Effects of business incubation on knowledge acquisition of incubatees and incubatee performance

---

Thesis submitted in partial fulfillment of the requirements for the degree of
Master of Science in Management of Technology

by

Robin Benjamins
1386794

August, 2009

Delft University of Technology
Faculty of Technology, Policy, and Management
Section of Technology, Strategy, and Entrepreneurship

Graduation Committee
Chairman: Prof. dr. P. Trott
First supervisor: Dr. ing. V.E. Scholten
Second supervisor: Dr. M.L.C. de Bruijne



Acknowledgements

First and foremost I wish to offer my sincerest gratitude to my supervisors, Dr. ing. Victor Scholten, Dr. Mark de Bruijne, and Prof. dr. Paul Trott for supporting me. The dedication and commitment that Victor has shown throughout the writing of this thesis has been greatly appreciated. Mark's creative input and insightful opinions have led to many moments of inspiration. The understanding and patience that Paul has offered me has kept me on track of my goal. Without their knowledge and assistance I would not have been able to complete this thesis. I greatly appreciate their encouragement while they gave me the opportunity to make my own choices.

Next, I would like to thank my fellow students Alexander Shibeshi and Floris Duursma for their kindness and support in 'the office'. Their companionship has helped me stay motivated and focused, which I believed has greatly benefited my thesis.

Furthermore, I want to thank Joris ter Meulen and Gabriela Wassing for proof reading my thesis. I would also like to thank Kees Eising and Sander Luijt for their contributions to the revision of the questionnaire.

I want to take the opportunity to show my appreciation to my family for supporting me throughout my study at Delft University of Technology. Special thanks to my girlfriend Rianne Eising for her understanding and consideration.

Moreover, I want to thank all my friends for their support and companionship, especially my housemates who made me feel at home in Delft.

There is so much that I have learned from my fellow Management of Technology students, that I can not thank them enough for allowing me the opportunity to work alongside them during the courses and projects of this study.

Finally, I would like to thank all those who directly and indirectly supported me in completing my thesis.

Robin Benjamins, Delft 2009

Preface

Conducting this research and writing a thesis have been an interesting experience for me, although it came with its ups and downs. The past months have allowed me to learn a great deal about myself. Academically, it has taught me many important concepts in the fields of business incubation and the support of new ventures. Although I experienced several difficulties and challenges in conducting the research I am satisfied with the final result.

This thesis represents the end of my Management of Technology study, which has been two important years in my life. Before enrolling in the program I never could have never imagined how satisfied I would be with this decision. I am looking forward to the next step in my life, but I am definitely going to miss these great years.

Robin Benjamins, Delft 2009

Executive summary

New ventures and entrepreneurs are an important driver of innovation and economic development. New ventures, unfortunately, tend to fail in higher proportions than mature businesses. Business incubation is one of the various approaches that has been developed to enhance survival rates and performance of new ventures.

Over the last half of the 20th century business incubation has greatly evolved. Different models of business incubators have been developed with a wide variety of goals and objectives. North America observed a growth in business incubators from 12 in 1980 to over 1,400 in 2006. It is estimated that there are more than 7,000 business incubators worldwide. In 2001 alone, these incubators assisted more than 35,000 new ventures, providing employment for 82,000 individuals and generated revenue of more than US$ 7 billion.

This study sets forth the importance of understanding of the impact of business incubation on the development of incubatees. Understanding the role incubators play in the development of new ventures can potentially lead to enhanced innovation and economic development. Second, business incubators have become increasingly popular as a policy tool. Assessing the impact of business incubators provides a form of evaluation and justification for its popularity. Third, it is unclear whether incubatees have a proper understanding of the impact business incubators have on their firm. Furthermore, this research may provide insights into the incubation process as it examines how business incubators influence the knowledge base of incubatees. These insights can serve as guidelines for incubator managers or incubator professionals that are responsible for supporting the development of incubatees.

This thesis posited that business incubation may influence knowledge acquisition of incubatees. It also proposed that knowledge acquisition of incubatees could be related to incubatee performance. The two research questions central to this study are: *"What is the effect of business incubation on knowledge acquisition of incubatees?"* and *"What is the effect of knowledge acquisition of incubatees on incubatee performance?"*.

To answer the research questions, a review of the relevant literature was con-

ducted. This resulted in the construction of a conceptual model that included six hypotheses which were statistically tested with data collected from 48 incubatees of 13 business incubators in the Netherlands. The rationale behind the conceptual model of this study is best reflected by the following quote:

> *"Outsider assistance can lead to the creation of knowledge that provides a basis for sustainable competitive advantage, which will, in turn, influence venture survival and performance"* (Chrisman and McMullan, 2004, p. 231)

This study has found that coaching provided by business incubators to incubatees has a positive influence on business knowledge acquisition of incubatees. In turn, the results indicate that business knowledge acquisition of incubatees is positively related to incubatee performance in terms of relative overall performance. The managerial implications of this study are best explained in terms of several levels of analyses.

On a macro level, the results of this study imply that business incubation are successful policy tool to enhance performance of incubatees. Incubatees generally are new ventures and are found to be an important driver of innovation and economic development. This is an important finding because it suggests a possibility for government or other institutions to stimulate innovation or economic development.

On the level of a business incubator, this research implies that coaching is an important service to provide to incubatees. Coaching can enhance development of incubatees in terms of business knowledge acquisition. In turn, this business knowledge acquisition will enhance incubatee performance in terms of relative overall performance – i.e. enhance incubatee performance in a more general way. Also network mediation has shown to be a critical service to provide to incubatees. Network mediation can enhance incubatee performance in terms of product distinctiveness – i.e. enhance incubatee performance in more specific areas. For network mediation to have a more general effect on incubatee performance the challenge for business incubators appears to be to adequately commit to facilitating the relation between incubatees and actors external to the incubator. The findings also set forth that, next to providing physical and shared services, it is important for incubators to provide more 'softer' or intangible services such as coaching and network mediation.

For incubatees, the results of this study outline the importance of coaching provided by the business incubator as it allows incubatees to acquire business knowledge. This acquired business knowledge, combined with the incubatees' prior knowledge, will enhance the incubatees' performance in terms of relative overall performance. This highlights the importance of not only the benefits of the physical services an incubatee often receives, but also the intangible benefits of being associated with a business incubator. Furthermore, the results imply that incubatees should make use of network mediation provided by a business incubator because, despite its shortcomings, it can allow an incubatee to enhance its product distinctiveness.

Although this research has its limitations, is far from perfect, and has left many issues still unresolved, this study has achieved its aim of examining the influence of business incubation on the development of incubatees. It also made a contribution for filling the gap in existing literature on the impact of business incubation.

Contents

Contents **ix**

List of Figures **xi**

List of Tables **xiii**

1 Introduction **1**
1.1 Background 1
1.2 Problem statement 2
1.3 Aim 3
1.4 Research questions 4
1.5 Relevance 5
1.6 Structure 5

2 Literature review **7**
2.1 Introduction 7
2.2 Business incubation 7
2.3 Knowledge and knowledge acquisition 11
2.4 Incubatee performance 14

3 Conceptual model **17**
3.1 Introduction 17
3.2 Coaching and knowledge acquisition 17
3.3 Knowledge acquisition and incubatee performance 20
3.4 Conceptual model 21

4 Methodology **23**
4.1 Introduction 23
4.2 Research strategy 23
4.3 Sample 24
4.4 Procedure 25
4.5 Measurement of constructs 26

4.6 Data analysis 31

5 Results and discussion **35**
5.1 Introduction 35
5.2 Response analysis 35
5.3 Results factor analysis 37
5.4 Correlation matrix 39
5.5 Results multiple regression analysis 43
5.6 Discussion 49

6 Conclusions and recommendations **53**
6.1 Introduction 53
6.2 Conclusions 53
6.3 Scientific contributions and managerial implications 59
6.4 Limitations and recommendations for future research 61

A Questionnaire **65**
A.1 Section: Firm 65
A.2 Section: Business incubation 65
A.3 Section: Knowledge acquisition 66
A.4 Section: Incubatee performance 67

B Vragenlijst **69**
B.1 Section: Bedrijfsgegevens 69
B.2 Section: Business incubation 69
B.3 Section: Kennisverwerving 70
B.4 Section: Prestaties 71

C Results factor analysis **73**
C.1 Relative performance 73
C.2 Distinctiveness 73
C.3 Coaching and network mediation 74
C.4 Technical and business knowledge acquisition 74

D Detailed correlation matrix **77**

References **77**

Bibliography **79**

List of Figures

3.1 Conceptual model 21

4.1 Conceptual model recapitulation 27

5.1 Significant relations for relative overall performance 47
5.2 Significant relations for product distinctiveness 49

List of Tables

2.1 Classification of incubators 8
2.2 Performance measures in incubation research 15

4.1 Sampling criteria 24

5.1 Distribution of incubatees over incubators 36
5.2 Overview factor analyses 39
5.3 Correlation matrix 42
5.4 Regression model 1 44
5.5 Regression model 2 45
5.6 Regression models 3, 4, and 5 46
5.7 Regression models 6, 7, and 8 48

6.1 Hypotheses to answer the first research question 54
6.2 Hypotheses to answer the second research question 57

C.1 Factor analysis relative performance 73
C.2 Factor analysis distinctiveness 73
C.3 Factor analysis coaching and network mediation 74
C.4 Factor analysis technical and business knowledge acquisition 74
C.5 Factor analysis technical and business knowledge acquisition 75

D.1 Detailed correlation matrix 78

Chapter 1

Introduction

1.1 Background

New ventures and entrepreneurs are important for economic development (Schumpeter, 1934). They often drive innovation, create jobs, and generate wealth for founders, employees, and owners. Moreover, new technology-based ventures are suggested to exhibit a 'multiplier' effect in terms of job creation (Udell, 1990). The technology developed by these types of new ventures often creates employment in additional industry sectors such as the service, retailing, or public sector.

New ventures, unfortunately, tend to fail in higher proportions than mature businesses (Stinchcombe, 1970). Research shows that only half of all new ventures survive their first five years after establishment (Birch, 1987). Mortality rates of Canadian new ventures are even more depressing; two in three do not make it to their fifth year, and four in five fail before they reach ten years of establishment (Kanagarajah, 2006). Those industries that lead technological change observe higher mortality rates of new ventures than other industries, (Hamdani, 2006).

Various approaches have been developed to enhance the survival rates of new ventures. Some academics term these approaches as 'sponsorship' – an intervention process to create an environment conducive to new ventures (Flynn, 1993). Examples of these environments are innovation centers, science parks and managed workspaces. Another, well-known and popular, approach is business incubation. Business incubation is generally provided by a business incubator and can be defined as follows:

> *"Business incubation is a business support process that accelerates the successful development of start-up and fledgling companies by providing entrepreneurs with an array of targeted resources and services. [...] A business incubator's main goal is to produce successful firms that will leave the program financially viable and freestanding"*(National

Business Incubation Association, 2009).

Over the last half of the 20th century business incubation has greatly evolved. Different models of business incubators have been developed with a wide variety of goals and objectives. North America observed a growth in business incubators from 12 in 1980 to over 1,400 in 2006. It is estimated that there are more than 7,000 business incubators worldwide (National Business Incubation Association, 2009). In 2001 alone, these incubators assisted more than 35,000 new ventures, providing employment for 82,000 individuals and generated revenue of more than US$ 7 billion (Tamasy, 2007).

1.2 Problem statement

Despite growing popularity of business incubation as a means to stimulate economic development by supporting new ventures, research on the impact of business incubators is underdeveloped and represents an opportunity for conducting research (Hackett and Dilts, 2004). Literature reviews (Mian, 1997) show that studies to assess business incubators are generally of descriptive and anecdotal nature. Additionally, most of the available knowledge of business incubation does not have a sound theoretical foundation (Tamasy, 2007). Hence, academic findings regarding business incubation and the impact business incubators have on new ventures are dispersed (Chan and Lau, 2005).

Studies to assess the impact of business incubators can be divided into two categories – those that examine the impact of incubators on an organizational level and those that focus on the incubators' impact on the incubatees associated with the incubator. The first category has received most attention. Academics have, for example, studied the effects of business incubation on job creation, survival and growth rate of new ventures (Allen and McCluskey, 1990; Udell, 1990). The critical drawback is that the organizational level of analysis fails to provide a detailed view of the impact of incubator programs (Bearse, 1998). Additionally, these studies are often based on data from incubator managers, which may result in less appropriate reflections on the merits and shortcomings of business incubation.

To properly assess the impact of business incubators it is important to include feedback directly from the incubators associated with the incubator (Centre for Strategy and Evaluation Services, 2002). In an attempt to assess impact of business incubators on an incubatee level, academics have studied the incubator

services provided to incubatees and determined the perceived value of these services. (Allen and Rahman, 1985; Mian, 1994, 1996, 1997; Smilor, 1987). These studies however, examine the inputs of the incubation process and do not provide insights in the development of incubatees. Thus, little is known about the impact business incubators have on the development of incubatees (Hackett and Dilts, 2004; Tamasy, 2007), which represents a gap in current research.

1.3 Aim

The purpose of this study is twofold. First, it aims to examine the influence of business incubation on knowledge acquisition of incubatees. Second, it examines how knowledge acquired from the business incubator is related to incubatee performance.

Although previous studies have associated incubator variables with incubatee performance, they are rarely statistically tested. Most impact studies make use of simple running counts for the dimensions of interest (Hackett and Dilts, 2004). Some studies assess the impact of business incubators by examining the added value of incubation services provided to new ventures (Mian, 1996; Allen and Rahman, 1985). They assess the inputs and outputs of the incubation process, but view the process itself as a 'black-box'.

This research is different in the sense that it examines incubator impact by studying the incubation process; knowledge resources are important in the developmental process of new ventures. Furthermore, it will statistically test the effects of the acquired knowledge on incubatee performance.

Understanding the impact business incubators have on incubatees is important for several reasons. First, because new ventures are a major driver of innovation and economic development. Understanding the role incubators play in the development of new ventures can potentially lead to enhanced innovation and economic development. Second, business incubators have become increasingly popular as a policy tool. Assessing the impact of business incubators provides a form of evaluation and justification for its popularity. Third, it is unclear whether incubatees have a proper understanding of the impact business incubators have on their firm. Allen and Rahman (1985) concluded from a sample of incubatees that 87% of the entrepreneurs would have started their businesses without the incubator services.

One of the main challenges in the creation of a new venture is to assemble

a resource base. New ventures need various types of resources to be successful (Brush et al., 2001; Lichtenstein and Brush, 2001; Greene and Brown, 1997). Especially intangible resources such as knowledge are important for the success, performance and thus survival of a venture. A firm's knowledge base has probably the greatest ability to provide a basis of competitive advantage (Dierickx and Cool, 1989; Gupta and Govindarajan, 2000). In addition, knowledge is the basis for the development of other important resources (West and Noel, 2009). This study will focus on the impact business incubators have on the knowledge acquisition of incubatees. In turn, it examines the effects of the acquired knowledge on incubatee performance.

This research recognizes the various services business incubators offer to incubatees to support their development. Business incubators may, for example, assist in developing management teams, business plans, raise capital, or develop a business network (Chrisman and McMullan, 2004). This research focuses on the incubatee's acquisition of knowledge as a result of the incubation process and relates it to its performance, while recognizing that business incubators may perform various other tasks to support the development of incubatees.

1.4 Research questions

Based on the problem statement and the aim of this study two main research questions are posed: *"What is the effect of business incubation on knowledge acquisition of incubatees?"* and *"What is the effect of knowledge acquisition of incubatees on incubatee performance?"*.

In order to effectively answer the main research questions a set of sub questions are constructed. These sub questions are:

- What is business incubation?
- What is knowledge acquisition of incubatees?
- What is incubatee performance?
- How can business incubation influence knowledge acquisition of incubatees?
- How can knowledge acquisition of incubatees influence incubatee performance?

1.5 Relevance

Understanding the impact business incubators have on incubatees is important for several reasons. First, because new ventures are a major driver of innovation and economic development. Understanding the role incubators play in the development of new ventures can potentially lead to enhanced innovation and economic development. Second, business incubators have become increasingly popular as a policy tool. Assessing the impact of business incubators provides a form of evaluation and justification for its popularity. Third, it is unclear whether incubatees have a proper understanding of the impact business incubators have on their firm. Furthermore, this research may provide insights into the incubation process as it examines how business incubators influence the knowledge base of incubatees. These insights can serve as guidelines for incubator managers or incubator professionals that are responsible for supporting the development of incubatees.

1.6 Structure

Chapter 2 reviews the literature and forms the basis of this study. This is followed by the development of hypotheses and a conceptual model in Chapter 3. Chapter 4 describes this study's methodological approach and elaborates on procedures involved with the measurement of the constructs. The results of the data analysis and accompanying discussion is provided in Chapter 5. Based on the discussion and literature review from previous chapters, Chapter 6 draws conclusions and suggests recommendations for future research.

Chapter 2

Literature review

2.1 Introduction

This chapter is concerned with a review of existing literature relevant to the research questions. The sections are concerned with answering the first three sub research questions. First, it is important to gain an understanding of business incubation. Second, literature that discusses knowledge and knowledge acquisition is reviewed. Finally, performance of firms in the context of business incubation will be discussed in this review. The hypotheses and conceptual model constructed in the subsequent chapter are an extension of this literature review.

