.

One way to implement the concept of indirect networking is by relating the input parameters to the internal environment of the firm. In this approach, one can relate the size of the firm to the maximum size attainable for the class of firms designated as SMEs. Wincent and Westerberg (2005) stressed two factors of importance in relation to firm performance when they discussed SME strategic networks: firm size and CEO personality. Another way to relate input parameters to the internal environment is to relate the firm's age to the age of the sector using the "average life span" concept (paper 3). Networking and openness are also reflected in the introduction of the open capital concept at the external environment level. It is even materialized at the internal environment level, through the introduction of the technology intake parameter (paper 3). Networking's impact on firm performance is also accounted for in the input from other firms into the innovation activities of the object firm. Technology intake deals with both the direct and indirect effects of innovation activities as single input figures encompassing both inward technology intake and outward-technology intake (papers 3 and 7). By integrating and defining the openness issue, the paper contributes to an improved approach to building performance models that are able to focus on the external environment of the firm.

Paper 7: "Implementing the SIV model on an Intensively Innovation-Oriented Enterprise: The Case of Autoadapt AB"

This working paper is presented at the International Council for Small Business (ICSB) Conference, Stockholm, 15–18 June 2011, Abouzeedan, A., Hedner, T. and Klofsten, M.

History of paper 7

To complete the message embedded in the thesis, we needed to run an SIV analysis model on a candidate firm that is focuses on innovation and inventive solutions in its operations and its product development. We selected a candidate that satisfied our objectives: Autoadapt AB. Autoadapt is a Swedish SME active in the field of healthcare. The company provides solutions to adapt personal cars for handicapped people. The company had a work force range of 49–90 employees through the years.

Summary of paper 7

This paper is a case study wherein the model is implemented, with the innovation aspects playing a major role in the evaluation of the firm's performance.

The studied firm, Autoadapt AB, is an innovative firm that maintains product development as a central activity. The firm works to adapt personal cars for the usage of handicapped people, both as drivers and as passengers. Because of the nature of this business activity, there are few standard product solutions; unique products must be developed to meet the variety of customer needs. This necessity induces in the firm a state of continuous invention and a profound innovation profile. The firm's managing director and owner is a very active entrepreneur. He is involved in a couple of projects, with focus on promising new technologies.

In all the papers presented in this thesis thus far, the major contribution was performed by me with the support of Professor Michael Busler from The Richard Stockton College of New Jersey, USA. The only exception was paper 6, which I co-authored with Professor Thomas Hedner from Sahlgrenska Academy, University of Gothenburg, Sweden. Paper 7, on the other hand, was developed with the support of Professor Magnus Klofsten from Linköping University, Sweden, and also Professor Thomas Hedner.

Contribution of paper 7 to the purpose of the thesis

The SIV model has the advantage of balancing both quantitative and qualitative input parameters. The quantitative variables in the model include R&D and other outward technology costs, as well as inward technology costs such as management and administrative innovations. These aspects are summed up in the technology intake parameter. The parameter is divided into two variables: the first is the inward technology intake, or SI_{tii}, and the second is the outward technology intake, SI_{toi}. The technology intake parameter represents an agglomeration of both. In this paper, the investment in development was not differential (meaning that it was a sum of the inward and outward technology intakes).

The analysis used an annual periodicity, because the analysis period was ten years—long enough to use such periodicity. The SIDs resulting from the analysis showed Autoadapt AB's continuous performance improvement through the years. All the SI values were positive. Most of the survival factor values, which are single data-points, were located on the positive side. The values for survivability coefficients, which are accumulated data-points, were positive. This indicates that, on average, the change of the survival index was always positive. This reflects a continuous improvement of the firm's performance. Furthermore, the survivability coefficient analysis indicated, as in the established literature, that the first five years of firm existence is critical. The fluctuation of the values of the coefficient during Autoadapt's first five years confirmed how vulnerable a business is during that time. After the first five years, the survivability coefficient value settled at a constant average, indicating a continuous and stable improvement in firm performance. This corresponded also to the steady increase in Auotadapt's expenditure on its R&D activities, from 4.94% of its annual turnover to 9.85% by 2010.

5. Discussion and Analysis

In this chapter, I discuss the advantages and disadvantages of the existing SME performance models. I then describe what characterizes a model that measures SME performance, and I close the chapter with a discussion about how to utilize an SME performance model to account for the innovation activities of a firm.

As noted in chapter 4, the papers of the thesis can be grouped into three sets. The first group includes papers 1 and 2. These conduct a literature review of existing SME performance models and present a topographic system for using the models. Papers 4, 5, and 6 analyze the nature of innovation capital in relation to the external environment of the firm. This group of papers introduces a new tool, the Innovation Balance Matrix (IBAM), which can be used to analyze the four components of innovation capital (human capital, financial capital, system capital, and open capital). Papers 3 and 7 implement the proposed model for SME performance evaluation—the Survival Index Value (SIV) model.