2.2 Business incubation

To understand what business incubation entails, this section starts in search of a definition of business incubation. Relevant literature reveals that various definitions of business incubators and incubation exist. These definitions mainly vary in scope, ranging from a simple 'black box' view (Campbell et al., 1985) to a comprehensive system (Smilor, 1987). Both types of definitions are not particularly useful for understanding the business incubation process. Therefore, another definition must be found that is appropriate for the scope and aim of this research.

The National Business Incubation Association (NBIA) provides a definition of business incubation that is more suitable for the purpose of this research. NBIA is a non profit organization devoted to help its members develop and manage successful business incubation programs. It is primarily composed of incubator developers and managers, and proposes the following definition of business incubation:

"Business incubation is a business support process that accelerates the

> *successful development of start-up and fledgling companies by providing entrepreneurs with an array of targeted resources and services. [...] A business incubator's main goal is to produce successful firms that will leave the program financially viable and freestanding"*(National Business Incubation Association, 2009).

Despite certain similarities, various different types of incubators emerged over time. A distinction between different types of incubators can generally be made based on (a) their primary financial sponsor, (b) incubating spin-offs or start-ups, (c) their incubatees' business nature, or (d) their business nature (Hackett and Dilts, 2004). Many researchers[1] have used a classification developed by Campbell and Temali (1984) as a part of their studies. An overview of this classification is provided in Table 2.1.

Table 2.1: Classification of incubators by Campbell and Temali (1984) in Udell (1990)

Incubator type	**Main objective**
Nonprofit incubators	Targeted economic development
University-related incubators	Assist in the commercialization of science and technology produced by university research
Privately sponsored incubators	Generate profits
Publicly sponsored incubators	Creating jobs by creating employers

It is interesting to note that despite these different types of business incubators, scholars have not found a significant difference in the services they provide to incubatees (Allen and McCluskey, 1990). The services that business incubators provide have been extensively described by scholars. Although it is hard to provide an overview of these services – the terminology to describe them varies from study to study – a summary of the most relevant findings is presented. A study examining 38 U.S. business incubators categorizes their services as financial consulting assistance, management assistance, general business assistance, professional business assistance, and physical services (Allen and Rahman, 1985). Smilor (1987) has similar findings but emphasizes the network that business incubator provide through affiliations with universities, government bodies, non profit institutions, and private sectors (Udell, 1990). Other academics (Allen and McCluskey, 1990) found that over 90% of their sample of business incubators

[1] See, for example, Allen and Rahman (1985), Smilor (1987), or Udell (1990)

associated with NBIA provided assistance in the areas of accounting, marketing, and general business planning. Of the sample, 75% offered ICT training, legal advice, and assistance for grant procurement.

Business incubation impact

The added value of business incubation and the impact business incubator services have on incubatees has been researched by various academics. Existing literature on business incubation shows studies that examine the influence of business incubation on the number of jobs created (Udell, 1990), incubatee development (Smilor, 1987), or incubatee graduation rates (Peters et al., 2004). Different types of incubators have been studied – such as university linked incubators, non profit incubators, and for profit incubators (Peters et al., 2004). Furthermore, the methodological approaches used in studies assessing business incubation vary from case studies (Mian, 1997) to surveys (Allen and McCluskey, 1990). This has, understandably, led to dispersed findings and leaves the value of business incubation a topic of debate.

In an early attempt to determine the potential of business incubators for venture development, Allen and Rahman (1985) concluded that incubatees do not rate the overall business incubator services, and business and technical assistance high. Moreover, 87% of the entrepreneurs would have started their businesses without the incubator services. Allen and McCluskey (1990) concluded that the number of jobs created among incubatees and the number of firms graduated from the incubator was virtually not influenced by the incubator's structure, services, or policies. It was found that, instead, age of the incubator and the number of incubatees explained over half the variance in jobs created and graduation of firms. This suggests that an incubator's impact on its incubatees is greater when it has learned from experience (Allen and McCluskey, 1990; Peters et al., 2004).

The low appreciation of business incubation services can be explained by the general notion that entrepreneurs downgrade the importance of external assistance[2] or that the services these business incubators provide are not appropriate to support incubatees. The latter reason may particularly be true for growth-oriented and technology based firms as they require sophisticated input such as mentoring, or business and technical support (Udell, 1990). The mere provision of physical services and capital will not allow these types of incubatees to develop themselves into successful firms.

[2] Udell (1990) explains this notion is in accordance with other studies

Other studies have found that business incubation generally have a positive influence on the development of incubatees. Based on a sample of 50 U.S. business incubators Smilor (1987) collected data through surveys, on-site reviews, case studies, and in-depth interviews with incubator managers. This led to the identification of ten factors important for the success of tenant companies and business incubators of which the most notable factors are:

- On-site business expertise
- Access to financing and capitalization
- In-kind financial support
- Community support
- Entrepreneurial network
- Entrepreneurial education
- Selection process for tenants

These suggestions partially overlap with the findings and suggestions of Udell (1990) mentioned before; the provision of expertise is important for the development of incubatees. This expertise can be provided through mentoring, education, or via an external network. This is supported in another study (Mian, 1996) that concluded that university technology business incubators are found to be especially suited to develop new technology-based firms. More specifically, 'softer' services such as psychological support, mentoring, providing knowledge, or seminars are deemed to be of added value to incubatees (Mian, 1996). Both the provision of mentoring and business expertise are in accordance to the suggestions made by Udell (1990).

The findings of Smilor (1987) and Udell (1990) clearly converge in that Smilor (1987) considers financial support and the selection process of incubatees to be a key factor in the success of an incubatee. Although these factors can be beneficial in the context of business incubation, this study will not cover their impact because it is believed that they do not allow an incubatee to substantially distinguish itself from its competitors. The role of the selection process in the success of incubatees has been addressed by Bearse (1998). It remains unclear however, whether incubatees perform well because of the efforts of the business incubator, or because the business incubator only selects incubatees that will perform well regardless of business incubation efforts (Bearse, 1998). For similar reasons as mentioned before – and in accordance to Allen and McCluskey (1990) – this

study will also refrain from considering the impact of passive environmental interventions (Rice, 2002) such as photocopiers, computers, meeting rooms, or a receptionist.

Based on the above stated literature review and considering the findings of the existing literature (Udell, 1990; Smilor, 1987; Mian, 1996), the provision of expertise and the linkages to a support network appear to be important in the development of incubatees. Therefore, this study will examine the impact of business incubation on incubatees in terms of the provision of expertise by coaching and the linkage of incubatees to other actors by network mediation.

2.3 Knowledge and knowledge acquisition

As mentioned before, business incubation aims to support the development of successful new ventures. Developing successful new ventures represents a great challenge considering their high mortality rates. New ventures often lack vital resources, a loyal customer base, a reputation to which it can refer (Brush et al., 2001) and have to overcome the liability of newness (Stinchcombe, 1970).

A key determinant in the successful development of new ventures that is identified by many scholars is knowledge. The eventual success or failure of a new venture may be attributed to various factors – Chrisman et al. (1998) suggest that a new venture's performance depends on the entrepreneur(s), industry, strategy, tangible and intangible resources, and organizational structure – but Wiklund and Shepherd (2003) explain that superior knowledge enables firms to assess their dynamic competitive environment, which in turn allows them to develop an appropriate strategy to deal with these changes. A new venture, similarly, is less capable to identify and benefit from new opportunities if it lacks this knowledge. Knowledge is also important because it forms the basis of other (tangible) resources such as financial or physical capital, which are essential to a developing firm (West and Noel, 2009).

Knowledge-based view of the firm

The theoretical foundation for the knowledge aspects that are used in this study is provided by the knowledge-based view (KBV) of the firm. The KBV is essentially an extension of the resource-based view (RBV) of the firm in that they both apply a perspective that relates a firm's internal characteristics to its performance. More specifically, the RBV posits that performance differences between

firms are largely determined by their ability to control resources that are valuable, rare, imperfectly imitable, and for which no direct substitute exist (Barney, 1991; Grant, 1996). KBV distinguishes itself from RBV by emphasizing the importance of knowledge-based resources. Spender (1996) explains this by arguing that, because a firm's tangible resources all find their origin outside the firm, intangible resources such as firm-specific knowledge are its most important strategic resources. KBV has evolved into several variations – varying in terms of level of analysis[3] – but the underlying idea remains the same; knowledge is a firm's most important source of organizational advantage over other firms (Grant, 1996; Spender, 1996; Kogut and Zander, 1996).

Types of knowledge

To understand the importance of knowledge in firms, it is necessary to conceptualize knowledge. Conceptualizations of knowledge have been the basis of debates ever since the time of classical Greek philosophers (Alavi and Leidner, 2001; Grant, 1996) without resulting in consensus. This study will not take part in the discussion, rather a concise overview is provided that covers the findings that are most relevant to the purpose of this research. A view that is widely adopted among academics makes the distinction between tacit and explicit knowledge. Tacit knowledge can be thought of as an experiential type of knowledge as it is mainly acquired by experience, or learning by doing (Hitt et al., 2000). Because of these characteristics, tacit knowledge is not easily codified, duplicated, or transferred (Chrisman and McMullan, 2004). The dimension of tacit knowledge can be associated with 'knowing how' (Grant, 1996). The ability to speak a language is an example of tacit knowledge, while its grammatical conventions stated in textbooks are a form of explicit knowledge. In contrast, explicit knowledge is an articulated type of knowledge (Hitt et al., 2000). Explicit knowledge is based on theory and facts (Chrisman and McMullan, 2004) and can be transferred through language or symbols (Alavi and Leidner, 2001). Therefore, explicit knowledge is more easily transferred and communicated and can be associated with 'knowing about' (Grant, 1996). Since the introduction of the two concepts, tacit knowledge has received more academic attention than explicit knowledge, but – as Alavi and Leidner (2001) explain – both types are beneficial to a firm. Tacit and explicit

[3]For example, Grant (1996) emphasizes the importance of knowledge in an organization on an individual level, while Spender (1996) focuses on organizational knowledge creation and acquisition at the firm level

knowledge are not two mutually exclusive types of knowledge. Instead they have to be thought of as complementing and influencing each other. Furthermore, these two types of knowledge can reside at both an individual level and firm level (Spender, 1996). In this study knowledge is examined at the firm level, rather than the individual level.

A more practical way in which knowledge can be viewed deals with the types of knowledge that are useful to firms. These types can consist of both tacit and explicit elements. Examples include knowledge about customers, stakeholders, products, or a firm's competitive environment (Alavi and Leidner, 2001). Other knowledge types, such as technical knowledge (Hitt et al., 2000), market knowledge (Wiklund and Shepherd, 2003), or general business knowledge (Studdard, 2006) are also deemed important in the context of a firm.

Knowledge acquisition

Firms operate in a dynamic competitive environment in which they rely on knowledge to survive. Knowledge is important as it enables a firm to identify opportunities and create value. Because the firm's competitive environment is dynamic, it needs to increase and adapt its knowledge base to sustain its competitive position (Hitt et al., 2000). Therefore, the creation, accumulation, and transfer of knowledge is an important factor in the development and growth of new ventures (Yli-Renko et al., 2001). Firms can acquire knowledge through organizational learning and, as such, a firm's performance is influenced by its ability to learn. Organizational learning refers to the firms ability to acquire and combine new knowledge with the knowledge it possesses (Hitt et al., 2000). This knowledge can be acquired externally (i.e. acquisitive learning) or internally (i.e. experimental learning). This study focuses on the acquisition of knowledge from sources external to incubatees – the business incubator.

A firms ability to acquire and exploit external knowledge (absorptive capacity) is determined by its prior related knowledge (Cohen and Levinthal, 1990). Lane and Lubatkin (1998) take this notion a step further by asserting that the knowledge acquisition process is determined by the similarity between two actors involved. The actors would be the 'teacher' firm and 'student' firm, or, in the context of this study, the incubator and incubatee. These notions give important insights in the knowledge acquisition process. This study recognizes that differences may exist in the ability of firms to acquire knowledge from external parties. To take these characteristics into account however, would require in-depth in-

sights in the internal characteristics of both the incubatee and incubator. Because this study focuses on the business incubation process, it chooses to place these subtleties outside the scope of this reseach. Although this may be interpreted as a crude measure, it is believed it is appropriate given the underdeveloped state of the type of research this study aims to conduct.

2.4 Incubatee performance

Relevant literature on business incubation reveals that the fundamental goal of any business incubator is to produce successful new ventures. To determine whether or not new ventures are successful, or to assess their level of success, the topic of performance needs to be discussed.

Performance of firms is a widely recognized and recurring theme in various research streams. Academically it is important to understand performance for theory development and conceptualization. Performance is also relevant to management for evaluating decisions and for improving a firm. Additionally – from a societal point of view – performance of firms is an essential concept as firms are sources of employment, economic development, and innovation.

Because of its importance, substantial discussions persist on the terminology and conceptualization of performance (Venkatraman and Ramanujam, 1986; Connolly et al., 1980; Steers, 1975; Chakravarthy, 1986). Performance is conceptually ambiguous because multiple dimensions exist of what can be referred to as performance (Murphy et al., 1996). In their comparison of approaches to performance measurement of organizations Venkatraman and Ramanujam (1986) note that:

> *"[...] the treatment of performance in research settings is perhaps one of the thorniest issues confronting the academic researchers today"* (Venkatraman and Ramanujam, 1986, p. 801)

Despite the issues, academic advances have been made in performance measurement research that can largely be attributed to organization theory and strategic management (Murphy et al., 1996; Venkatraman and Ramanujam, 1986).

When it comes to conceptualizing business performance in the context of new ventures however, matters are still complex. This is partly due to the limited research and guidance on the performance concept in the context of new ventures (Chandler and Jansen, 1992; Brush and Vanderwerf, 1992; Murphy et al., 1996).

It is also caused by the mixed views on what are appropriate dimensions to assess new venture performance.

Lee et al. (2001) explain, for example, that financial performance indicators may not be appropriate in assessing new ventures because these firms generally are in the product development phase. They illustrate this by well known new ventures – at that time – such as Amazon.com and Yahoo! Korea that financially did not perform well in their start-up phase. Financial performance however, is highly popular among academics in the field of entrepreneurship (Murphy et al., 1996). Because it is hard to collect financial data from new ventures, Bhabra-Remedios and Cornelius (2003) suggest non-financial operational measures – such as market share or product quality (Murphy et al., 1996) – to measure performance of incubatees. Other studies that assess new ventures located in business incubators suggests additional indicators such as total funds raised or total amount of venture capital funding to determine performance in the context of business incubation (Rothaermel and Thursby, 2005). These different perspectives on performance are aggregated by Voisey et al. (2006) who conceptualize performance in business incubation research as in Table 2.2.

Table 2.2: Performance measures in incubation research (Voisey et al., 2006)

	Incubatee-specific	**Incubator-specific**
'Soft' indicators	Professionalism	Expertise or experience of staff
	Business skills	Recognition by enterprise community
	Confidence in self and business	Stakeholder support
	Networking with peers	Internal evaluation
	Knowledge	
	Cost savings	
	Positive publicity	
'Hard' indicators	Sales turnover	Number of incubatees
	Profitability	Number of businesses graduated
	Growth of enterprise	Meeting targets
	Graduation	Continued operation or success

What becomes clear of the dispersed information stated above is that – as in general business performance – incubatee performance is a multidimensional concept. Furthermore, there exists no consensus on the performance dimensions appropriate to study new ventures or incubatees. Consequently, appropriate incubatee performance measures depend on the level of analysis, and their interpretation is contingent on the perspective of the study. Hence, this study will have to rely on multiple indicators of incubatee performance to ensure generalizability

of the results. The specific indicators used to measure incubatee performance in this study will be more elaborately discussed in Chapter 4.

Chapter 3

Conceptual model

3.1 Introduction

This chapter describes the conceptual model and hypotheses that form the core of this research. The sections are concerned with answering the last two sub research questions. The bodies of knowledge reviewed in the previous chapter are combined and extended to construct six hypotheses. Finally, the conceptual model is provided.

3.2 Coaching and knowledge acquisition

The literature review conducted in the previous chapter reveals that the provision of coaching is an important way in which business incubators assist the development of incubatees. Coaching can be referred to as the provision of training, seminars, educational workshops, or programs (Peters et al., 2004). In the context of business incubation, coaching is closely related to the concept of counseling; counseling is the dissemination of knowledge and advice to entrepreneurs in the domain of business startups (Rice, 2002). While some studies (Rice, 2002) choose to separately consider these activities, other studies (Chrisman et al., 1998) aggregate them. Because both activities are geared towards the provision of knowledge to incubatees, this study will refrain making subtle distinctions between counseling, consulting, and education. Instead, and similar to other studies, it will aggregately consider these concepts and label it 'coaching'.

Literature reveals that business incubators provide targeted coaching to incubatees (Allen and McCluskey, 1990; Allen and Rahman, 1985; Smilor, 1987; Udell, 1990). The areas in which incubatees receive coaching and assistance can vary from general business advice to more specific advice in areas such as marketing or finance (Allen and McCluskey, 1990; Allen and Rahman, 1985). Mian (1996) assessed business incubators focused on technology development and determined

that these incubators provide workshops and transfer programs to incubatees, which can be interpreted as a form of coaching. Similarly, business incubators are suggested to fill knowledge gaps in technology or product and service development (Rice, 2002).

Research suggests that the assistance of external advisors can be beneficial to new ventures as it allows them to obtain knowledge to the development of their business (Chrisman and McMullan, 2000, 2004). Chrisman (1999) explains that – through interaction between the business incubator and the incubatee – a form of 'learning by doing' takes place, which allows an incubatee to acquire knowledge. In fact, Nahavandi and Chesteen (1988) found that advice by external consultants was generally perceived to be useful and have positive impact on performance of small businesses. This suggests that the knowledge and advice provided by these consultants represented knowledge not possessed by the incubator before. Because incubatees are generally small firms, it is likely that consulting will also be useful and leads to the acquisition of knowledge.

Thus, assistance from external advisors allows an incubatee to acquire knowledge. Coaching provided by business incubators to incubatees suggests a way in which incubatees acquire technical and business knowledge. Therefore, this study hypothesizes that:

> *H1: Coaching provided by an incubator to an incubatee is positively related to technical knowledge acquisition of an incubatee*

> *H2: Coaching provided by an incubator to an incubatee is positively related to business knowledge acquisition of an incubatee*

Network mediation and knowledge acquisition

New ventures make extensive use of network to access valuable knowledge and advice, and to identify entrepreneurial opportunities. The use of networks is not restricted to the start up phase but continues to be important throughout a firm's lifetime (Hoang and Antoncic, 2003). Entrepreneurs are known to complement their prior knowledge with knowledge acquired through networking (West and Noel, 2009).

Firms use their own network to acquire knowledge but, because networks are so important, some academics suggest that firms benefit from a network provided by an institution (Macpherson and Holt, 2007). The rationale behind this suggestion is that these institutions enable new ventures to access actors that

possess relevant knowledge but that the firm could not have accessed through its own network.

This phenomenon has been examined by McEvily and Zaheer (1999) who explain that knowledge sharing in regional clusters is enhanced by regional institutions, which act as intermediaries between firms. These regional institutions are defined as *"locally-oriented organizations that provide a host of collective support services to firms in the region"* (McEvily and Zaheer, 1999, p. 1135). Although the context of this study is slightly different, the parallel between regional institutions and business incubators is apparent. These institutions are a great source of knowledge because of their mediation between many actors. Furthermore, they reduce the costs involved in searching for valuable knowledge. Similar to findings of Macpherson and Holt (2007) previously stated, McEvily and Zaheer (1999) conclude that the value of intermediaries in terms of knowledge acquisition lie in their ability to bridge structural holes[1] (i.e. connecting companies that otherwise would not have been easily connected).

In fact, research shows that business incubators link incubatees to actors outside the incubator to support the incubatee and aid its development (Smilor, 1987; Peters et al., 2004). Business incubators are known to tie incubatees to their network in the aid of knowledge acquisition. This is supported by Rice (2002) who asserts that:

> *"The community know-how network upon which the incubator manager can draw includes technical experts, bankers, business attorneys, intellectual property attorneys, university professors, accountants, marketing and other types of consultants, and potential debt or equity investors. The referral is usually a reactive response by the incubator manager to an entrepreneurs request for assistance, which the manager is not prepared to provide or which could be provided more effectively by an outside expert."* (Rice, 2002, p. 176).

Exposure to a variety of actors enhances a new venture's technical knowledge acquisition (Zahra et al., 2000). Similarly Hitt et al. (2000) suggest that firms acquire valuable technical knowledge from an external network. If incubators intermediate between incubatees and venture capitalists or other professional service organizations it will allow incubatees to obtain valuable talent and market knowledge (Hoang and Antoncic, 2003). The role of incubators acting as

[1] A structural hole is a social chasm between two actors (McEvily and Zaheer, 1999)

mediators between incubatees and external actors is further addressed by Studdard (2006). Depending on whether or not the incubator manager possesses the technical or managerial knowledge requested by an incubatee, it will refer the incubatee to an actor in its network that does possess relevant knowledge Studdard (2006). Based on these findings it is hypothesized that:

> *H3: Network mediation provided by an incubator to an incubatee is positively related to technical knowledge acquisition of an incubatee*

> *H4: Network mediation provided by an incubator to an incubatee is positively related to business knowledge acquisition of an incubatee*

3.3 Knowledge acquisition and incubatee performance

As discussed in the previous chapter, knowledge is often considered a firm's most important source of organizational advantage over other firms (Grant, 1996; Spender, 1996; Kogut and Zander, 1996).

Various types of knowledge have been identified to be important to a firm. For example, multiple studies (Cohen and Levinthal, 1990; Wiklund and Shepherd, 2003) suggest that market and technical knowledge allow a firm to assess market potential and exploit ideas. Hitt et al. (2000) support this by asserting that especially technical knowledge can create opportunities and enable a firm to create value. Other research (Yli-Renko et al., 2001) however, strongly suggests business knowledge is important for new ventures because it allows them to develop more new and distinct products, and become more efficient.

Because firms – and thus incubatees – operate in a dynamic competitive environment, it must increase and adapt its knowledge base to sustain a competitive position (Hitt et al., 2000). Hence, the knowledge acquisition of incubatees is important for incubatee performance. Indeed, several academics (Studdard, 2006; Wiklund and Shepherd, 2003; West and Noel, 2009; Yli-Renko et al., 2001) assert that a new venture's performance is influenced by the knowledge it is able to acquire. More specifically, Thorpe et al. (2005) suggest that performance of small and medium-sized firms depends on their capability to integrate acquired knowledge with prior knowledge because it is extremely idiosyncratic. This is caused by the unique composition of experience, information sources and contacts addressed. Consequently, the synthesized knowledge fulfills all criteria set by the

resource-based theory (Barney, 1991) in order to provide competitive advantage (West and Noel, 2009; Chrisman and McMullan, 2004). Hitt et al. (2000) stretch this point by asserting that idiosyncratic knowledge acquired at the firm level is difficult to imitate for competitors.

The above stated arguments show that business and technical knowledge are important for performance of firms. Moreover, knowledge constantly needs to be replenished because incubatees operate in a dynamic competitive environment. Therefore, the following hypotheses are proposed:

> *H5: Technical knowledge acquisition of an incubatee is positively related to incubatee performance*

> *H6: Business knowledge acquisition of an incubatee is positively related to incubatee performance*

3.4 Conceptual model

Based on the literature review in Chapter 2 and the hypotheses developed in the previous sections, the conceptual model – which forms the core of this research – can be outlined as in Figure 3.1. The model shows relations between business incubation, knowledge acquisition, and incubatee performance. The rationale behind the total model can be reaffirmed by the following quote:

> *"Outsider assistance can lead to the creation of knowledge that provides a basis for sustainable competitive advantage, which will, in turn, influence venture survival and performance"* (Chrisman and McMullan, 2004, p. 231)

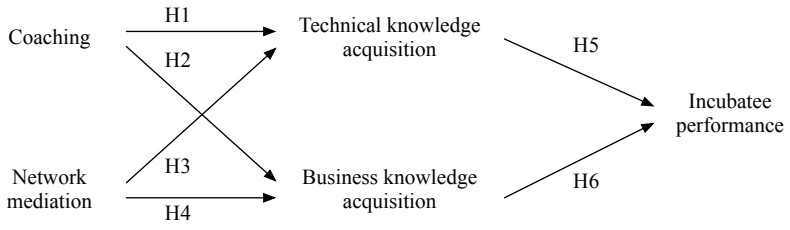


Figure 3.1: Conceptual model

Chapter 4

Methodology

4.1 Introduction

This chapter describes the methodological approach employed to achieve the objectives of this research. First, the research strategy is provided, followed by a discussion on the construction of the sample. It continues with an explanation of the procedures to obtain the data. Then, the measurement of constructs is discussed. Finally, the methods to conduct the quantitative data analysis are explained.

4.2 Research strategy

The review of literature on business incubation reveals that many academics in the field apply a case study approach – employing either qualitative or quantitative methods – to fulfill their research objectives. This research intends to built upon this literature by employing a survey strategy. Although in a survey strategy a researcher is limited in the extent to which he or she intervenes and is not able to gain in-depth insights, it allows for a enhanced generalization of findings.

As with any research strategy, a survey strategy has its advantages and disadvantages. Its main advantage is that it allows for examination of a large number of variables and can including many research units. This, in turn, allows for drawing generalizable conclusions. Questionnaires will be used to collect quantitative data in order to test the hypotheses developed in the previous chapter. Survey research is concerned with the examination of opinions and attitudes of respondents. Therefore, its main disadvantage is that it is susceptible to viewpoints and memory effects.

4.3 Sample

To fulfill the objectives of this research a sample was constructed from which data could be collected. Firms had to meet several sampling criteria – tabulated in Table 4.1 – to be included in the sample.

Table 4.1: Sampling criteria

Sampling criteria for firms to be included in the sample
(1) Associated with a business incubator[1]
(2) Year of establishment between 2000 and 2009

This study examines the effect of business incubation on its incubatees. Therefore, the first sampling criterion ensures that firms in the sample are associated with a business incubator. To properly match the objectives of this research, it was tested whether the business incubators matched the definition of business incubation stated in Chapter 2. This is necessary because different types of business incubators exists (Allen and McCluskey, 1990). Some types of business incubators are primarily focused on real estate development or capital provision. Including firms that are associated with these types of incubators may make it impossible to properly examine knowledge acquisition of incubatees and its effect on incubatee performance. Because this sample encompasses several business incubators, it is likely that different types of incubatees will be included. Incubatees will operate in various industries and may, or may not, be technology-based. The influence of these differences will be controlled for in the regression analyses and is topic of discussion near the end of this chapter.

A second sampling criterion is related to the age of the incubatees. Literature on business incubation often assumes incubatees are new or developing ventures. Furthermore, this research makes use of other bodies of literature that specifically concerns new ventures. To ensure the sample is appropriate for the theoretical base of this research, it is necessary to limit the age of firms in the sample. Academics have used different threshold levels for age under which firms can be considered new ventures (Yli-Renko et al., 2001; Zahra et al., 2000). This study uses the cut off level of ten years, which is comparable to other studies on incubatees (Chen, 2009) and new ventures (Yli-Renko et al., 2001). It should be

[1]The business incubator matches the definition of a business incubator used in the context of this study

noted that academics such as Zahra et al. (2000) suggest lower age levels as a threshold for new firms.

An existing database or data set was, unfortunately, not directly available for the purpose of this study. Therefore, a sample was constructed by reverting to business incubators associated with the Dutch Incubator Association (DIA) – a network for and by business incubators and incubation professionals in the Netherlands. Business incubators affiliated with DIA were screened to determine whether they matched this study's definition of a business incubator. Because not every incubator in the Netherlands is affiliated with DIA, an internet search was conducted to identify additional business incubators. This led to the identification of a total of 17 business incubators in the Netherlands that matched the definition of business incubation used in this study. Academics in the field of business incubation and professionals from the incubator industry were asked to corroborate the list of incubators, which resulted in no unusual findings.

Once it was certain that the most important business incubators in the Netherlands were identified, their individual websites were screened to identify associated firms. Subsequently, an extensive examination was conducted on the websites of the incubatees to secure contact details.

Finally, 392 firms were identified that matched the sampling criteria. An online questionnaire was sent to the firms according to the procedure described in the next section.

4.4 Procedure

The data was collected by means of an online questionnaire. Questionnaires are especially suitable when large groups of firms need to be reached. One main advantage is that questionnaires make it possible to collect a large amount of data in a relatively short time – making it more effective than, for example, oral interviews. Another advantage is that respondents have a greater sense of anonymity, which may reduce a specific answer tendency. The main disadvantage of using an internet questionnaire is that it is not always possible to monitor who is responding. This research precludes this by providing a unique link to each respondent that prevents one person from filling in the questionnaire twice. Additionally, this prevents contamination of data by 'accidental visitors' because access to the questionnaire was only provided through the link.

The questionnaire for this research was made by using a tool called NETQ

(www.netq.nl). NETQ is a questionnaire generator that lets respondents access a questionnaire online via email or website links and fill it in online.

Several steps were taken to ensure data validity and reliability. The questionnaire was tested with the aid of executives of two incubated companies associated with one of the business incubators in this study. To enhance face validity they were asked to closely review the questionnaire after which any potentially confusing items were revised. In addition, an academic with relevant research experience reviewed the questionnaire so as to guarantee content validity.

In an attempt to maximize response rate, the questionnaire was made available in two languages – English and Dutch. To guarantee reliability, back translation was employed. Back translation involved translating the originally English questionnaire into Dutch. Then, the Dutch questionnaire was translated back into English to assess reliability of the translation. When unsatisfying results were found, the Dutch questionnaire was revised. This process was repeated until a reliable Dutch version of questionnaire had been constructed. The back translation was carried out with the aid of two native English speaking students from Delft University of Technology that use Dutch as their second language. The final questionnaire – in both English and Dutch – can be found in Appendix A and Appendix B respectively.

An email describing the background and purpose of the research served as a cover letter of the questionnaire and was sent to the firms in the targeted sample. The email also contained a link to the online questionnaire, allowing respondents to follow that link and fill in the questionnaire. A reminder was sent to non-responding firms. If firms had not responded after receiving the initial invitation and the reminder, a phone call was made to request their response to the questionnaire.

4.5 Measurement of constructs

Conceptual model

Figure 4.1 recapitulates the conceptual model constructed for this study.

Dependent variables

Given the multidimensional nature of incubatee performance – as outlined in Chapter 2 – this research uses multiple measures of incubatee performance. Except one performance indicator, all scales were derived from or based on previous

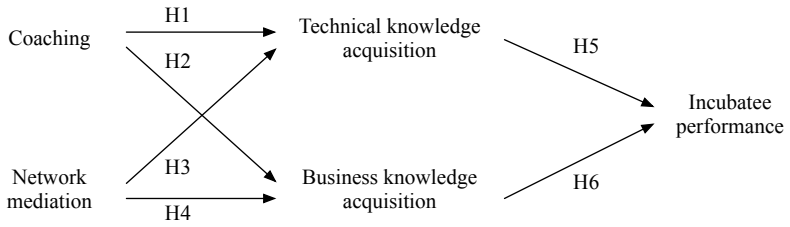


Figure 4.1: Conceptual model recapitulation

studies in the context of business incubation, knowledge acquisition, or new venture performance. The scales were critically reviewed and tailored to the specific objectives of this study. The use of previously validated and existing scales is believed to increase the reliability of this research.

Although absolute and financial measures might not always be appropriate when assessing new ventures (Lee et al., 2001; Gilbert et al., 2006), the use of these indicators is widely adopted (Murphy et al., 1996). As such, this research will apply absolute, relative, financial, and non-financial measures of performance in an attempt to assess their appropriateness in measuring incubatee performance.

Revenues

The incubatees' total revenue was measured on a ratio scale adopted from Rothaermel and Thursby (2005). This indicator of performance is widely adopted in researching new ventures (Murphy et al., 1996) and has also been applied in a business incubation context (Rothaermel and Thursby, 2005). Rothaermel and Thursby (2005) caution for the use of this performance indicator because incubatees tend to be young. Despite these drawbacks, this study includes them to verify the suggestions of Rothaermel and Thursby (2005). Respondents were asked to indicate the total cumulative amount of revenues (in euros) their firm has obtained.

Funds raised

The total funds raised by the incubatees was also adopted from Rothaermel and Thursby (2005). Respondents were requested to indicate the total cumulative amount of funds (in euros) their firm had obtained from different financing sources (e.g. themselves, family, friends, angel investors, venture capitalists, private placements, equity investments, or grants). This performance indicator was applied to incubatees that are technology-based and appeared to measure per-

formance properly. It is unclear whether this applies to non technology-based incubatees and as such will be part of the interests of this study.

Expressions of interest

In search of more operational measures of incubatee performance, this study includes expressions of interest. Because incubatees are generally in the starting phase of their business it is important for them to receive customer feedback. Therefore, expressions of interest are believed to reflect, at least partially, an incubatees' performance, even though it is unclear what the response will be to this indicator. Respondents were asked to indicate the number of expressions of interest from (potential) customers for their firms product/service.

Relative performance

Relative performance of incubatees was measured by a seven-point Likert-scale originally developed by Lumpkin and Dess (1995). It contains three items that assessed the firm's performance compared to other firms facing similar business development challenges or that are in the same business – hence 'relative' performance. The three items focused on sales growth, profitability, and overall performance respectively. Respondents were able to indicate performance of their firm on a seven-point scale ranging from 'very low performer' (1) to 'very high performer' (7). A similar scale has been used by West and Noel (2009) in their study of the impact of knowledge resources on new venture performance. A relative measure was chosen because absolute and financial performance indicators may not appropriately reflect performance of an incubatee. The value of using a relative measure of performance is also highlighted by Wiklund and Shepherd (2003). Absolute and financial indicators may not always be available as most incubatees are in the start up phase. Additionally, incubatees – or new ventures in general – often refuse to disclose these details for strategic reasons.