Advantages and disadvantages of existing SME performance models

The first research question asks what are the advantages and disadvantages of the existing models used in evaluating performance of SMEs. To answer this question, the study analyzed three areas: 1) the topological nature of the existing literature on SME performance models; 2) innovation capital and its relevance to firm performance; and 3) how the SIV model can remedy the deficiencies of the existing models.

Topological nature of existing SME performance models

Paper 1 provided a topological analysis of SME performance models. There are basically two groups of SME performance models: those based on firm dynamic theories and those based on financial failure prediction models. The first group includes stochastic, learning, and hazard model theories. All tend to focus on the external environment of the firm. The other group includes Z-Scores, ZETA Scores, Neural Networks, and the SIV model. These are more suitable to the investigation of firm performance in relation to the internal environment of an enterprise. However, with the exception of the SIV model, these models rely heavily on business ratios, are focused on quantitative variables, and neglect non-financial parameters. The models do not consider the important issue of innovation, and they are unpractical to use as management tools. They deal with the firm as a closed system, while in the context of current economical realities firms are highly reliant on one another. The

existing models also do not take into account in their structures the variations in business sectors and other issues of significance to the external environment of the firm.

Paper 2 presented a strategic tool to select suitable performance models for SMEs, called the Arena of SME Performance Models (ASPEM) diagram. The horizontal axis of the ASPEM graph indicates the information intensity requirements. The vertical axis indicates the coverage intensity of the model. The first variable represents the information requirements of the models, while the second describes the level of analysis (from single firm to a population of firms). As the ASPEM diagram indicates, traditional models that function at a single firm level, such as the ZETA and Neural Networks models, require a high information intensity level. Such a requirement can be a problem when it comes to analyzing SMEs, which often lack comprehensive information.

Innovation capital and its relevance to firm performance

The innovation capital availability of firms is determined by their richness and their balance of the three traditional components of innovation capital (human, financial, and system) as well as the open capital. A firm's innovation capital is analyzed in relation to the external environment of the firm by use of the Innovation Balance Matrix (IBAM).

The connection between the internal and external environments of the firm, as relates to firm performance, must be considered in the study of the categorization of the firm performance models. Some of the models are more related to the external environment of the firm, such as stochastic theories and hazard rate models. That relationship is less extensive in the case of the learning models. Other models are more concerned with the internal experiences of single firms, but can also treat a group of internal analyses at an aggregate level. The innovation aspects of firm performance are neglected in the traditional models, as these models do not account for the research and development input of the object firm. The availability of inexpensive resources and their positive impact on performance is not considered in traditional methods. Financial assets are used not as indicators of the availability of financial resources to the firm, but rather as a descriptor of firm size. Existing models lack a clear connection to system capital, as these neglect variations in the firms' business sectors, locations, external environment conditions, and the age of the sector.

Performance of SMEs should be measured by relating the external environment of the firm to its entrepreneurial policy issues, using IBAM as the bridging tool. A performance model that does not correctly assess the internal environment can miscalculate the nature of the firm's innovation activities as they relate to its external environment. This

may guide planners to enact harmful innovation policies. The Arab World shows how misunderstanding a firm's internal situation can impact the whole picture. All the entrepreneurially relevant characteristics, such as the locally concentrated nature of the economy, the high degree of fragmentation and dispersion of the economic structure, the narrow scope of economic development due to policies that focus on only a few sectors, the absence of knowledge, the lack of innovativeness, the old-style methods of operation, and the non-originality of the economic theory, stem, to a large extent, from negligence of the role played by SMEs and the need to evaluate their performance using suitable tools.

To understand the relationship between the firm's internal and external environments, and how that is related to the innovation issue, I used a sample of firms from Arab countries to reflect on the current disadvantages of using traditional models to measure firm performance. Historically, economic planning in the Arab World neglected SMEs and showed no concern about their performance, compared to their concern for larger firms. When the Arab countries started to look at the performance of SMEs in the region, they used classical models with all the disadvantages discussed in paper 1.

The problem with existing SME performance models is their reliance on large number business ratios; the ratios were thus subject to statistical elimination due to the lack of any reporting obligation of SMEs in the Arab World. There exist no transparent bookkeeping reports for smaller enterprises.

Classical firm performance models were built in a period of limited exposure for issues of firm networking and the degree of interaction and exchange of resources among firms. This lack of exposure shows in the way the SME performance models were built. The input parameters were defined in a way that avoided relating the performance of a single firm to other firms, either within its sector or outside it. Even the models that dealt with performance issues in relation to the external environment of the firm neglected the impact of networking and the exchange of resources and knowledge on firm survival and growth. The other models, which are coupled to the internal environment of the firm, were structured to describe a single firm in isolation from other enterprises.

To remedy the deficiencies of the existing SME performance models

The SIV model has a number of advantages over existing SME performance models. The SIV model balances the two types of input parameters (quantitative and qualitative). The quantitative variables include: turnover, production cost, profit margin,

initial total investment, self-financed initial investment, and cost of technology intake. The qualitative parameters are firm size and firm age.

The SIV model is simpler than the existing models and does not use sophisticated statistical methods to eliminate input data. Rather, it uses limited accountancy information in an efficient way. The SIV model can be easily used as a managerial tool. It describes firm performance though a simple graphic presentation of the Survival Index Values in relevance to a time axis. It also accounts for the innovation input to firm performance by incorporating the technology intake parameter in its structure. Two case studies were used to demonstrate the SIV model's ability to deal with the current problems in existing models. The first is case was that of a small fishery firm based in Gothenburg, Sweden, with 6 to 12 employees. The analysis covered two years, 1999–2000 and 2000–2001. Compared to the existing models, which require a greater number of business ratios, the SIV analysis can use basic accountancy data and does not need advanced statistical methods. The fishery firm had no innovation or development activities, and the technology intake parameter was zero (paper 3). The second case (Autoadapt AB) was that of an innovation-intensive firm that adapts cars for handicapped people. In this case, the firm's innovation activity was enough to justify assigning a figure to the technology intake variable (paper 7).

What characterizes a model for measuring SME performance in relation to innovation?

The second research question asks what characterizes a model for measuring SME performance in relation to innovation. To answer the question, three areas are discussed: 1) the desired characteristics of the intended SME performance model; 2) the bridging of the SMEs' internal environment in relation to performance analysis with a focus on the external environment; and 3) the extent of the SIV model's responsiveness to the desired characteristics.

The desired characteristics of the intended SME performance model

Paper 1 discusses characteristics that must be considered to envision the desired model for SME performance evaluation. Among these characteristics is the need to obtain a balance between quantitative and qualitative factors when selecting input variables for the models. The literature frequently criticizes the intensive use of business ratios in existing models, and the tendency of models to be complex and non-practical for usage. When, for example, ZETA-Scores are used to judge allowances for new loans, banks tend to exclude potentially successful firms from consideration, leading to the bankruptcy of potentially

profitable firms. The literature criticized also the models' use of complex statistical refining methods in selecting the input parameters, and called for a more simplistic approach. The desired model should have a reasonably moderate data input to counter the issue of SMEs accounting and reporting techniques, which provide less intensive information input than those of large firms. The SIV model has a moderate information requirement level, compared to the requirements of other models.

The bridging of the SMEs' internal environment focused performance analysis to an external environment focused approach

A desired SME performance model should incorporate innovation at the internal environment level in its build up. The SIV model achieves that incorporation through the technology intake parameter (paper 3). However, it is important to discuss the innovation input in relation to the firm's external environment. Innovation activities related to the external environment of a firm also affect the internal environment of that firm.

Today's firms do not exist in a closed system, or in isolation from their external environments, but rather exist in an open system with a high degree of networking that varies from one sector to another. The IBAM tool establishes the external environment perspective of the firm by stressing the need to have a balance between the three classical components of human, financial, and system capital. When this balance is met, the innovation capital levels can be enhanced both in relation to the external and the internal environments of the firm. The same can be said of the fourth component: open capital. It is important that the desired SME performance model facilitate the bridging of the SME's internal environment analysis to the external environment related issues of innovation using the IBAM analysis tool. It is also important that such bridging creates an understanding of the policies necessary to support entrepreneurial and innovative development in regions with less economic output.

Neglecting the networking nature of modern economy in relation to innovation issues is a major weakness in classical SME performance models. Existing models are less able to capture the contemporary nature of innovation processes, which tend to be conducted in the spirit of the open innovation paradigm. Any strong SME performance model has to assess networking issues in order to capture the true nature of innovation in modern times and reflect on the open innovation paradigm, as called upon by Chesbrough (2001). Networking enables SMEs to build competitive advantages, and as thus enhances their ability to develop new products despite limited resources and without impacting negatively on their flexibility and agility (Wincent and Westerberg 2005).

The responsiveness of the SIV model to the desired characteristics

The SIV model allows one to run the analysis at periodicity coefficients varying from six months to two months (paper 3). This flexibility produces variations in the value of the true survivability coefficient ($\Phi^{\perp}$) from +5.845 to -5.859, which reflects the dynamics involved in the SIV model. A good model should respond to variations in the firm's age. Having different periodicities enables the model to run a reasonably accurate analysis even for younger firms. The model is also able to account for the type of financing used to start the firm via the self-financed proportion of the total initial investment. A model for evaluating SME performance should be realistic in its understanding of how entrepreneurs rely on their resources to initiate a firm, but the classical models are not.