Distinctiveness

Distinctiveness was measured by a seven-point Likert-scale derived from Yli-Renko et al. (2001) and Studdard (2006). It contains four items that provided statements reflecting the distinctiveness of the firm's product or service. Respondents were able to indicate the extent to which they agreed with these statements on a seven-point Likert-scale ranging from 'disagree strongly' (1) to 'agree strongly' (7). The scale was developed by Yli-Renko et al. (2001) based on the

work of others in a study that assessed knowledge exploitation of new technology-based firms. Studdard (2006) applied the scale in the context of business incubation. Both works were used as the basis for this scale, but slight modifications were made to fit the objectives of this study. As performance of incubatees may not be properly reflected by 'hard' measures (Voisey et al., 2006), it was deemed necessary to include this 'soft' measure of incubatee performance in the study.

Although the last two measures of incubatee performance are subjective, existing research (Venkatraman and Ramanujam, 1986) suggests consistency between subjective and objective performance measures (Lumpkin and Dess, 1995).

Independent variables

Coaching

Coaching was measured by a seven-point Likert-scale based on the work of Rice (2002) and Chrisman and McMullan (2004). The scale contained four items that assessed the extent of coaching the incubatee had received from its business incubator. Respondents were able to indicate the extent of the items on a seven-point Likert-scale ranging from 'no extent' (1) to 'very large extent' (7). The first two items were related to counseling support. To enhance understandability and avoid interpretive differences, a guiding text was provided that stated the following: *"Business incubators sometimes provide counseling to firms located in the incubator either for a fee or free of charge. Counseling is the dissemination of knowledge, recommendations or advice by the business incubator"*. The last two items assessed the education the incubatee received from its incubator and were based on Dahlqvist et al. (2000). To enhance understandability and avoid interpretive differences, a guiding text was provided that stated the following: *"Business incubators sometimes organize education for firms located in an incubator either for a fee or free of charge. This education can include courses, master classes or workshops for example"*.

Network mediation

Network mediation was measured by a seven-point Likert-scale. Even though applied in a different context, the two items were derived from Yli-Renko et al. (2001). The scale contained two items that assessed the extent to which the incubatee's business incubator has acted as a mediator between the venture and other actors. Respondents were able to indicate the extent of the items on a

seven-point Likert-scale ranging from 'no extent' (1) to 'very large extent' (7). To enhance understandability and avoid interpretive differences, a guiding text was provided that stated the following: *"Business incubators sometimes engage in network mediation. Network mediation is matching firms located in the incubator with other actors such as potential customers, partners, employees, university researchers and investors either for a fee or free of charge"*.

Technical knowledge acquisition

Technical knowledge acquisition was measured by a seven-point Likert-scale derived from Yli-Renko et al. (2001) and Studdard (2006). The scale consisted of two items that provided statements reflecting the technical knowledge acquired by the incubatee from being associated with its business incubator. Respondents were able to indicate the extent to which he or she agreed with these statements on a seven-point Likert-scale ranging from 'disagree strongly' (1) to 'agree strongly' (7). To account for firms that did not require a specific type of knowledge in the development of their business, the option 'not applicable' (0) was included. Knowledge acquisition and learning effects have been successfully measured through survey-based measured in other studies (Simonin, 1997; Zander and Kogut, 1995; Zahra et al., 2000).

Business knowledge acquisition

Business knowledge acquisition was measured by a seven-point Likert-scale derived from Yli-Renko et al. (2001) and Studdard (2006). The scale consisted of eight items that provided statements reflecting the business knowledge acquired by the incubatee from being associated with its business incubator. Respondents were able to indicate the extent to which he or she agreed with these statements on a seven-point Likert-scale ranging from 'disagree strongly' (1) to 'agree strongly' (7). To account for firms that did not require a specific type of knowledge in the development of their business, the option 'not applicable' (0) was included. Knowledge acquisition and learning effects have been successfully measured through survey-based measured in other studies (Simonin, 1997; Zander and Kogut, 1995; Zahra et al., 2000).

Control variables

The control variables used in this research are *firm age*, *firm size*, *incubation time*, *technology-based*, *industry*, and *incubator* because these variables have repeatedly

been identified as factors that can have an effect on knowledge acquisition and performance (Zahra et al., 2000; Lane and Lubatkin, 1998; Autio et al., 2000; Yli-Renko et al., 2001; Studdard, 2006; Rothaermel and Thursby, 2005).

Firm age was constructed by subtracting the year of establishment from the current year. Firms were assumed to be established at the beginning of the year of establishment. Firm size was measured by the number of full time equivalent employees. Incubation time was constructed by subtracting the year in which their firm entered the business incubator from the current year. Firms were assumed to have entered the business incubator at the beginning of the year. Whether or not a firm is technology-based may have an effect on a firm's knowledge acquisition or performance. To measure whether a firm is technology-based or not, respondents were asked to indicate whether their firm was involved in developing, commercializing, or manufacturing advanced technology (Yli-Renko et al., 2001). If it was deemed necessary, response to this item was verified by consulting the respondent's website. Respondents were asked to provide the industry in which their firm primarily operates. Based on this description, firms were classified into one of three industry sectors; business services, industrial sector, or miscellaneous. Finally, the incubator to which the incubatee belonged was determined by examining the website of the incubators included in the sample.

4.6 Data analysis

The follow sections describe the methods employed to conduct the data analysis. Most of the information and procedures in this section were adopted from Hair et al. (2006) which served as a guide for data analysis of this study.

Factor analysis

The constructs in the conceptual model were measured on multiple-item scales wherever possible to help ensure reliability. To identify underlying dimensions of the items, factor analysis is employed. Factor analysis is an interdependence technique that aims to determine the underlying structure among variables. As this research makes use of several multiple-item constructs, separate factor analyses was performed for each construct.

A first step is to assess whether it is justified to apply factor analysis. This can be determined by two separate tests; the Kaiser-Meyer-Olkin measure of sampling adequacy and the Bartlett test of sphericity. The Kaiser-Meyer-Olkin measure

of sampling adequacy is an index that quantifies the degree of intercorrelations among variables, which is important in factor analysis. Its index ranges from 0 to 1, where values below 0.50 imply that the use of factor analysis is not justified. The Bartlett test of sphericity tests for presence of significant correlations among at least some variables. As this is important for factor analysis its value should be significant ($p < 0.05$).

The method used to extract the factors was principal components analysis, rather than common factor analysis. Principal components analysis considers the total variance, while common factor analysis only considers common variance. Due to complications of common factor analysis, principal components analysis is used more often.

As unrotated solutions often do not provide theoretically meaningful results, the factor matrix was rotated by means of orthogonal factor rotation. The essential effect of orthogonal factor rotation is a redistribution of extracted variance among the factors. Rotating the initial solution simplifies interpretation of the factor matrix. The orthogonal approach used for rotation is the VARIMAX method, which maximizes the sum of variance of required loadings of the factor matrix.

Once the factors underlying the variables are determined, an assessment of the variables' communalities should follow to identify variables not adequately accounted for by the factor solution. A variable's communality represents its common variance among the variables. Variables with communalities less than 0.50 are considered to not meet the required levels of explanation and should be removed.

The threshold value for an item's loading significance on a factor was 0.40, meaning it is removed from the factor if it falls below that level. Items that cross-loaded on factors – loading significantly on more than one factor – were deleted and the loadings were recalculated.

Finally, the reliability of the identified factors was diagnosed with the aid of Cronbach's alpha. Cronbach's alpha determines the degree of consistency of a multiple-item scale. Generally, a value of 0.70 or higher is considered acceptable and as such this will be the level applied in this research.

Multiple regression analysis

Multiple regression analysis is used to examine the (linear) relations between the dependent and independent variables of this study. Multiple regression can be

used to predict the value of a single unknown dependent variable with the aid of several independent variables whose values are known.

To ensure maximum prediction each independent variable is weighted. This results in a linear combination of weighted independent variables that maximizes prediction of the dependent variable. This combination is also known as the regression model. This study will construct several models to assess the nature of the hypothesized relations between the variables.

The prediction accuracy of the regression model is indicated by its adjusted coefficient of determination (R^2). This value represents the ratio of the variance in the dependent variable explained by the model to the total variance in the dependent variable. The statistical significance of the overall model can be assessed by an F statistic which determines whether the model's R^2 is significantly greater than zero – explaining more variance than the baseline prediction. To test statistical significance of the individual coefficients, t tests were used. The t value represents the number of standard deviations the coefficient lies from zero.

The significance level of the coefficients will be indicated at the 0.10, 0.05, 0.01, and 0.001 level. Finding statistical significance of a model's R^2 is determined by an interplay of the significance level, the number of independent variables, and the sample size. Because of this study limited sample size it will become harder to find significant models at more stringent significance levels. The typical significance level is 0.05. Although it may increase the chances of making a Type I error this research will employ a less restrictive significance level of 0.10. A Type I error is the probability of rejecting the null hypothesis while it should not have been rejected. In contrast, a Type II error is the probability of not rejecting the null hypotheses while it should have been rejected.

Chapter 5

Results and discussion

5.1 Introduction

This chapter sets out the results of the statistical data analyses. First, the response to the questionnaire will be analyzed. Second, the results of the factor analyses will be discussed. Third, the correlations among the variables in this study will be presented. Fourth, the hypotheses constructed in Chapter 3 will be tested through eight regression models. Finally, a discussion will follow that covers the consequences of the data analyses for the hypotheses developed in this study.

5.2 Response analysis

A first assessment of the response revealed that the financial indicators of performance – total funds and revenues – were often missing or inadequately indicated by respondents. Response to the indicator expressions of interest exhibited the same characteristics. If these performance indicators are used, the total number of useful cases are inadequate for the purpose of this study. Therefore, it was decided to exclude these dependent variables from the data analysis. This left two subjective performance indicators – relative performance and distinctiveness – for analysis. As mentioned before, existing research (Venkatraman and Ramanujam, 1986) suggests consistency between subjective and objective performance measures (Lumpkin and Dess, 1995). Therefore, it is believed the two indicators are adequate measures of performance in the context of this research. Furthermore, to ensure enough usable cases for the data analyses, the knowledge acquisition items for which some respondents had indicated not applicable were converted to a neutral score.

In total, 392 firms were approached of which 59 completed the full questionnaire, resulting in a response rate of 15.1 percent. Although similar studies in

business incubation research are sparse, this rate is comparable to studies such as Studdard (2006) who had a 14.8 percent response rate to a survey of U.S. incubatees and a 5.0 percent response rate to a survey of Finnish incubatees. Of the 59 returned questionnaires, 4 were excluded as they did not match the sampling criteria. Additionally, 7 were excluded due to missing or incomplete answers to questions, which left 48 usable cases. This resulted in an effective response rate of 12.2 percent.

The average age of the firms in sample is 3.52 years, with an average employee base of 4.50 full time equivalents. The average incubation time is 2.63 years. More than half of the incubatees (58.3 percent) are technology-based. The respondents operate in various industries, but the majority (60.4 percent) operates in the business services industry. Incubatees from industrial sector accounted for 25.0 percent of the respondents, while 14.6 percent works in miscellaneous industries. The firms are distributed over the incubators as outlined in Table 5.1

Table 5.1: Distribution of incubatees over incubators

Incubator	**Percent**
I	4.2
II	2.1
III	4.2
IV	2.1
V	8.3
VI	12.5
VII	8.3
VIII	12.5
IX	2.1
X	6.2
XI	10.4
XII	2.1
XIII	25.0
N = 48	100.0

To assess whether significant differences exist between respons of groups of respondents, Mann-Whitney U-tests[1] were performed on the most important variables. Respondents that are technology-based rank significantly higher than non technology-based incubatees in terms of *distinctiveness* and *business knowledge acquisition*. A dummy variable for the largest industry – business services – was constructed. Tests indicate a significantly lower rank for respondents from this industry than others in terms of *firm size*, *incubation time*, and *distinctiveness*.

[1]Mann-Whitney U-test is a nonparametric statistical test that examines whether two samples are different in terms of their rank sums

The final test was conducted with a dummy variable for incubator XIII as it is heavily represented in the sample. This test indicates significantly higher ranks in *coaching*, *network mediation*, *technical knowledge acquisition*, and *business knowledge acquisition* for firms from incubator XIII, compared to respondents from other incubators. These findings support the need to consider the control variables in the regression analyses.

5.3 Results factor analysis

Dependent variables

Relative performance

To test whether the three items measuring relative performance indeed measure the intended construct, factor analysis was performed. The outcomes of the Kaiser-Meyer-Olkin test of 0.725 (> 0.50) and Bartlett's test of sphericity ($\chi^2 = 84.665$, $p = 0.000$) suggest that the application of factor analysis is justified. The results could not be rotated as one factor was underlying the data. All items loaded significantly on the factor with values > 0.45. The items' communalities all exceeded the minimum of 0.30. The items are measuring the intended construct so they are combined into one variable; relative performance. Cronbach's α was calculated which resulted in: relative performance (three items) $\alpha = 0.89$. Table C.1 provides a more detailed overview of the results of the factor analysis.

Distinctiveness

To test whether the four items measuring distinctiveness indeed measure the intended construct, factor analysis was performed. The outcomes of the Kaiser-Meyer-Olkin test of 0.615 (> 0.50) and Bartlett's test of sphericity ($\chi^2 = 43.367$, $p = 0.000$) suggest that the application of factor analysis is justified. The results could not be rotated as one factor was underlying the data. All items loaded significantly on the factor with values > 0.45. The items communalities all exceeded the minimum of 0.30. The items are measuring the intended construct so they are combined into one variable; distinctiveness. Cronbach's α was calculated which resulted in: distinctiveness (four items) $\alpha = 0.70$. Table C.2 provides a more detailed overview of the results of the factor analysis.

Independent variables

Coaching and network mediation

The Kaiser-Meyer-Olkin test indicates that it is not justified to perform factor analysis on the two items of network mediation to assess whether the items measure the individual construct. Therefore, factor analysis is performed over the six items measuring coaching and network mediation, although they intend to measure two separate constructs.

The outcomes of the Kaiser-Meyer-Olkin test of 0.729 (> 0.5) and Bartlett's test of sphericity ($\chi^2 = 289.464$, $p = 0.000$) suggest that the application of factor analysis is justified. The results could be rotated as two factors were underlying the data. All items loaded significantly on the factor with values > 0.45. The items' communalities all exceeded the minimum of 0.30. As expected, the two factors were related to two dimensions; coaching and network mediation. Cronbach's α was calculated for each dimension which resulted in: coaching (four items) $\alpha = 0.94$ and network mediation (two items) $\alpha = 0.95$. Table C.3 provides a more detailed overview of the results of the factor analysis.

Technical knowledge acquisition and business knowledge acquisition

The Kaiser-Meyer-Olkin test indicates that it is not justified to perform factor analysis on the two items of technical knowledge acquisition to assess whether the items measure the individual construct. Table C.4 provides a more detailed overview of the results of the factor analysis. Therefore, factor analysis is performed over the ten items measuring technical knowledge acquisition and business knowledge acquisition, although they intend to measure two separate constructs.

To test whether the ten items measuring knowledge acquisition indeed measure the construct, factor analysis was performed. The outcomes of the Kaiser-Meyer-Olkin test of 0.795 (> 0.5) and Bartlett's test of sphericity ($\chi^2 = 487.286$, $p = 0.000$) suggest that the application of factor analysis is justified. The results indicated that three items – business knowledge acquisition A, E, and F – had to be removed as these items cross-loaded on the factors.

Factor analysis was repeated after the three items were removed. The outcomes of the Kaiser-Meyer-Olkin test of 0.740 (> 0.5) and Bartlett's test of sphericity ($\chi^2 = 283.651$, $p = 0.000$) suggest that the application of factor analysis is justified. The results could be rotated as two factors were underlying the data. All items loaded significantly on the factor with values > 0.45. The items' communalities all exceeded the minimum of 0.30. As expected, the two factors

were related to two dimensions; technical knowledge acquisition and business knowledge acquisition. Cronbach's α was calculated for each dimension which resulted in: technical knowledge acquisition (two items) $\alpha = 0.85$ and business knowledge acquisition (five items) $\alpha = 0.93$. Table C.5 provides a more detailed overview of the results of the factor analysis.

Factor analysis summary

Table 5.2 provides an overview of the main results of the factor analysis of constructs as described in the previous section. More detailed results are provided in Appendix C.

Table 5.2: Overview factor analyses

Construct	**N**	**KMO**	**Bartlett, p**	α	**Items**
Relative performance	48	0.725	0.000	0.89	3
Distinctiveness	48	0.615	0.000	0.70	4
Coaching	48	0.729	0.000	0.94	4
Network mediation	48	0.729	0.000	0.95	2
Technical knowledge acquisition	48	0.740	0.000	0.85	2
Business knowledge acquisition	48	0.740	0.000	0.93	5

5.4 Correlation matrix

The construct's Cronbach's α values suggest that the items that were used to measure the constructs are consistent. To improve the study however, a detailed correlation matrix was examined that sets out the correlations among the dependent, independent, and control variables. The dependent variables however, were not correlated as a construct but as the individual items. This detailed correlation matrix can be found in Table D.1 in Appendix D.

First, it can be observed that the detailed correlation matrix shows significant correlations among the individual items measuring relative performance. The same statement can be made regarding the items measuring distinctiveness. These observations make sense when considering the outcomes of the factor analyses and their Cronbach's α values.

Second, it can be observed that the individual items of the dependent variables inconsistently correlate with the independent variables technical knowledge acquisition and business knowledge acquisition. Relative performance A and B

do not correlate significantly with technical knowledge acquisition and business knowledge acquisition, only relative performance C does. The items for distinctiveness show even more inconsistency in their correlations with the independent variables for technical knowledge acquisition and business knowledge acquisition. Distinctiveness A, B, and C show no significance, while distinctiveness D only correlates significantly with business knowledge acquisition.

Entering the three items for relative performance and the four items for distinctiveness as two constructs into the regression equations will most likely result in non significant relations. Therefore, it was decided not to use the constructs as a whole but to use their items most significantly correlating with the independent variables – relative performance C and distinctiveness D. Considering the way in which they were measured – question 32 and 29 respectively in the questionnaire in Appendix A – it is understandable that respondents would relate better to these items. Both items were renamed to give an enhanced reflection of the concept that they measured; relative performance C was renamed *relative overall performance* – distinctiveness D was renamed *product distinctiveness*. Given the correlations among the items for relative performance and among the items for distinctiveness it is believed that the potential bias of this corrective intervention is not critical.

The final correlation matrix that results from the decisions explained before it represented in Table 5.3. The correlation matrix shows favorable correlations among the dependent and independent variables. Although not every correlation is significant, the ones that are significant, are positive.

This study employs multiple control variables but because the sample size is limited (N = 48), it is necessary to discard some control variables so as to ensure generalizability[2]. The first control variable firm age exhibits few significant correlations with the dependent and independent variables. In fact, firm age is only significantly correlated with the independent variable coaching but this is a negative correlation. One explanation is that as incubatees mature, they require less coaching from a business incubator than younger firms. Younger firms suffer more from liabilities of newness and struggle to obtain resources. Therefore, they are more likely to require coaching from a business incubator than younger firms.

Furthermore, the significant correlation between firm age and incubation time

[2]A ratio of observations to independent variables should not be lower than 5:1 but favorable ratios would exceed 15:1 (Hair et al., 2006)

suggests that both variables measure similar concepts. Theoretically this makes sense; older firms are less likely to enter a business incubator than younger firms. Therefore, older firms will exhibit a higher incubation time. Younger firms, similarly, will invariably exhibit a lower incubation.

Incubation time is significantly, but negatively, correlated with business knowledge acquisition. One explanation is that an incubator's business knowledge base plays a role in the business knowledge acquisition of incubatees. Incubatees that have spent more time in an incubator may have a different perception of business knowledge acquisition than other incubatees because the business incubator was less mature. Consequently, it can be that its business knowledge was not well developed. As it matures, the incubator's business knowledge base most likely improves, which results in more business knowledge acquisition of incubatees that recently entered the incubator. Another explanation is that memory and viewpoint effects are at work. Incubatees that have spent more time in an incubator may simply find it harder to assess its business knowledge acquisition than other incubatees.

Whether or not a firm operates in the business service industry is not significantly correlated with the dependent variables of this study. One interpretation of this observation is that performance differences and industry may not be associated for firms of this size (mean firm size = 4.50 employees, S.D. = 4.56) and stage of development (mean age = 3.52 year, S.D. = 2.30). Incubatees in a given business incubator generally operate in different industries. Their very stay in the incubator suggests no association between coaching, network mediation, and industry. This is also reflected by the correlations among these variables.

Because all firms in the sample are generally small (mean firm size = 4.50 employees, S.D. = 4.56), firm size becomes the next best candidate for exclusion as a control variable. Firm size correlates significantly with product distinctiveness but the dummy for technology-based firms also exhibits a correlation with this variable. Both are suitable as control variables in association with the dependent variables and are correlated among each other. It is believed that in this context it is justified to control with the dummy technology-based.

To enhance the overall study – and based on the above stated arguments – the decision was made to exclude firm age, industry, and firm size as control variables from the regression models in the following sections. It is believed that the remaining control variables – incubation time, incubator XIII, and technology-based – are adequate to account for these exclusions.

Table 5.3: Correlation matrix

	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Relative overall performance	4.75	1.28	–														
2. Product distinctiveness	4.23	1.75	.235	–													
3. Coaching	2.61	1.88	.098	.060	–												
4. Network mediation	3.36	1.82	.049	.310*	.540***	–											
5. Technical knowledge acq.	2.39	1.34	.256†	.020	.264†	.266†	–										
6. Business knowledge acq.	2.76	1.43	.286*	.281†	.617***	.517***	.516***	–									
7. Firm age	3.52	2.30	.125	.004	-.257†	-.025	-.058	-.200	–								
8. NQ Firm size	4.50	4.56	.203	.345*	.040	.069	-.055	.184	-.106	–							
9. Incubation time	2.63	1.67	.154	.026	-.154	-.232	-.226	-.292*	.292*	.166	–						
10. Incubator XIII (dummy)	0.25	0.44	.000	.090	.812***	.471**	.231	.556***	-.217	.155	-.160	–					
11. Not incubator XIII (dummy)	0.75	0.44	.000	-.090	-.812***	-.471**	-.231	-.556***	.217	-.155	.160	-1***	–				
12. Technology-based (dummy)	0.58	0.50	.167	.526***	.206	.171	-.025	.230	-.104	.398**	.115	.195	-.195	–			
13. Not technology-based (dummy)	0.42	0.50	-.167	-.526***	-.206	-.171	.025	-.230	.104	-.398**	-.115	-.195	.195	-1***	–		
14. Business services (dummy)	0.60	0.49	.008	-.212	-.105	.010	.219	.104	.138	-.268†	-.274†	-.123	.123	-.338*	.338*	–	
15. Not business services (dummy)	0.40	0.49	-.008	.212	.105	-.010	-.219	-.104	-.138	.268†	.274†	.123	-.123	.338*	-.338*	-1***	–

†, p < .10; *, p < .05; **, p < .01; ***, p < .001; N = 48

5.5 Results multiple regression analysis

This section is concerned with regression analyses of the variables. To test the whether the hypotheses can be supported or have to be rejected this study used several regression models.

The first model examines the relation between the independent variables coaching and network mediation, and the dependent variable technical knowledge acquisition. The second model uses the same independent variables as the first model but considers their relation with the dependent variable business knowledge acquisition. The third, fourth, and fifth model consider the relation between the independent variables and the dependent variable relative overall performance. These models also allow for examination of a mediating effect of knowledge acquisition between business incubation and the first indicator of incubatee performance – relative overall performance. To assess whether knowledge acquisition mediates the relation between business incubation efforts and incubatee performance, three condition were examined that must hold to establish mediation (Baron and Kenny, 1986):

1. The independent variables (coaching and network mediation) should be related to the mediators (technical and business knowledge acquisition)
2. The independent variables should be related to the dependent variables (relative overall performance and product distinctiveness)
3. The mediators should be related to the independent variables

Once these conditions hold, the relation between the independent variables and the dependent variables should be reduced of eliminated when the mediator is taken into account. The sixth, seventh, and eighth model consider the relation between the independent variables and the dependent variable product distinctiveness. The last three models also allow for examination of a mediating effect of knowledge acquisition between business incubation and the second indicator of incubatee performance – product distinctiveness.

Model 1 – Effects on technical knowledge acquisition

The first model examines the relation between the independent variables coaching and network mediation, and the dependent variable technical knowledge acquisition. This model tests hypotheses 1 and 3. Table 5.4 provides an overview of the regression coefficients.

Table 5.4: Regression model 1

Dependent variable	**Control**		**Model 1**	
Technical knowledge acquisition	β	(t)	β	(t)
Control variables				
Incubation time	-.187	(-1.272)	-.156	(-1.035)
Incubator XIII (dummy)	.210	(1.407)	.025	(.100)
Technology-based (dummy)	-.045	(-.301)	-.069	(-.458)
Independent variables				
Coaching (H1)			.155	(.594)
Network mediation (H3)			.146	(.828)
R^2		**.092**		**.122**
Adjusted R^2		**.030**		**.018**
F-value		**1.484**		**1.172**

†, p < .10; *, p < .05; **, p < .01; ***, p < .001; N = 48

First, the control variables incubation time, technology-based (two dummies), and incubator XIII (two dummies) are entered into the model. The model's adjusted R^2 is not significantly different from zero. This indicates that the variance which the model explains is not significantly different from its baseline prediction. Hence, the control variables are not significantly related to technical knowledge acquisition.

Second, the independent variables coaching and network mediation are entered into the model. Including these variables leads to a diminished adjusted R^2 value – from 0.030 to 0.018 – and the overall model remains non-significant.

Model 2 – Effects on business knowledge acquisition

The second model uses the same independent variables as the first model but considers their relation with the dependent variable business knowledge acquisition. This model tests hypotheses 2 and 4. Table 5.5 provides an overview of the regression coefficients.

First, the control variables incubation time, technology-based (two dummies), and incubator XIII (two dummies) are entered into the model. The model is significant at the 0.001 level with an F-statistic of 8.833. The control variable incubation time is significantly ($p < 0.10$) but negatively related to business knowledge acquisition. Furthermore, the control variable incubator XIII ($p < 0.001$) exhibits a significant positive relation with business knowledge acquisition.

Second, the independent variables coaching and network mediation are entered into the model. Including these variables leads to an increased adjusted R^2

Table 5.5: Regression model 2

Dependent variable	**Control**		**Model 2**	
Business knowledge acquisition	β	(t)	β	(t)
Control variables				
Incubation time	-.232	(-1.904)†	-.184	(-1.574)
Incubator XIII (dummy)	.487	(3.942)***	.113	(.584)
Technology-based (dummy)	.161	(1.315)	.120	(1.026)
Independent variables				
Coaching (H2)			.362	(1.791)†
Network mediation (H4)			.205	(1.503)
R^2		**.376**		**.473**
Adjusted R^2		**.333**		**.410**
F-value		**8.833*****		**7.544*****

†, p < .10; *, p < .05; **, p < .01; ***, p < .001; N = 48

value – from 0.333 to 0.410. The overall model remains significant ($p < 0.001$) but shows a decreased F-statistic of 7.544. No significant relation was found between network mediation and business knowledge acquisition. In contrast, a positive relation with the dependent variable is exhibited by coaching ($p < 0.10$). By entering these independent variables into the regression equation the control variables become non significant.

Models 3, 4, and 5 – Effects on relative overall performance

The next three models consider the relation between the independent variables and the dependent variable relative overall performance. These models also allow for examination of a mediating effect of knowledge acquisition between business incubation and the first indicator of incubatee performance – relative overall performance. Table 5.6 provides an overview of the regression coefficients.

First, the control variables incubation time, technology-based (two dummies), and incubator XIII (two dummies) are entered into the model. The model's adjusted R^2 is negative and not significantly different from zero. This indicates that the variance which the model explains is not significantly different from its baseline prediction. Hence, the control variables show no significant relation with relative overall performance.

Model 3

The third model considers the relation between the independent variables technical and business knowledge acquisition, and the dependent variable relative

Table 5.6: Regression models 3, 4, and 5

Dependent variable	**Control**		**Model 3**		**Model 4**		**Model 5**	
Relative overall performance	β	(t)	β	(t)	β	(t)	β	(t)
Control variables								
Incubation time	.135	(.897)	.255	(1.736)†	.148	(.956)	.245	(1.618)
Dummy - Incubator XIII	-.008	(-.054)	-.227	(-1.363)	-.233	(-.912)	-.280	(-1.152)
Dummy - Technology-based	.153	(1.007)	.101	(.688)	.136	(.878)	.104	(.694)
Independent variables								
Technical knowledge acq. (H5)			.176	(1.077)			.180	(1.075)
Business knowledge acq. (H6)			.372	(1.889)†			.369	(1.714)†
Coaching					.270	(1.007)	.108	(.412)
Network mediation					.024	(.134)	-.077	(-.442)
R^2		**.046**		**.207**		**.073**		**.213**
Adjusted R^2		**-.019**		**.113**		**-.037**		**.076**
F-value		**.713**		**2.199**†		**.664**		**1.550**

†, p < .10; *, p < .05; **, p < .01; ***, p < .001; N = 48

overall performance. This model tests hypotheses 5 and 6. Compared to the control model, entering these variables leads to an increased adjusted R^2 value – from -0.019 to 0.113. The overall model becomes significant ($p < 0.10$) with an F-statistic of 2.199. No significant relation was found between technical knowledge acquisition and relative overall performance. In contrast, a positive relation with the dependent variable is exhibited by business knowledge acquisition ($p < 0.10$). By entering these independent variables into the regression equation the control variable incubation time becomes significant ($p < 0.10$). The other control variables remain non significant.

Model 4

To examine whether the second condition for the mediating effect of knowledge acquisition holds, the fourth model regresses the dependent variable relative overall performance on coaching and network mediation. Compared to the control model, entering these variables leads to a decreased adjusted R^2 value – from -0.019 to -0.037 – and the overall model remains non significant. Hence, the independent variables are not significantly related to relative overall performance. By entering these independent variables into the regression equation the control variables remain non significant.

Model 5

The fifth model is concerned with the relation between the independent variables and the dependent variable relative overall performance – relative overall performance is regressed on technical knowledge acquisition, business knowledge acquisition, coaching, and network mediation. This model tests hypotheses 5 and 6. Compared to the control model, entering these variables leads to an increased adjusted R^2 value – from -0.019 to 0.076 – but the overall model remains non significant. No significant relation was found between coaching, network mediation, technical knowledge acquisition, and relative over performance. In contrast, a positive relation with the dependent variable is exhibited by business knowledge acquisition ($p < 0.10$). By entering these independent variables into the regression equation the control variables remain non significant.

The above stated models suggest significant relations exist between the independent and dependent variables. An overview of the relations found by the regression analyses are depicted in Figure 5.1.

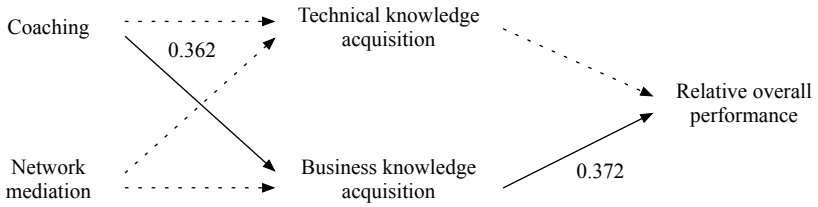


Figure 5.1: Significant relations for relative overall performance

Models 6, 7, and 8 – Effects on product distinctiveness

The last three models consider the relation between the independent variables and the dependent variable product distinctiveness. These models also allow for examination of a mediating effect of knowledge acquisition between business incubation and the second indicator of incubatee performance – product distinctiveness. Table 5.7 provides an overview of the regression coefficients.

First, the control variables incubation time, technology-based (two dummies), and incubator XIII (two dummies) are entered into the model. The model is significant at the 0.05 level with an F-statistic of 5.645. The control variable technology-based exhibits a significant ($p < 0.001$) positive relation with product distinctiveness.

Table 5.7: Regression models 6, 7, and 8

Dependent variable	**Control**		**Model 6**		**Model 7**		**Model 8**	
Product distinctiveness	β	(t)	β	(t)	β	(t)	β	(t)
Control variables								
Incubation time	-.038	(-.292)	.016	(.117)	.015	(.115)	.054	(.414)
Dummy - Incubator XIII	-.020	(-.152)	-.149	(-.972)	.049	(.232)	.018	(.086)
Dummy - Technology-based	.534	(4.042)***	.482	(3.565)**	.511	(3.990)***	.468	(3.594)**
Independent variables								
Technical knowledge acq. (H5)			-.085	(-.561)			-.097	(-.670)
Business knowledge acq. (H6)			.301	(1.655)			.298	(1.587)
Coaching					-.272	(-1.226)	-.365	(-1.593)
Network mediation					.350	(2.340)*	.303	(1.986)†
R^2		**.278**		**.323**		**.365**		**.403**
Adjusted R^2		**.229**		**.242**		**.290**		**.298**
F-value		**5.645****		**4.009****		**4.835****		**3.856****

†, p < .10; *, p < .05; **, p < .01; ***, p < .001; N = 48

Model 6

The sixth model considers the relation between the independent variables technical and business knowledge acquisition, and the dependent variable product distinctiveness. This model tests hypotheses 5 and 6. Compared to the control model, entering these variables leads to an increased adjusted R^2 value – from 0.229 to 0.242. The overall model remains significant ($p < 0.05$) with a decreased F-statistic of 4.009. No significant relation was found between technical knowledge acquisition and product distinctiveness. For the relation between business knowledge acquisition and product distinctiveness holds the same as its significance level just falls outside the significance range. By entering these independent variables into the regression equation the control variable technology-based remains significant ($p < 0.01$). The other control variables remain non significant.

Model 7

To examine whether the second condition for the mediating effect of knowledge acquisition holds, the seventh model regresses the dependent variable product distinctiveness on coaching and network mediation. Compared to the control model, entering these variables leads to an increased adjusted R^2 value – from 0.229 to 0.290. The overall model remains significant ($p < 0.05$) with a decreased F-statistic of 4.835. No significant relation was found between coaching and product distinctiveness. In contrast, a positive relation with the dependent variable is exhibited by network mediation ($p < 0.05$). By entering these independent vari-

ables into the regression equation the control variable technology-based remain significant ($p < 0.001$). The other control variables remain non significant.