The graphic representation, using the survival index diagrams, can help managers to visualize and comprehend their company's performance history in a more simplified way. In that sense, graphical statistics play an important role in the interpretation of the data output of the model. The Survival Progression Indicator (IP) can be used to project a firm's future development, under a certain level of uncertainty, not accounting for unforeseen events. Using a two-month analysis, one can see that the slope angle of the SPI line, expressed as the true survivability angle ($\theta^{\perp}$) (Table 3d, p. 292), is +80.29. The slope, which is the true survivability coefficient, equal to +5.845, is negligible compared to a maximum theoretical value of infinity. I anticipate that hyper growth firms would have larger values for their true survivability coefficients than firms with classical rates of growth.

The SIV model satisfies the desired characteristics of the intended model in relation to innovation. By incorporating the technology intake parameter as an input variable, the SIV model can account for the affect of innovation activities on a firm. The technology intake parameter is divided into two variables: inward technology intake, or SI_{tii}, and outward technology intake, SI_{toi}. The technology intake used by the SIV model represents an agglomeration of both.

How can an SME performance model be utilized to account for a firm's innovation activities?

The third research question asked how a SME performance model could be implemented to account for the innovation activities of the firm. Two points are discussed to address this question: (i) incorporating innovation activities in the SIV model in relation to the internal environment of the firm and (ii) implementing the IBAM model as a tool of innovation capital analysis in relation to the external environment of the firm.

Incorporating innovation activities in the SIV model in relation to the internal environment of the firm

Paper 1 used existing literature to stress the role of innovation in enhancing firm survival and growth (Mansfield 1962, Audretsch 1991). It also indicated clearly that the survival index is split in two: one half focuses on operating conditions while the other half focuses on technology intake**.** Innovation activities input can be expressed in a simplistic form if one knows the related costs. Researchers can keep the level of detailed information needed at a moderate level by using a single figure to measure innovation activities (technology intake).

The technology intake in the case study presented in paper 3 was considered to be zero, as the firm had no development activities. In that sense, innovation aspects were considered but could not be assigned a value other than zero. Three considerations contributed to this score: there was no budge assigned for R&D activities; the firm was in a traditional type industry; and the firm was very young when the analysis was performed (2.2 years old), so it had not yet worked out an R&D strategy. In the second case study, innovation activities played a distinct role in the elevating the firm's performance (paper 7). The analysis showed that Autoadapt AB's performance was enhanced by innovation activities. For this particular case, the investment in development was not differential. Rather, it was a sum of the two technology intakes (inward and outward).

Utilizing the IBAM model as a tool of innovation capital analysis in relation to the external environment of the firm

An SME evaluation model that considers the innovation aspects of a firm in relation to its external environment needs also to look at the aggregate level of firm population, whether regional, national, or global. The IBAM provides for that analysis when it comes to various firm population sizes. The understanding of the entrepreneurial policy required can help us to understand the innovation dynamics of economies. In that sense, using an SME performance model that incorporates innovation activities in its build-up is a fundamental step toward gaining that understanding.

One way to implement the concept of indirect networking is by relating the input parameters of the model to the external environment of the firm. Such an approach can be used to relate the size of the firm to the maximum size attainable for the class of firms designated as SMEs. Wincent and Westerberg (2005) stressed two factors of importance in relation to firm performance when he discussed SMEs' strategic networks: firm size and CEO

personality. Another way to relate the age of the firm to the age of the sector is to use the "average life span" concept introduced in paper 3.

Networking and openness are also reflected in the introduction of the open capital concept at the external environment level. They are even reflected at the internal environment level by the introduction of the technology intake parameter. This parameter includes also input from other firms into the innovation activities of the object firm. It deals with both the direct and indirect effects on innovation activities as single input figures encompassing both in-ward technology intake and outward technology intake (paper 7).

Connecting the papers of the thesis

The characteristics of the desired model are understood by focusing on the existing shortages in current models. These shortages, identified in papers 1 and 2, were treated in paper 3 through the introduction of the SIV model. The first three papers, together with paper 7, discussed the performance evaluation model issue in relation to the internal environment of the firm.

The new approach required use of theory-driven strategy to build performance models for SMEs, rather than following the traditional accountancy discipline that dominated firm performance prediction in the past. The question of the advantage and disadvantages of existing SME performance models was discussed directly at two stages. At the first stage, covered in papers 1 and 2, a topology of the existing models is presented. The ASPEM tool introduced in paper 2 showed clearly that it is difficult to utilize the current models due to the extent of information input (the so-called information intensity requirements) required by the models, regardless of whether they function at the internal environment (i.e. single firm) level or at the external environment (i.e. aggregate of firms) level. Thus, the nature of the models prominent in the area of SME performance is cause for concern. There is a need to build a new approach to SME performance with innovation activities in focus. The discussion about innovation in relation to the single firm (internal environment-focused models) leads naturally to similar discussion at the external environment level.