Model 8

The eighth model is concerned with the relation between the independent variables and the dependent variable product distinctiveness – product distinctiveness is regressed on technical knowledge acquisition, business knowledge acquisition, coaching, and network mediation. This model tests hypotheses 5 and 6. Compared to the control model, entering these variables leads to an increased adjusted R^2 value – from 0.229 to 0.298. The overall model remains significant ($p < 0.05$) with an F-statistic of 3.856. No significant relation was found between technical knowledge acquisition and product distinctiveness, and neither between business knowledge acquisition and product distinctiveness as its statistics fall just outside the significance range. In contrast, a positive relation with the dependent variable is exhibited by network mediation ($p < 0.10$). By entering these independent variables into the regression equation the control variable technology-based remains significant ($p < 0.05$). The other control variables remain non significant.

The above stated models suggest significant relations exist between the independent and dependent variables. An overview of the relations found by the regression analyses are depicted in Figure 5.2.

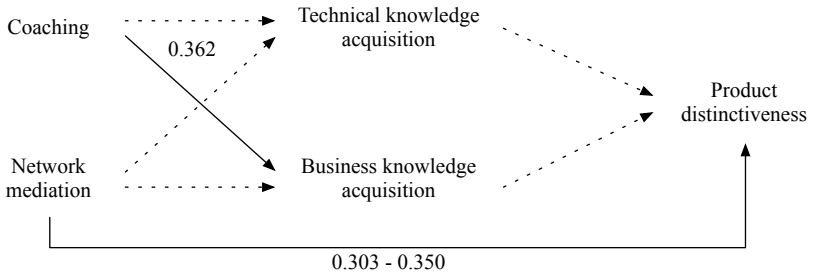


Figure 5.2: Significant relations for product distinctiveness

5.6 Discussion

The preceding analyses indicate that relations exist between the dependent and independent variables of this study. Although interesting findings are observed,

the results of the regression models generally suggest that is was hard to detect significant relations between independent and dependent variables.

This study suffers from the drawback that it has a limited sample size. The limited sample size, combined with multiple independent variables, makes it hard to detect significant relations. Moreover, the Mann-Whitney U-tests conducted at the start of this chapter suggest that differences exists among groups of respondents with respect to some critical variables. This may cause inconsistent patterns in the relations, which does not add to the ease of detecting significant relations.

Interpreting effects on technical knowledge acquisition

The first model does not significantly explain variance in technical knowledge acquisition. Although coaching and network mediation both significantly and positively correlate with technical knowledge acquisition, the regression model was not able to determine a significant relation. Consequently, the first model suggests that hypotheses 1 and 3 can not be accepted. The model suggests that technical knowledge acquisition of an incubatee is not significantly influenced by coaching or network mediation provided by a business incubator to an incubatee.

Interpreting effects on business knowledge acquisition

The second model shows interesting effects on the dependent variable business knowledge acquisition. In the control model, incubation time is significantly but negatively related to business knowledge acquisition. This suggests that the business knowledge acquisition of an incubatee is negatively influenced by the time it spends in an incubator. Furthermore, the dummy for incubator XIII is positively related to business knowledge acquisition. This implies that there is a difference between incubatees associated with incubator XIII and the incubatees associated with other incubators regarding their business knowledge acquisition. Interestingly, these effects are eliminated when coaching and network mediation are taken into account. This suggests that coaching is a better predictor of business knowledge acquisition than incubation time and the incubator. Consequently, the second model suggests that hypothesis 2 can be accepted, however, hypothesis 4 can not be accepted. The model suggests that business knowledge acquisition of an incubatee is positively influenced by the coaching provided by the incubator to the incubatee.

Interpreting effects on relative overall performance

The third model shows that variance in relative overall performance is significantly explained by business knowledge acquisition and incubation time. Consequently, suggests hypothesis 6 can be accepted, however, hypothesis 5 can not be accepted. This is an interesting finding because it suggests that the business knowledge incubatees acquire positively influences its relative overall performance. The technical knowledge acquisition of an incubatee does not appear to significantly influence the relative overall performance of an incubatee. Furthermore, the model implies that the relative overall performance of an incubatee is positively influenced by the time it spends in a business incubator.

The fourth model was not employed for testing hypotheses; it was employed to assess one of the conditions that must hold to formally test whether knowledge acquisition mediates the relation between business incubation and relative overall performance. The models does not significantly explain variance relative overall performance. Consequently, the second condition that must hold to formally test the mediating effect of knowledge acquisition does not hold. This means that the mediating effect of knowledge acquisition cannot formally be tested. Furthermore, coaching and network mediation provided by an incubator do not appear to directly influence the relative overall performance of incubatees.

The fifth model shows that a significant positive relation exists between business knowledge acquisition and an incubatees' relative overall performance. Because the model itself is non significant however, it must be concluded that this model suggests that hypothesis 5 and 6 can not be accepted. The model suggests that technical and business knowledge acquisition, coaching, and network mediation do not significantly influence an incubatees relative overall performance.

Interpreting effects on product distinctiveness

The sixth model shows that variance in product distinctiveness is not significantly explained by technical and business knowledge acquisition. As a result, this model suggests that hypothesis 5 and 6 can not be accepted. This implies that technical and business knowledge acquisition do not significantly influence an incubatees' product distinctiveness. It does show however, that significant differences exist between technology-based incubatees and non technology-based incubatees regarding their product distinctiveness.

The seventh model was not employed for testing hypotheses; it was employed to assess one of the conditions that must hold to formally test whether knowl-

edge acquisition mediates the relation between business incubation and product distinctiveness. The model shows that variance in product distinctiveness is significantly explained by network mediation and the dummy for technology-based incubatees. Consequently, the second condition that must hold to formally test the mediating effect of knowledge acquisition holds. The previous model however, shows that the third condition does not hold. This means that the mediating effect of knowledge acquisition cannot formally be tested. Furthermore, coaching provided by an incubator does not appear to directly influence the product distinctiveness of incubatees.

The eighth model shows that no significant relation exists between technical and business knowledge acquisition, and product distinctiveness. As a result, this model suggests that hypothesis 5 and 6 can not be accepted. It does suggest however, that network mediation provided by an incubator positively affects an incubatees product distinctiveness. It also implies that significant differences exist between technology-based incubatees and non technology-based incubatees regarding their product distinctiveness.

Chapter 6

Conclusions and recommendations

6.1 Introduction

This chapter draws the final conclusions based on the literature review, data analyses, and discussion. It also provides the scientific contributions and managerial implications of this research. Finally, the limitations of this study are discussed and recommendations are made for future research.

6.2 Conclusions

This thesis posited that business incubation may influence knowledge acquisition of incubatees. It also proposed that knowledge acquisition of incubatees could be related to incubatee performance. The two research questions central to this study are:

> *"What is the effect of business incubation on knowledge acquisition of incubatees?"*
>
> *"What is the effect of knowledge acquisition of incubatees on incubatee performance?"*

Effect of business incubation on knowledge acquisition of incubatees

To answer the first research question, a review of the relevant literature was conducted. This resulted in the construction of four hypotheses which statistically tested with data collected from 48 incubatees of 13 business incubators in the Netherlands. Table 6.1 displays the hypotheses and the statistical evidence that

was found. The results of the data analyses suggest that a significant positive relation exists between coaching provided by business incubators to incubatees and business knowledge acquisition of incubatees.

Table 6.1: Hypotheses to answer the first research question

	Hypothesis	**Statistical evidence**
H1	Coaching provided by an incubator to an incubatee is positively related to technical knowledge acquisition of an incubatee	Not accepted
H2	Coaching provided by an incubator to an incubatee is positively related to business knowledge acquisition of an incubatee	Accepted
H3	Network mediation provided by an incubator to an incubatee is positively related to technical knowledge acquisition of an incubatee	Not accepted
H4	Network mediation provided by an incubator to an incubatee is positively related to business knowledge acquisition of an incubatee	Not accepted

The positive significant relation between coaching on business knowledge acquisition supports theoretical argument underlying a case study conducted by (Rice, 2002). In that study, it is asserted the business incubators compensate knowledge gaps of incubatees. The relation also shows that, indeed, incubatees make use of the greater experience and business knowledge of business incubators (Rice, 2002). In fact, Rice (2002) suggests that this is business incubation's main reason of being. The findings also provide the statistically tested support for the findings of a case study (Peters et al., 2004) that involved interviews with four business incubator managers. That study examined the role of business incubators in the entrepreneurial process. One of its conclusions was that interaction between business incubators and incubatees allows incubatees (and incubators) to learn and acquire knowledge regarding business development.

Based on data collected through surveys, on-site reviews, case studies, and in-depth interviews, Smilor (1987) argues that while incubatees often possess knowledge for product or service development (e.g. technical knowledge), they generally lack business knowledge. Therefore, Smilor (1987) suggests, the provision of business knowledge is important for incubatee development. The findings of the data analyses suggest that coaching provided by business incubators to incubatees can lead to business knowledge acquisition of incubatees. In their examination of business incubators, Allen and Rahman (1985) make a somewhat anecdotal statement, which perfectly captures the notion of Smilor (1987)

explained before:

> *"[...] although entrepreneurs may have specialized knowledge, they often lack a full array of business skills. This is where the incubator facility plays a key role. Incubators provide the assistance that fills the knowledge gaps [...]"* (Allen and Rahman, 1985, p. 13)

This study's results are consistent with the statement displayed above and, additionally, provide insights in how business incubators assist incubatees and which knowledge gaps are filled.

In absence of appropriate data, some studies (Chrisman and McMullan, 2004) use proxies to obtain insights regarding knowledge acquisition of firms. A study to examine the importance of outsider assistance as a knowledge resource for new venture survival uses the extent of assistance received from counselors to reflect knowledge acquisition of new ventures. In the context of this study, it would suggest that coaching is used to reflect business knowledge acquisition. The results of the data analyses provide a form of justification for their assumptions because it shows that a significant positive relation exists between coaching and business knowledge acquisition. This enhances the conceptual and theoretical bases for understanding the importance of outsider assistance for new venture survival.

Business incubators operate, almost by definition, in an entrepreneurial environment. Therefore, business incubators represent a vast source of business knowledge for incubatees (Studdard, 2006). The fact that this study found a significant positive relation between coaching provided by business incubators and business knowledge acquisition of incubatees is thus not surprising.

The results of the data analyses did not indicate a significant relation between coaching provided by business incubators and technical knowledge acquisition of incubatees. One possible explanation involves the abilities of business incubators to provide coaching in technical areas. The analyses suggested that incubatees from incubator XIII ranked significantly higher in terms of technical knowledge acquisition than incubatees from other incubators included in the sample. It can not be determined whether this difference is caused by the incubator or because of the type of incubatees this incubator attracts. As Studdard (2006) explains, business incubators may or may not posses technical knowledge necessary for coaching incubatees that require technical assistance. It may well be that differences exist among incubators included in the sample in terms of their ability to

provide coaching in technical areas. This can have caused an inconsistent pattern in technical knowledge acquisition. Therefore, other relations may be found for incubators that focus on the development of technology-based firms and those that do not.

This research proposed that business incubators act as network mediators between incubatees and actors external to the incubator. By covering structural holes and exposing incubatees to a variety of actors it was suggested that network mediation would lead to knowledge acquisition of incubatees. The results did not find a significant relation however, between network mediation and technical knowledge acquisition. Moreover, network mediation and business knowledge acquisition also did not exhibit a significant relation. One explanation is provided by Rice (2002) who – through interviews with 32 incubatees and 8 business incubators – found that the network mediation suffers from shortcomings in assisting incubatees:

- External actors are generally not fully committed to assist incubatees because of the low remuneration. Instead, they use the connection as a base for future services once the incubatee has graduated from the incubator.
- Skill of incubatees and commitment to engage in the networking process often lacks.
- Business incubators diminish the effectiveness of network mediation once they fail to evaluate the external actor.

As discussed in Chapter 2 and 3, a vast body of literature suggests that network mediation can lead to business and technical knowledge acquisition of incubatees. Rice (2002) suggests however, that – in practice – the network mediation process may be constrained. The fact that the data analyses revealed no significant relation between network mediation and technical knowledge acquisition, and between network mediation and business knowledge acquisition, supports this suggestion.

Overall, this study concludes that coaching provided by business incubators to incubatees has a significant positive effect on business knowledge acquisition of incubatees. This research did not find a significant relation between coaching provided by business incubators to incubatees and technical knowledge acquisition of incubatees. The relation between network mediation provided by business incubators to incubatees and technical and business knowledge acquisition of incubatees was also tested but the analyses exhibited no significant relation.

Effects of knowledge acquisition of incubatees on incubatee performance

To answer the second research question, a review of the relevant literature was conducted. This resulted in the construction of two hypotheses which statistically tested with data collected from 48 incubatees of 13 business incubators in the Netherlands. Table 6.2 displays the hypotheses and the statistical evidence that was found. The results of the data analyses suggest that a significant positive relation exists between business knowledge acquisition of incubatees and incubatee performance in terms of relative overall performance.

Table 6.2: Hypotheses to answer the second research question

	Hypothesis	**Statistical evidence**
H5	Technical knowledge acquisition of an incubatee is positively related to incubatee performance	Not accepted
H6	Business knowledge acquisition of an incubatee is positively related to incubatee performance	Accepted

The results of the data analysis indicate a significant positive influence of the business knowledge an incubatee acquires from being associated with a business incubator on its performance. Although this significant positive relation was found for only one of the two performance indicators in this study, the hypothesis can not be rejected. The positive relation was found for the performance indicator relative overall performance. This item measured a firm's overall performance compared to other firms facing similar business development challenges or that are in the same business.

Several authors (Smilor, 1987; Rice, 2002; Allen and Rahman, 1985) argue that while incubatees often possess knowledge for product or service development (e.g. technical knowledge), they generally lack business knowledge. The finding that coaching is significantly related to business knowledge acquisition suggests that this knowledge is combined with incubatees' prior knowledge. In fact, the data analyses suggest that technology-based incubatees rank significantly higher in terms of business knowledge acquisition than non technology-based incubatees. When knowledge is combined, it becomes extremely idiosyncratic because of the unique composition of prior knowledge and information sources and contacts addressed. Consequently, the synthesized knowledge fulfills all criteria set by the resource-based theory in order to provide competitive advantage. The

positive significant relation between business knowledge acquisition of incubatees and their relative overall performance is consistent with these arguments.

The findings of this study are consistent with studies of new ventures that suggest new venture performance is influenced by their ability to acquire, combine, and apply new knowledge (Wiklund and Shepherd, 2003; West and Noel, 2009; Yli-Renko et al., 2001). More specifically, West and Noel (2009) have examined the role of new ventures' prior knowledge resources on their performance. Although that particular study considered the ventures' prior business knowledge, this prior business knowledge has been shown to positively influence new venture performance. The findings of this study confirm that business knowledge is also an influencing factor in incubatee performance.

The results of the data analyses did not find a significant relation between technical knowledge acquisition and incubatee performance. One explanation for this is that diversity among the firms and incubators in the sample caused an inconsistent pattern in technical knowledge acquisition. The analyses suggested that incubatees from incubator XIII ranked significantly higher in terms of technical knowledge acquisition than incubatees from other incubators included in the sample. It can not be determined whether this difference is caused by the incubator or because of the type of incubatees this incubator attracts. This sample included several types of incubators. Therefore, other relations may be found for incubators that focus on the development of technology-based firms and those that do not.

Another interesting finding of the data analyses is that network mediation provided by incubators to incubatees has a direct effect on incubatee performance in terms of product distinctiveness. In contrast, the effect of coaching provided by business incubators to incubatees on incubatee performance follows a path via business knowledge acquisition. The preceding section suggested some arguments for the lack of a significant relation between network mediation and knowledge acquisition of incubatees. One explanation for the direct and significant positive relation between network mediation and incubatee performance in terms of product distinctiveness is that mechanisms (i.e. not technical and business knowledge acquisition) are at work that are not accounted for in this study. It can be that incubatees make use of the network mediation to acquire knowledge that allows them to enhance product distinctiveness. This knowledge does not have to be the technical or business knowledge that this suggest is important. It can be some form of tacit knowledge that allows incubatees to enhance their product

and make it more distinct.

Overall, this study concludes that business knowledge acquisition of incubatees has a significant positive effect on incubatee performance in terms of relative overall performance. This research did not find a significant relation between technical knowledge acquisition of incubatees and incubatee performance.

6.3 Scientific contributions and managerial implications

Scientific contributions

The first chapter of this thesis has set forth the importance of understanding of the impact of business incubation on the development of incubatees. Incubators are ventures that are a major driver of innovation and economic development. Moreover, business incubation has become an important policy tool. Examining the impact of business incubators on incubatees can be a form of evaluation and justification for their popularity. Furthermore, it is unclear whether incubatees have a proper understanding of the impact that business incubators have on their firm. This is illustrated by Allen and Rahman (1985) who found – from a sample of 126 incubatees – that 87% of the entrepreneurs would have started their businesses without the incubation services. Relevant literature reveals that the findings of business incubator impact are dispersed. This area of research is underdeveloped and thus represents a gap in current research. Moreover, most impact studies of business incubation make use of simple running counts of data and are anecdotal in nature.