The second group of papers, namely papers 4, 5, and 6, focuses on the external environment of the firm and its connection to innovation as a component in the firm's general performance. The nature of the desired model was also related to the total picture of the relationship of SME performance to innovation. This analysis is achieved by discussing the innovation activities at the aggregate level through the innovation capital concept and its components. The framework binding the internally related innovation activities to the firm's

external environment is the Innovation Balance Matrix (IBAM). Even the policy issues raised by paper 5 were reflective of the fact that analysis of the innovation activities at the level of a single firm is dependent on the state of the innovation activities at the aggregate level. Assessing the openness and exchange of resources and knowledge among organizations and firms was accounted for by the introduction of the fourth component to innovation capital: open capital.

For a single firm to engage actively in innovation it requires input from society via four important components of innovation capital (human, financial and system capital [papers 4 and 5], as well as open capital [paper 6]). The Innovation Balance Matrix (IBAM) played a vital role in this discussion. The tool was used to analyze the level of all the components and provided insight into how the different components of Innovation capital are related to each other.

Although papers 4 and 5 do not discuss a specific model to assess firm performance in relation to the external environment of the firm, they present a strong analysis for how to address the issue of innovation in relation to the firm's external environment. The SIV model is internally-focused, but it does not neglect the realities of the external environment of the enterprise.

The policy discussion in paper 6 provided a good of example of how policy profiling profits from empirical work. The last paper (paper 7) returns the discussion to the internal environment of the single firm. It provides for an alternative approach to SME performance, in which innovation is a major component. The same logic can be deducted from paper 3, where I could not test the innovation aspects of the intended model, as the firm studied lacked any innovation activities. The analysis done in paper 7 exemplified the nature of the construct needed in the model to tackle the issue of innovation in SMEs while discussing the topic of SME performance.

The SIV model satisfies the requirements of the desired model for SME performance evaluation. It has quantitative as well as qualitative variables and, most importantly, it incorporates a technology intake parameter to account for the innovation activities in the firm. The analysis of the Swedish fishery firm (paper 3) indicated the ability of the SIV model to identify bad performers. The true survivability angle is +80.29, which should be compared to a maximum theoretical value of 90 degrees. It does not take a slope higher than the value of 1 (corresponding to 45 degrees) to increase the angle dramatically. That is why this parameter is of secondary importance to the true survivability coefficient (in this case +5.845) as an indicator for the progression of firm performance.

Because the firm in the first case study was very young (two years in age), a periodicity of two months was used as the base of the analysis. The analysis done in the second case study (Autoadapt AB) could highlight the good performance of the firm. This firm, however, was older, and the analysis spanned over ten years. That is why an annual periodicity was used instead. In both cases, the graphical presentation of the survival index helped us see the progression of the firm though the analysis period. A summation of the above discussion is displayed in Table (5.1)

Table (5.1): Connecting the papers of the thesis

Discussion
Research question (1) The question of the advantages and disadvantages of the existing SME performance models is discussed in a direct way at two stages. The first stage, covered in papers 1 and 2, was a topology of the existing models. The ASPEM tool, which was introduced in paper 2, showed clearly that the current models are difficult to utilize, due to the extent of information input (the so-called information intensity requirements) demanded by the models, regardless of whether they function at the internal environment (i.e. single firm) level or at the external environment (i.e. an aggregate of firms) level. Thus, the nature of the models prominent in the area of SME performance is cause for concern. It is necessary to build a new approach to SME performance, with innovation activities in focus. The discussion about innovation in relation to the single firm (the internal environment-focused models) leads naturally to a similar discussion at the external environment level. For a single firm to engage actively in innovation requires an input from society via four important components of innovation capital (human, financial, and system capital [papers 4 and 5], and also open capital [see paper 6]). The Innovation Balance Matrix (IBAM) played a vital role in this discussion. The tool is used to analyze the level of each of form of capital and provides an insight into how the different components are related. The policy discussion in paper 6 gave a good example of how policy profiling profits from empirical work. The last paper, paper 7, is a practice on how to identify the existing deficiencies of the SME performance models. It provides for an alternative approach to SME performance modeling in which innovation is a major component. The same logic can be deducted from paper 3, wherein I could not test the innovation aspects of the intended model, as the firm studied lacked any innovation activities.
Research question (2) The characteristics of the desired model are understood by focusing on the existing shortages in current models, such as non-balanced quantitative/qualitative input variables, excessive use of business ratio approach, inability to serve as a managerial tool for assessing SME performance, inability to consider the wide variations between SMEs in relation to sector, geography, and economic contexts, and lack of innovation aspects in the input parameters. These issues, which are identified in papers 1 and 2, are treated in paper 3 through the introduction of the SIV model. The SIV model satisfies the requirements of the desired model for SME performance evaluation. It has both quantitative and qualitative variables, and it incorporates a technology intake parameter to account for the innovation activities of the firm. The analysis of the Swedish fishery firm indicated the ability of the SIV model to differentiate bad performers (paper 3). The true survivability angle was +80.29 and the survivability coefficient was +5.845, which is negligible compared to a maximum theoretical of infinity. Because the firm was very young (two years in age), a periodicity of two months was used in the analysis. The analysis done in the second case study (paper 7), which spanned over ten years period, was able to differentiate the good performance of the firm. This firm, however, was older and more innovative. That is why an annual periodicity was used. In both cases, the graphical presentation of the survival index indicated the progression of the firm though the analysis period. Papers 4-6 addressed the need to couple the innovation activities of the single firms to its surroundings and the importance of the networking impact on firm innovation and its performance.

Table (5.1): Connecting the papers of the thesis (continue)

Discussion
Research question (3) The nature of the desired model is also related to the relationship of SME performance to innovation and how they can be enhanced in relation to the external environment. This analysis is achieved by discussing the innovation activities at the aggregate level through the innovation capital concept and its components. This is achieved in papers 4-6. The framework binding the firm's internally related innovation activities to the external environment is the Innovation Balance Matrix (IBAM). Even the policy issues raised by paper 5 are reflective of the fact that analysis of the innovation activities at the single firm level is coupled to the analysis of innovation activities at the aggregate level. Openness and exchange of resources and knowledge between organizations and firms is accounted for by the introduction of the fourth component of the innovation capital: open capital (paper 6). The analysis performed in papers 3 and 7 exemplified the approach needed in the model to address the issue of innovation impact on SME performance. The first two papers confirmed the lack of such aggregate analysis in relation to innovation activities in the classical firm performance theory.

6. Main Findings, Implications, and Future Research

In this last chapter, I discussed the main theoretical contributions of the thesis and its findings. I displayed the implications within the field of SME performance and its relationship to innovation activities. I close the chapter by providing some general possible future research tracks in relation to SME performance evaluation.

Main findings

SMEs play an important role in the economic development of nations and regions (Ahmed and Retzloff 1995, Huang et al. 2002, GEM 1999, Stringer 2000, Castrogiovanni 1996, Monk 2000, Ross 1996, NUTEK 2004). Thus the discussion about SMEs and the need to evaluate their performance (Acs 1999, Houghton 1984, Libby and Lewis 1982), along with support programs to enhance the firms' efficiency (Norrman 2008), is widespread in literature. The SME performance models rely on a financial ratio approach and accountancy indicators (Keasey and Watson 1993, Klofsten 2010). The existing models are complex systems of analysis that utilize advanced statistical tools and measurements. This resulted in their being unpractical for use by SME managers. This is an issue of significance if one wanted to benefit from these models by helping SMEs to plan their survival and growth activities (Klofsten 1992a, b, 2010, Davidsson and Klofsten 2003, Keasey and Watson 1991a, b). The existing models may be fine for evaluating the performance of larger firms, but they are far less beneficial for SMEs (Keasey and Watson 1986a). They also neglect the non-financial parameters of firm age and size, among others (Altman 1968, 1983, Altman et al. 1977).

The existing models are static ones, as they look at performance within separate individual years only. The models do not present performance in a dynamic way, where one can see the development of the firm and its progression in relation to its years of operation. The models do not consider that firm size is sector-related and even nation-defined. They neglect to incorporate the aging process, which allows firms to gain more knowledge and experience, thus giving them the ability to improve their performance with time. The existing models treat SMEs as a homogenous group, while in reality these firms are diverse in relation to a number of factors, including age, size, business sector, input in innovation activities, and geographical location. This negligence is reflected in the way SMEs were defined (Cross 1983, Ganguly 1985, Atkins and Lowe 1990, NUTEK 2004, Bolton 1971, Australian Bureau of Statistics 1988).

SME models deviate in their analysis from the nature of the processes related to innovation. These processes are more based on interconnectivity and the exchange of resources and information as manifested in the open innovation paradigm (Chesbrough 2001, 2003, Chesbrough et al. 2006). Existing SME models treated the firm as a closed system, neglecting the impact of networking on firm performance (Wincent and Westerberg 2005, Wincent et al. 2009). It is very risky to use the business ratio to evaluate SME performance, because the reality of a situation cannot be captured using such an approach (Davidson and Klofsten 2003). A firm that is performing brilliantly in accordance with these ratio-based models can suddenly collapse due to an unforeseen external factor. I believe that a practical approach to firm performance should be more comprehensive and generalized. There are other factors that impact the performance, and they cannot be quantified despite their importance to the well-being of the firm. One such factor includes the personal traits of the CEO (Wincent and Westerberg 2005). A good model should treat the firm as an open system with input parameters stretching beyond the classical business ratios. The networking issue and the effect of the firm's external environment have a clear impact on innovation (Wincent and Westerberg 2005, Wincent et al. 2009).

The work achieved in this thesis contributes to firm theory (Cyert and Hedrick 1972, Moss 1984, Amess 2002, Jacobides and Winter 2007, Ricketts 2003), and more specifically to the area of SME performance (Keats and Bracker 1988). It presents a new way of evaluating firm survival and growth, where the input parameters are valued not of out of their accountancy perspective but through the value they add to the efficiency of the firm and its management. This method presents a different approach to measuring performance. Also, the work contributes to the literature's correlation of organization theory (Scott 2003) to the theory of the firm by emphasizing the impact of networking on SME performance.