This research has aimed to complement and enhance the existing body of literature by statistically testing the effect of business incubation on incubatees. First, it examined the influence of business incubation on knowledge acquisition of incubatees. Second, it examined how knowledge acquired from the business incubator is related to incubatee performance.

The results of the quantitative data analyses indicate that, coaching provided by business incubators to incubatees is significantly and positively related to business knowledge of incubatees. In turn, a significant positive relation was found between business knowledge acquisition of incubatees and incubatee performance in terms of relative overall performance. These findings are important because they provide insights in the business incubation process, which in many studies is viewed as a 'black box'. Rather than examining the influence of business incu-

bation services (input) on the graduation rate, survival rate, or number of jobs created among incubatees (output), this study shows that knowledge acquisition is an important mechanism in the successful development of new ventures.

The theoretical foundations to study business incubation are believed to be enhanced in several ways. First, this study has integrated findings from various bodies of research so as to establish a more solid foundation for this study. This may provide new entries for studying the effects of business incubation on incubatees. Second, it used multiple regression analyses to test hypotheses regarding the impact of business incubation, specifically avoiding the use of running counts of data and anecdotal claims that are sometimes observed in business incubation literature. Third, the impact of business incubation was studied at the level of the incubatee, which provides a more detailed view of the impact of business incubation programs.

Insights were obtained regarding performance measurement of new ventures, or more specifically, of incubatees. Once more, response to financial and absolute performance indicators was poor – a phenomenon noted by Lee et al. (2001); Gilbert et al. (2006). The enhanced response to subjective and relative performance indicators suggest that these indicators may be more suitable to assess performance of new ventures and incubatees.

Although this research has its limitations (which will be discussed at the end of this chapter), is far from perfect, and has left many issues still unresolved, this study has achieved its aim of examining the influence of business incubation on the development of incubatees. It also made a contribution for filling the gap in existing literature on the impact of business incubation.

Managerial implications

This study has found that coaching provided by business incubators to incubatees has a positive influence on business knowledge acquisition of incubatees. In turn, the results indicate that business knowledge acquisition of incubatees is positively related to incubatee performance in terms of relative overall performance. The managerial implications of this study are best explained in terms of several levels of analyses.

On a macro level, the results of this study imply that business incubation are successful policy tool to enhance performance of incubatees. Incubatees generally are new ventures and are found to be an important driver of innovation and economic development. This is an important finding because it suggests a pos-

sibility for government or other institutions to stimulate innovation or economic development.

On the level of a business incubator, this research implies that coaching is an important service to provide to incubatees. Coaching can enhance development of incubatees in terms of business knowledge acquisition. In turn, this business knowledge acquisition will enhance incubatee performance in terms of relative overall performance – i.e. enhance incubatee performance in a more general way. Also network mediation has shown to be a critical service to provide to incubatees. Network mediation can enhance incubatee performance in terms of product distinctiveness – i.e. enhance incubatee performance in more specific areas. For network mediation to have a more general effect on incubatee performance the challenge for business incubators appears to be to adequately commit to facilitating the relation between incubatees and actors external to the incubator. The findings also set forth that, next to providing physical and shared services, it is important for incubators to provide more 'softer' or intangible services such as coaching and network mediation.

For incubatees, the results of this study outline the importance of coaching provided by the business incubator as it allows incubatees to acquire business knowledge. This acquired business knowledge, combined with the incubatees' prior knowledge, will enhance the incubatees' performance in terms of relative overall performance. This highlights the importance of not only the benefits of the physical services an incubatee often receives, but also the intangible benefits of being associated with a business incubator. Furthermore, the results imply that incubatees should make use of network mediation provided by a business incubator because, despite its shortcomings, it can allow an incubatee to enhance its product distinctiveness.

6.4 Limitations and recommendations for future research

Limitations

Although this research has found statistically-tested support for the qualitative findings of some case studies in current business incubation literature, it turned out to be hard to find generalizable results. A significant positive relation was found between coaching and business knowledge acquisition, and between business knowledge acquisition and the relative overall performance of incubatees.

The findings make sense because business knowledge is a much more generalizable concept than technical knowledge acquisition. These considerations reflect the idiosyncratic nature of the knowledge acquisition process of incubatees, and firms in general. Case studies may be a more appropriate research approach to study knowledge acquisition of incubatees because it allows for an enhanced understanding of the idiosyncratic elements associated with the process.

This study has considered two specific types of knowledge acquisition in the business incubation process – technical and business knowledge acquisition. Most likely, these two types of knowledge do not encompass the full concept of knowledge acquired by incubatees from the business incubator. Enhanced insights may be gained by considering other types of knowledge, such as tacit knowledge. Examples are: knowledge of how to approach investors to raise capital or how to deal with customer feedback. Inherent to tacit knowledge however, are problems associated with objectively measuring it. Still, the hypotheses in this study may have used knowledge types that are too narrow to cover the total knowledge concept in the incubation process.

A limitation of this study is that it considers incubatees to have equal abilities of knowledge acquisition. However, as Cohen and Levinthal (1990) point out, firms are constrained in their ability to acquire knowledge by their absorptive capacity. Following this line of reasoning, this study may have examined knowledge acquisition of incubatees among a sample of incubatees, which exhibited no favorable conditions for knowledge acquisition.

Similarly, it was assumed that business incubators provide knowledge to incubatees, which they are willing to acquire. As some studies (Chrisman and McMullan, 2004) indicate however, the knowledge acquisition process is influenced by the strength of the knowledge provider. Related to this is the concept of relative absorptive capacity (Lane and Lubatkin, 1998) which asserts that characteristics of both the incubator and incubatee are of influence on the knowledge acquisition ability of incubatees. The abilities of the business incubator in providing coaching and network mediation to incubatees is an element not accounted for in this study and thus, represents a limitation.

A limitation regarding the effect of knowledge acquisition on incubatee performance is that incubatee performance is assessed at one point in time. In this way, it is impossible to determine the long term impact of business incubation on incubatees. The business knowledge acquired by incubatees during the incubation time, may not have a positive influence on relative overall performance once

a firm has graduated from the incubator.

Finally, the results of this research may be influenced by the fact that it uses self-reported data in the data analyses. It measured the incubatees' opinions of knowledge acquisition, instead of actual knowledge acquisition. This is analogous to measuring what people say they do in contrast to what they actually do. Thus, viewpoints and memory effects may have biased the results.

Recommendations for future research

Future research is suggested to take into account the concept of (relative) absorptive capacity when studying knowledge acquisition of incubatees. This can improve the understanding of the extent to which incubatees acquire knowledge from business incubation. In this way it is possible to account for differences in ability of knowledge acquisition of the incubatee and knowledge provision abilities of the incubator. Eventually, this can lead to guidelines for incubators to influence an incubatees absorptive capacity for enhanced knowledge acquisition and performance.

Another suggestion for future research is to address the long term impact of business incubation by means of longitudinal research methods. This can lead to insights that may improve the incubation process for successful development of firms on the long term. Simultaneously it would be possible to assess whether a time-lag exists between business incubation and enhanced incubatee performance. Although business incubators may be benefited by this research, it is expected they are more focused on the short term performance of incubatees. Therefore, this type of research would be especially helpful for entrepreneurs or government institutions.

Finally, it is encouraged to search for, test, and examine additional performance indicators to identify useful measures of new venture and incubatee performance as this still proves to be a major obstacle in performance research.

Although this research has its limitations, is far from perfect, and has left many issues still unresolved, this study has achieved its aim of examining the influence of business incubation on the development of incubatees. It also made a contribution for filling the gap in existing literature on the impact of business incubation.

Appendix A

Questionnaire

A.1 Section: Firm

1. What is the name of your firm? .....
2. In which year was your firm established? .....
3. What is the number of full-time equivalent (fte) employees currently working for your firm? .....
4. In which industry does your firm primarily operate? .....
5. In which year did your firm enter the business incubator? .....
6. Is your firm involved in developing, commercializing, or manufacturing advanced technology? .....

A.2 Section: Business incubation

Business incubators sometimes provide counseling to firms located in the incubator either for a fee or free of charge. Counseling is the dissemination of knowledge, recommendations or advice by the business incubator. On a scale ranging from 'no extent' (1) to 'very large extent' (7), please indicate:

7. The extent to which your firm has received counseling from the business incubator 1 2 3 4 5 6 7
8. The extent to which your firm has received advice or direction from the business incubator 1 2 3 4 5 6 7

Business incubators sometimes engage in network mediation. Network mediation is matching firms located in the incubator with other actors such as potential customers, partners, employees, university researchers and investors either for a fee or free of charge. On a scale ranging from 'no extent' (1) to 'very large extent' (7), please indicate:

9. The extent to which your firm has acquired new contacts through the business incubator 1 2 3 4 5 6 7
10. The extent to which the business incubator has 'opened' the doors to new contacts for your firm 1 2 3 4 5 6 7

Business incubators sometimes organize education for firms located in an incubator either for a fee or free of charge. This education can include courses, master classes or workshops for example. On a scale ranging from 'no extent' (1) to 'very large extent' (7), please indicate:

11.	The extent to which your firm has participated in courses or workshops provided by the business incubator	1 2 3 4 5 6 7
12.	The extent to which your firm has received training or education provided by this business incubator	1 2 3 4 5 6 7

A.3 Section: Knowledge acquisition

To what extent do you agree with the following statements on a scale ranging from 'disagree strongly' (1) to 'agree strongly' (7), and 'not applicable' (0)?

13.	Because my firm is associated with this business incubator, my firm is able to obtain a tremendous amount of technical knowledge (e.g. designing new products, manufacturing)	0, 1 2 3 4 5 6 7
14.	My firm gets most of its valuable technical knowledge from being associated with this business incubator	0, 1 2 3 4 5 6 7
15.	Because my firm is associated with this business incubator, my firm is able to obtain a tremendous amount of business knowledge (e.g. accounting, bookkeeping, hiring practices, employee benefits)	0, 1 2 3 4 5 6 7
16.	My firm gets most of its valuable business knowledge from being associated with this business incubator	0, 1 2 3 4 5 6 7
17.	Because my firm is associated with this business incubator, my firm is able to obtain a tremendous amount of marketing knowledge (e.g. public relations, sales, service delivery, market conditions)	0, 1 2 3 4 5 6 7
18.	My firm gets most of its valuable marketing knowledge from being associated with this business incubator	0, 1 2 3 4 5 6 7
19.	Because my firm is associated with this business incubator, my firm is able to obtain a tremendous amount of financial knowledge (e.g. venture capitalist funding, subsidies, angel investors, banks)	0, 1 2 3 4 5 6 7
20.	My firm gets most of its valuable financial knowledge from being associated with this business incubator	0, 1 2 3 4 5 6 7
21.	Because my firm is associated with this business incubator, my firm is able to obtain a tremendous amount of other knowledge (e.g. knowledge not discussed above)	0, 1 2 3 4 5 6 7
22.	My firm gets most of its valuable other knowledge from being associated with this business incubator	0, 1 2 3 4 5 6 7

A.4 Section: Incubatee performance

23. What is the total cumulative amount of funds (in euros) your firm has obtained from different financing sources (e.g. yourself, family, friends, angel investors, venture capitalists, private placements, equity investments, or grants)? .....

24. What is the total cumulative amount of revenues (in euros) your firm has obtained? .....

25. What is the number of expressions of interest from (potential) customers for your firms product/service? .....

To what extent do you agree with the following statements on a scale ranging from 'disagree strongly' (1) to 'agree strongly' (7)?

26. My firm's product/service is better than my firm's competitors' product/service 1 2 3 4 5 6 7

27. My firm's competitive advantage is strongly based on my firm's product/service 1 2 3 4 5 6 7

28. My firm invests very heavily in research and development 1 2 3 4 5 6 7

29. My firm's product/service is highly sophisticated and complex 1 2 3 4 5 6 7

Please assess your firms performance compared to other firms facing similar business development challenges or that are in the same business on a scale ranging from 'very low performer' (1) to 'very high performer' (7), in the following areas:

30. Sales growth 1 2 3 4 5 6 7

31. Profitability 1 2 3 4 5 6 7

32. Overall performance 1 2 3 4 5 6 7

Appendix B

Vragenlijst

B.1 Section: Bedrijfsgegevens

1. Wat is de naam van uw bedrijf? .....
2. In welk jaar is uw bedrijf opgericht? .....
3. Wat is het aantal fulltime-equivalente (fte) werknemers momenteel aan het werk voor uw bedrijf? .....
4. In welke industrie opereert uw bedrijf voornamelijk? .....
5. Wat is de naam van de incubator waarin uw bedrijf is gevestigd? .....
6. Is uw bedrijf betrokken bij de ontwikkeling, commercialisatie of vervaardiging van geavanceerde technologie? .....

B.2 Section: Business incubation

Incubators geven soms raad aan bedrijven in de incubator. Raadgeving is de verspreiding van kennis, aanwijzigen of advies door de incubator. Dit kan gratis of tegen betaling zijn. Op een schaal van 'geen' (1) tot 'heel erg veel' (7), geef a.u.b. aan:

7. In hoeverre uw bedrijf raadgeving heeft gekregen van de incubator 1 2 3 4 5 6 7
8. In hoeverre uw bedrijf advies of sturing heeft gekregen van de incubator 1 2 3 4 5 6 7

Incubators doen soms aan netwerkbemiddeling. Netwerkbemiddeling is het 'matchen' van bedrijven in de incubator met andere actoren zoals potentiële klanten, partners, werknemers, academische onderzoekers en financiers. Dit kan gratis of tegen betaling zijn. Op een schaal van 'geen' (1) tot 'heel erg veel' (7), geef a.u.b. aan:

9. In hoeverre uw bedrijf nieuwe contacten heeft gekregen door de incubator 1 2 3 4 5 6 7
10. In hoeverre de incubator de 'deuren heeft geopend' van nieuwe contacten voor uw bedrijf 1 2 3 4 5 6 7

Incubators organiseren soms onderwijs voor bedrijven in de incubator. Dit onderwijs kan bijvoorbeeld bestaan uit cursussen, masterclasses of workshops. Dit kan gratis of tegen betaling zijn. Op een schaal van 'geen' (1) tot 'heel erg veel' (7), geef a.u.b. aan:

11.	In hoeverre uw bedrijf heeft deelgenomen aan cursussen of workshops die werden verschaft door de incubator	1 2 3 4 5 6 7
12.	In hoeverre uw bedrijf training of educatie heeft gekregen dat werd verschaft door de incubator	1 2 3 4 5 6 7

B.3 Section: Kennisverwerving

In hoeverre bent u het eens met de volgende stellingen op een schaal van 'helemaal mee oneens' (1) tot 'helemaal mee eens' (7), en 'n.v.t.' (0)?

13.	Omdat mijn bedrijf verbonden is met de incubator is het in staat om een enorme hoeveelheid technische kennis (b.v. ontwerpen van nieuwe producten, vervaardiging) te verwerven	0, 1 2 3 4 5 6 7
14.	Mijn bedrijf krijgt het meeste van zijn waardevolle technische kennis van het verbonden zijn met de incubator	0, 1 2 3 4 5 6 7
15.	Omdat mijn bedrijf verbonden is met de incubator is het in staat om een enorme hoeveelheid bedrijfskennis (b.v. accountancy, boekhouden, in dienst nemen van personeel) te verwerven	0, 1 2 3 4 5 6 7
16.	Mijn bedrijf krijgt het meeste van zijn waardevolle bedrijfskennis van het verbonden zijn met de incubator	0, 1 2 3 4 5 6 7
17.	Omdat mijn bedrijf verbonden is met de incubator is het in staat om een enorme hoeveelheid marketing kennis (b.v. public relations, verkoop, levering van diensten, marktcondities) te verwerven	0, 1 2 3 4 5 6 7
18.	Mijn bedrijf krijgt het meeste van zijn waardevolle marketing kennis van het verbonden zijn met de incubator	0, 1 2 3 4 5 6 7
19.	Omdat mijn bedrijf verbonden is met de incubator is het in staat om een enorme hoeveelheid financiële kennis (b.v. durfkapitaal (venture capital), subsidies, bedrijfsengelen (angel investors), banken) te verwerven	0, 1 2 3 4 5 6 7
20.	Mijn bedrijf krijgt het meeste van zijn waardevolle financiële kennis van het verbonden zijn met de incubator	0, 1 2 3 4 5 6 7
21.	Omdat mijn bedrijf verbonden is met de incubator is het in staat om een enorme hoeveelheid andere kennis (b.v. kennis wat niet boven is beschreven) te verwerven	0, 1 2 3 4 5 6 7
22.	Mijn bedrijf krijgt het meeste van zijn waardevolle andere kennis van het verbonden zijn met de incubator	0, 1 2 3 4 5 6 7

B.4 Section: Prestaties

23. Wat is de totale cumulatieve hoeveelheid kapitaal (in euro's) dat uw bedrijf heeft verworven van verschillende financieringsbronnen (b.v. uzelf, familie, vrienden, bedrijfsengelen, subsidies)? .....
24. Wat is de totale cumulatieve hoeveelheid omzet (in euro's) dat uw bedrijf heeft verworven? .....
25. Wat is het aantal expressies van interesse van (potentiële) klanten voor het product/service van uw bedrijf? .....