The main contributions of this thesis to the field of SME performance evaluation can be summarized in three outcomes: 1) the SIV model as a new model of SME performance evaluation, 2) the ASPEM as a new tool for strategic utilization of SME performance models, and 3) a new approach that accounts for innovation in relation to the firm's external environment using the IBAM tool.

The Survival Index Value Model, or SIV, and the internal environment of innovation

Innovation activities impact both the internal environment of the firm as well as its external environment. Existing SME performance models intensively utilize the financial

input parameters (Story et al. 1987). Generally, the models do not consider the non-financial aspects of performance (Keasey and Watson 1993), and when they incorporate such aspects they do so indirectly, by emphasizing the aspects' impact on the firm's financial input parameters (Altman 1983, 1968, Altman et al. 1977).

Current models deal with SMEs as a single group (Bolton 1971). The models assess firms in isolation from their external environments, and in essence considered them to be closed systems (Caves 1998, McPhersson 1995, Allison 1984, Waring 1996, McGahan and Porter 1996). Also, they do not account for innovation's affect on SME performance (Siqueira and Cosh 2008).

In the thesis, I tried to account for these issues in relation to the firm's internal and external environments. The SIV model incorporates the input parameters of significance that other models lack. The input parameters of SIV as relates to the internal environment of the firm include: the number of employees**,** the maximum number of employees distinguishing the different categories of enterprise, firm age, and the average life span of firms in that business sector. These indicators are qualitative parameters related to firm performance. The quantitative parameters of the SIV model includes sales (or turnover), the intake and absorption of new technologies as indicated by investment and the total costs of production, the initial investment costs, the self-financed initial capital of investment, and the profit margin (a neutral percent figure).

The "technology-intake" parameter covers both the technology absorption by firm management (such as new IT tools), called "inward-focused technology intake," as well as technology absorption and development through own innovativeness and inventiveness, called "outward-focused technology intake." The argument concerning what are the sources that induce innovation in SMEs (Romano 1999, Motwani et al. 1999) touches on the issue of expenditures on research and development (R&D) activities. These expenditures are allocated for costs of material and other accessories as well as costs of manpower involved in developing new products and services at the firm. R&D is incorporated in the second type of expenditures, but outward-focused technology intake encompasses more than just expenditure on R&D. It also includes all costs related to facilitating innovation activities in the firm. Using the technology-intake as a measure of innovativeness of the firm, the SIV model demonstrated a clear indication of its ability to account for the innovation activities as a performance-enhancing factor.

Innovation in SMEs differs from that in larger enterprises (Rothwell 1991, Rothwell and Dodgson 1994, Vossen 1998, Hadjimanolis 2000). The approach I used to

incorporate innovation activities in the SIV model might not be the best way to account for the impact of innovation on the performance of larger firms, due to the higher level of complexity of innovation processes in such enterprises.

At the external environment level, the input indicators that are candidates for performance evaluation are the four components of innovation capital: human capital, financial capital, system capital, and open capital.

ASPEM as a new tool for strategic utilization of SME performance models

To the best of my knowledge, the existing SME literature lacks a strategic approach for researchers to use the performance models. The published works tend to avoid such discussion by focusing on alternative topics, such as business strategy models (Rasheed 2009, Cheng 2009, Steffens et al. 2009, Butler et al. 2001, Sonfield et al. 2001), SMEs' entry modes into global markets (Rasheed 2005, Dhanaraj and Beamish 2003), or possible marketing strategies (Chaston and Mangles 2002, Noe and Parker 2005, Pelham and Wilson 1996). The ASPEM is a tool developed for researchers to help them strategically choose the right type of SME performance model for a specific application. This is important when researchers want to address particular evaluation input indicators in relation to SME performance in an economy.

There are wide variations in the natures of SME models. Some of the models are more related to the external environment of the firm, while others are more focused on the internal environment of the enterprise. They also require different levels of information input. The ASPEM diagram places each of the models in relation to two dimensions. The first dimension is the SME model coverage level, known as "coverage intensity." The dimension of intensity ranges from a group of firms to a single SME. The coverage intensity is presented by the vertical axis. The second dimension is the information intensity requirements of the model, known as the "information intensity requirement." It indicates the level of information input required by the performance evaluation model. The information intensity requirement is presented by the horizontal axis in the diagram.

A new approach to looking at innovation in relation to the external environment of the firm

Traditional SME models provided no specific focus on the role that acquiring new technologies and promoting innovation activities play in directly enhancing SME performance. The models could not account directly for the firm's managers' efforts to be

inventive and innovative, nor for their efforts to conduct a strategic approach to business survival and growth. The role of innovation in enhancing the performance of SMEs and establishing a connection between the internal environment of the firm and its external environment is vital to the firm's performance (Mazzarol and Reboud 2008, Vermeulen et al. 2005, Wolff and Pett 2006).