In hoeverre bent u het eens met de volgende stellingen op een schaal van 'helemaal mee oneens' (1) tot 'helemaal mee eens' (7)?

26. Het product/service van mijn bedrijf is beter dan het product/service van mijn concurrenten 1 2 3 4 5 6 7
27. Het concurrentievoordeel van mijn bedrijf is sterk gebaseerd op het product/service van mijn bedrijf 1 2 3 4 5 6 7
28. Mijn bedrijf investeert sterk in research and development (onderzoek en ontwikkeling) 1 2 3 4 5 6 7
29. Het product/service van mijn bedrijf is erg geavanceerd en complex 1 2 3 4 5 6 7

Schat a.u.b. de prestaties van uw bedrijf in ten opzichte van andere bedrijven met gelijksoortige bedrijfsuitdagingen of bedrijven in dezelfde 'business' op een schaal van 'erg lage presteerder' (1) tot 'erg hoge presteerder' (7), in de volgende onderdelen:

30. Omzetgroei 1 2 3 4 5 6 7
31. Winstgevendheid 1 2 3 4 5 6 7
32. Algehele prestatie 1 2 3 4 5 6 7

Appendix C

Results factor analysis

C.1 Relative performance

Table C.1: Factor analysis relative performance (only factor loadings > 0.40 are shown)

	Factor 1	**Communalities**
Relative performance A	.870	.757
Relative performance B	.921	.849
Relative performance C	.931	.866
% Variance explained	.824%	**.824%**

C.2 Distinctiveness

Table C.2: Factor analysis distinctiveness (only factor loadings > 0.40 are shown)

	Factor 1	**Communalities**
Distinctiveness A	.764	.583
Distinctiveness B	.645	.417
Distinctiveness C	.735	.541
Distinctiveness D	.804	.646
% Variance explained	.547%	**.547%**

C.3 Coaching and network mediation

Table C.3: Factor analysis coaching and network mediation (only factor loadings > 0.40 are shown)

	Factor 1	**Factor 2**	**Communalities**
Coaching A	.885		.852
Coaching B	.920		.888
Coaching C	.842		.819
Coaching D	.892		.859
Network mediation A		.931	.958
Network mediation B		.946	.953
% Variance explained	.547%	.341%	**.888%**

C.4 Technical and business knowledge acquisition

Table C.4: Factor analysis technical and business knowledge acquisition (only factor loadings > 0.40 are shown)

	Factor 1	**Factor 2**	**Communalities**
Technical knowledge acquisition A		.836	.763
Technical knowledge acquisition B		.917	.883
Business knowledge acquisition A	.715	.476	.790
Business knowledge acquisition B	.828		.809
Business knowledge acquisition C	.861		.781
Business knowledge acquisition D	.813		.685
Business knowledge acquisition E	.666	.491	.684
Business knowledge acquisition F	.671	.440	.643
Business knowledge acquisition G	.855		.766
Business knowledge acquisition H	.842		.789
% Variance explained	.509%	.250%	**.759%**

Table C.5: Factor analysis technical and business knowledge acquisition (only factor loadings > 0.40 are shown)

	Factor 1	**Factor 2**	**Communalities**
Technical knowledge acquisition A		.876	.850
Technical knowledge acquisition B		.922	.896
Business knowledge acquisition B	.818		.782
Business knowledge acquisition C	.877		.820
Business knowledge acquisition D	.852		.772
Business knowledge acquisition G	.866		.785
Business knowledge acquisition H	.847		.791
% Variance explained	.538%	.276%	**.814%**

Appendix D

Detailed correlation matrix

Table D.1: Detailed correlation matrix

	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. Relative performance A	4.54	1.43	–																			
2. Relative performance B	4.29	1.30	.68***	–																		
3. Relative performance C	4.75	1.28	.70***	.82***	–																	
4. Distinctiveness A	5.69	1.10	.23	.21	.20	–																
5. Distinctiveness B	5.92	0.92	-.03	.09	.20	.48**	–															
6. Distinctiveness C	4.92	1.96	.06	-.08	.02	.30*	.27†	–														
7. Distinctiveness D	4.23	1.75	.32*	.15	.24	.47**	.25†	.59***	–													
8. Coaching	2.61	1.88	.00	-.04	.10	-.03	.01	.22	.06	–												
9. Network mediation	3.36	1.82	.09	.02	.05	-.12	-.30*	.15	.31*	.54***	–											
10. Technical knowledge acq.	2.39	1.34	.17	.23	.26†	-.02	-.14	-.09	.02	.26†	.27†	–										
11. Business knowledge acq.	2.76	1.43	.17	.22	.29*	-.08	-.08	.14	.28†	.62***	.52***	.52***	–									
12. Firm age	3.52	2.30	.07	.07	.13	-.05	-.12	-.29*	.00	-.26†	-.03	-.06	-.20	–								
13. NQ Firm size	4.50	4.56	.30*	.07	.20	.14	-.07	.31*	.35*	.04	.07	-.06	.18	-.11	–							
14. Incubation time	2.63	1.67	.17	.09	.15	.10	.15	.01	.03	-.15	-.23	-.23	-.29*	.29*	.17	–						
15. Incubator XIII (dummy)	0.25	0.44	.02	-.06	.00	-.10	-.05	.22	.09	.81***	.47**	.23	.56***	-.22	.16	-.16	–					
16. Not incubator XIII (dummy)	0.75	0.44	-.02	.06	.00	.10	.05	-.22	-.09	-.81***	-.47**	-.23	-.56***	.22	-.16	.16	-1***	–				
17. Technology-based (dummy)	0.58	0.50	.23	.03	.17	.38**	.11	.51***	.53***	.21	.17	-.03	.23	-.10	.40**	.12	.20	-.20	–			
18. Not technology-based (dummy)	0.42	0.50	-.23	-.03	-.17	-.38**	-.11	-.51***	-.53***	-.21	-.17	.03	-.23	.10	-.40**	-.12	-.20	.20	-1***	–		
19. Business services (dummy)	0.60	0.49	-.20	.02	.01	-.04	-.03	-.45**	-.21	-.11	.01	.22	.10	.14	-.27	-.27†	-.12	.12	-.34*	.34*	–	
20. Not business services (dummy)	0.40	0.49	.20	-.02	-.01	.04	.03	.45**	.21	.11	-.01	-.22	-.10	-.14	.27	.27†	.12	-.12	.34*	-.34*	-1***	–

†, p < .10; *, p < .05; **, p < .01; ***, p < .001; N = 48

Bibliography

Alavi, M. and Leidner, D. E. (2001). Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS Quarterly*, 25(1):107–136.

Allen, D. N. and McCluskey, R. (1990). Structure, policy, services, and performance in the business incubator industry. *Entrepreneurship Theory and Practice*, 15(2):61–77.

Allen, D. N. and Rahman, S. (1985). Small business incubators: A positive environment for entrepreneurship. *Journal of Small Business Management*, 23(3):12–22.

Autio, E., Sapienza, H. J., and Almeida, J. G. (2000). Effects of age at entry, knowledge intensity, and imitability on international growth. *The Academy of Management Journal*, 43(5):909–924.

Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1):99–120.

Baron, R. M. and Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51(6):1173–1182.

Bearse, P. (1998). A question of evaluation: NBIA's impact assessment of business incubators. *Economic Development Quarterly*, 12(4):322–333.

Bhabra-Remedios, R. and Cornelius, B. (2003). Cracks in the egg: Improving performance measures in business incubator research. In *Small Enterprise Association of Australia and New Zealand 16th annual Conference*.

Birch, D. L. (1987). *Job creation in America: How our smallest companies put the most people to work*. The Free Press.

Brush, C. G., Greene, P. G., and Hart, M. M. (2001). From initial idea to unique advantage: The entrepreneurial challenge of constructing a resource base. *The Academy of Management Executive*, 15(1):64–78.

Brush, C. G. and Vanderwerf, P. A. (1992). A comparison of methods and sources for obtaining estimates of new venture performance. *Journal of Business Venturing*, 7(2):157–170.

Campbell, C., Kendrik, R. C., and Samuelson, D. S. (1985). Stalking the la-

tent entrepreneur: Business incubators and economic development. *Economic Development Review*, 3(2):178–191.

Campbell, C. and Temali, M. (1984). *Business incubator profiles: A national survey*. NCSL State Legislative Report.

Centre for Strategy and Evaluation Services (2002). *Benchmarking of business incubators*. European Commission.

Chakravarthy, B. S. (1986). Measuring strategic performance. *Strategic Management Journal*, 7(5):437–458.

Chan, K. F. and Lau, T. (2005). Assessing technology incubator programs in the science park: The good, the bad and the ugly. *Technovation*, 25(10):1215–1228.

Chandler, G. N. and Jansen, E. (1992). The founder's self-assessed competence and venture performance. *Journal of Business Venturing*, 7(3):223–236.

Chen, C.-J. (2009). Technology commercialization, incubator and venture capital, and new venture performance. *Journal of Business Research*, 62(1):93–103.

Chrisman, J. J. (1999). The influence of outsider-generated knowledge resources on new venture creation. *Journal of Small Business Management*, 37(4):42–58.

Chrisman, J. J., Bauerschmidt, A., and Hofer, C. W. (1998). The determinants of new venture performance: An extended model. *Entrepreneurship Theory and Practice*, 23(1):5–29.

Chrisman, J. J. and McMullan, W. E. (2000). A preliminary assessment of outsider assistance as a knowledge resource: The longer term impact of new venture counseling. *Entrepreneurship Theory and Practice*, 24(3):37–53.

Chrisman, J. J. and McMullan, W. E. (2004). Outsider assistance as a knowledge resource for new venture survival. *Journal of Small Business Management*, 42(4):229–244.

Cohen, W. M. and Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, 35(1):128–152.

Connolly, T., Conlon, E. J., and Deutsch, S. J. (1980). Organizational effectiveness: A multiple-constituency approach. *Academy of Management Review*, 5(2):211–217.

Dahlqvist, J., Davidsson, P., and Wiklund, J. (2000). Initial conditions as predictors of new venture performance: A replication and extension of the Cooper et al. study. *Enterprise and Innovation Management Studies*, 1(1):1–17.

Dierickx, I. and Cool, K. (1989). Asset stock accumulation and sustainability of competitive advantage. *Management Science*, 35(12):1504–1511.

Flynn, D. M. (1993). Sponsorship and the survival of new organizations. *Journal of Small Business Management*, 31(1):51–63.

Gilbert, B. A., McDougall, P. P., and Audretsch, D. B. (2006). New venture growth: A review and extension. *Journal of Management*, 32(6):926–950.

Grant, R. M. (1996). Toward a knowledge-based theory of the firm. *Strategic Management Journal*, 17(Winter special issue):109–122.

Greene, P. G. and Brown, T. E. (1997). Resource needs and the dynamic capitalism typology. *Journal of Business Venturing*, 12(3):161–173.

Gupta, A. K. and Govindarajan, V. (2000). Knowlegde flows within multinational corporations. *Strategic Management Journal*, 21(4):473–496.

Hackett, S. M. and Dilts, D. M. (2004). A systematic review of business incubation research. *Journal of Technology Transfer*, 29(1):55–82.

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., and Tatham, R. L. (2006). *Multivariate data analysis*. Prentice Hall.

Hamdani, D. (2006). *Conceptualizing and measuring business incubation*. Catalogue no. 88F0006XIE, Statistics Canada.

Hitt, M. A., Ireland, R. D., and uk Lee, H. (2000). Technological learning, knowledge management, firm growth and performance: An introductory essay. *Journal of Engineering and Technology Management*, 17(3-4):231–246.

Hoang, H. and Antoncic, B. (2003). Network-based research in entrepreneurship: A critical review. *Journal of Business Venturing*, 18(2):165–187.

Kanagarajah, S. (2006). *Business dynamics in Canada*. Catalogue no. 61-534-XIE, Statistics Canada.

Kogut, B. and Zander, U. (1996). What firms do? Coordination, identity, and learning. *Organization Science*, 7(5):502–518.

Lane, P. J. and Lubatkin, M. (1998). Relative absorptive capacity and interorganizational learning. *Strategic Management Journal*, 19(5):461–477.

Lee, C., Lee, K., and Pennings, J. M. (2001). Internal capabilities, external networks, and performance: A study on technology-based ventures. *Strategic Management Journal*, 22(6-7):615–640.

Lichtenstein, B. M. B. and Brush, C. G. (2001). How do "resource-bundles" develop and change in new ventures? A dynamic model and longitudinal exploration. *Entrepreneurship Theory and Practice*, 25(3):37–58.

Lumpkin, G. T. and Dess, G. G. (1995). Simplicity as a strategy-making process: The effects of stage of organizational development and environment on performance. *The Academy of Management Journal*, 38(5):1386–1407.

Macpherson, A. and Holt, R. (2007). Knowledge, learning and small firm growth: A systematic review of the evidence. *Research Policy*, 36(2):172–192.

McEvily, B. and Zaheer, A. (1999). Bridging ties: A source of firm heterogeneity in competitive capabilities. *Strategic Management Journal*, 20(12):1133–1156.

Mian, S. A. (1994). US university-sponsored technology incubators: An overview of management, policies, and performance. *Technovation*, 14(8):515–528.

Mian, S. A. (1996). The university business incubator: A strategy for developing new research/technology-based firms. *The Journal of High Technology Management Research*, 7(2):191–208.

Mian, S. A. (1997). Assessing value-added contributions of university technology business incubators to tenant firms. *Research Policy*, 25(3):325–335.

Murphy, G. B., Trailer, J. W., and Hill, R. C. (1996). Measuring performance in entrepreneurship research. *Journal of Business Research*, 36(1):15–23.

Nahavandi, A. and Chesteen, S. (1988). The impact of consulting on small business: A further examination. *Entrepreneurship Theory and Practice*, 13(1):29–40.

National Business Incubation Association (2009). http://www.nbia.org.

Peters, L. S., Rice, M. P., and Sundararajan, M. (2004). The role of incubators in the entrepreneurial process. *Journal of Technology Transfer*, 29(1):83–91.

Rice, M. P. (2002). Co-production of business assistance in business incubators: An exploratory study. *Journal of Business Venturing*, 17(2):163–187.

Rothaermel, F. T. and Thursby, M. (2005). University-incubator firm knowledge flows: Assessing their impact on incubator firm performance. *Research Policy*, 34(3):305–320.

Schumpeter, J. A. (1934). *The theory of economic development*. Harvard University Press.

Simonin, B. L. (1997). The importance of collaborative know-how: An empirical test of the learning organization. *The Academy of Management Journal*, 40(5):1150–1174.

Smilor, R. W. (1987). Managing the incubator system: Critical success factors to accelerate new company development. *IEEE Transaction on Engineering Management*, 34(4):146–156.

Spender, J. (1996). Making knowledge the basis of a dynamic theory of the firm. *Strategic Management Journal*, 17(Winter special issue):45–62.

Steers, R. M. (1975). Problems in the measurement of organizational effectiveness. *Administrative Science Quarterly*, 20(4):546–558.

Stinchcombe, A. L. (1970). Social structure and organizations. In March, J. G., editor, *Handbook of Organization*. Rand McNally & Company.

Studdard, N. L. (2006). The effectiveness of entrepreneurial firm's knowledge acquisition from a business incubator. *International Entrepeneurship Management Journal*, 2(2):211–225.

Tamasy, C. (2007). Rethinking technology-oriented business incubators: Developing a robust policy instrument for entrepreneurship, innovation, regional development? *Growth and Change*, 38(3):460–473.

Thorpe, R., Holt, R., Macpherson, A., and Pittaway, L. (2005). Using knowledge within small and medium-sized firms: A systematic review of the evidence. *International Journal of Management Reviews*, 7(4):257–281.

Udell, G. G. (1990). Are business incubators really creating new jobs by creating new business and new products. *Journal of Product Innovation Management*, 7(2):108–122.

Venkatraman, N. and Ramanujam, V. (1986). Measurement of business performance in strategy research: A comparison of approaches. *Academy of Management Review*, 11(4):801–814.

Voisey, P., Gornall, L., Jones, P., and Thomas, B. (2006). The measurement of success in a business incubation project. *Journal of Small Business and Enterprise Development*, 13(3):454–468.

West, G. P. and Noel, T. W. (2009). The impact of knowledge resources on new venture performance. *Journal of Small Business Management*, 47(1):1–22.

Wiklund, J. and Shepherd, D. (2003). Knowledge-based resources, entrepreneurial orientation, and the performance of small and medium-sized businesses. *Strategic Management Journal*, 24(13):1307–1314.

Yli-Renko, H., Autio, E., and Sapienza, H. J. (2001). Social capital, knowledge acquisition, and knowledge exploitation in young technology-based firms. *Strategic Management Journal*, 22(6-7):587–613.

Zahra, S. A., Ireland, R. D., and Hitt, M. A. (2000). International expansion by new venture firms: International diversity, mode of market entry, technological learning, and performance. *The Academy of Management Journal*, 43(5):925–950.

Zander, U. and Kogut, B. (1995). Knowledge and the speed of the transfer and imitation of organizational capabilities: An empirical test. *Organization Science*, 6(1):76–92.