Innovation in relation to the external environment of the firm can be expressed via the "capital" concept. Traditionally, the discussion about different types of "capital" in relation to an economy's ability to be innovative centered around two basic concepts: human capital and financial capital. In the context of this thesis, I proposed a new form of capital to cover the ability of public institutions and private organizations to support the entrepreneurial environment in a country. This third type was designated as system capital. This form of capital is more concerned with societal input into the innovation activities of an economy.

I also addressed the issue of firm openness and networking by proposing a fourth type of capital: open capital. I combined the four types of capital into a new form of capital, innovation capital. Innovation capital presents the accumulated input of technology in relation to the firm's external environment that promotes innovativeness and the entrepreneurial drive of the economy. The optimal situation is one where the four components of innovation capital are relatively abundant at the same level. To study the possible variations of innovation capital levels in an economy, I introduced the Innovation Balance Matrix (IBAM). I applied the analysis tool to firms in Arab countries. In that analysis, I did not include open capital. I only considered human capital, financial capital, and system capital. Open capital should be integrated as a fourth component of innovation capital in any future work using the IBAM tool.

The Arab countries presented a unique case, where each country has an overflow in only one component capital, while the other two components are in poor shape. Although the concept "capital" is not built into the SIV model, the SIV model can be used as a performance input indicator to build models at the aggregate level of the economy.

Implications for SME research policies

The outcome from this thesis would lead, I hope, to a reexamination of some of the current research practices in relation to the SME field. A major point is that one should avoid focusing on the financial ratio approach and abstain from using sophisticated statistical methods. A combination of literature screening and the theory-building approach would be the best practice through which to construct SME performance models.

The first stage of building performance models is to study the existing performance valuation literature that discusses the impact of individual factors on performance. This study should be combined with the value-added approach of these individual input parameters in relation to firm performance. I recommend that statistical analysis be used only as a verification instrument to test the robustness of the models, and not as a construction tool. Another research policy issue is the need to relate the innovativeness of a firm to its external environment and not to restrict oneself to studying the firm's internal environment. The choice of input parameters in the SIV model can be further tested to relate to specific business sectors. When creating SME performance models, it is important to emphasize the theory building approach to input parameters selection. Researchers should not be captive to the classical finance and accountancy approach that dominated the area of SME performance evaluation for so long but rather they need to reexamine the way they deal with the issue.

Implications for regional and national economic development policies

The results of the thesis would, hopefully, lead to some positive implications for the internal as well as the external environments of the firm.

Aspects related to the internal environment of the firm

In this thesis, I incorporated the aspects of the firm's internal environment to the issue of innovation. I used the concept of "technology-intake" as a parameter to indicate the firm's level of innovation activity. It is thus possible to use the SIV model to assess the status of SMEs in a given economy, and even to study several possible progressions scenarios for the development of individual firms. That would enable policy-makers to study the impact of their strategies and policies on the growth of small and medium sized enterprises. Attaining such capacity is of particular importance to the innovation activities of SMEs, as policy-makers can use the SIV model to evaluate how their innovation policies impact SMEs. This would help them to select strategies that would avoid decisions that may have a negative impact on SME welfare.

Aspects related to the external environments of the firm

SME performance models that account for innovation's affect on the internal environment of the firm would be expected to reflect on innovation's relation to the firm's external environment, as well. The results from this thesis point to the way by which one can

construct a system of innovation with true "openness." The outcome of the dissertation in relation to the innovation issue can help us to visualize an effective open innovation system. Such a system creates an environment that encourages SMEs to innovate and thus enhance their survival, nourishment, and growth potential. Policy-makers and governmental agencies that promote SMEs can use the tools of analysis developed in this work, such as the SIV model, the ASPEM, and the IBAM, to create a set of regulations promoting openness in the innovation activities of firms.

Future research

Traditional models of SME performance have focused mostly on financial indicators. Non-financial parameters are, for the most part, excluded from these models. Only minor efforts are recorded in that direction. The SIV model incorporated two non-financial parameters in its structure: firm age and firm size. However, there remains a need to study the ability of non-financial parameters other than age and size to impact the performance of SMEs. There is also a need to further develop the SIV model to study specific cases, such as firm birth at the project stage prior to pre-launching, when the firm is only in the business idea phase. Studying how variations in the business sector and location of firm impact SME performance can be of value to the goal of projecting and investigating firm development.

Looking at innovativeness as an ingredient of competitive strategies, the SME competitive edge is an area worth investigating. Studying the components related to innovation and the resources (or "capital") available to use at the external level of the enterprise, is a new approach to grasp the relationship between firm innovativeness and performance.

Further research is needed to build SME performance models focused on the external environment of the firm. Although I did not develop a specific performance model that considers innovation at the aggregate level, the ideas related to innovation capital and the IBAM tool can be used as indicators and inputs for such a model.

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