The role of incubator interactions in assisting new ventures

Joanne L. Scillitoe, Alok K. Chakrabarti

School of Management, New York Institute of Technology, Old Westbury, New York, USA
Department of Industrial Management, Tampere University of Technology, Tampere, Finland and L.M. Thapar School of Management, Thapar University, India

Abstract

Past literature on the development of new technology-based firms (NTBF) within business incubators suggests that the incubation process of these ventures includes both business and technical assistance. In addition, past literature suggests that this assistance is accessible through direct and networking interactions with the incubator management. However, research on the influence of each of these types of interactions on the types of beneficial assistance gained by ventures is unclear. Drawing predominately from social capital theory, this study examines the role of counseling and networking interactions with incubator management on both beneficial business and technical assistance for NTBFs. Results of this study suggest that business assistance, in the form of venture learning about buyer preferences, is best enabled through counseling interactions with incubator management. Learning buyer preferences was not enabled through networking interactions. Technical assistance, in the form of venture learning technological know-how skills, is best enabled through networking interactions with incubator management. Learning technological know-how skills was not enabled through counseling interactions. This study, therefore, highlights the importance and a clearer distinction of how both counseling and networking interactions with incubator management enable the incubation process of new ventures.

1. Introduction

Successful new technology-based firms (NTBFs) serve a critical role in the development of local, regional, and national economies through the creation of jobs and the generation of profits (Reynolds and White, 1997; Birch, 1981) and innovations (Acs and Audretsch, 1992). Business incubators are newer and popular organizational forms that are created, often with the help of economic development agencies, to support and accelerate the development and success of affiliated ventures to achieve economic development goals (Hansen et al., 2000; Mian, 1996; Abetti, 2004).

There is evidence that ventures associated with business incubators succeed at a greater rate than non-incubated ventures in terms of sales and employment growth (Mian, 1997), survival (Reitan, 1997), and the formation of beneficial commercial- and technical-based cooperative relations (Colombo and Delmastro, 2002). However, there is also contradictory evidence that suggests incubators have little or no effect on the success of ventures in terms of survival, innovation (Tamasy, 2007), and job growth (Reitan, 1997). This is compounded by the difficulties associated with control group comparisons with non-incubated ventures in regard to venture selection criteria, difficulty in securing data from non-incubator small firms, the local and regional influence of incubators beyond affiliated ventures (Mian, 1997; Tamasy, 2007), and a heterogeneous group of institutions commonly termed as incubators (Grimaldi and Grandi, 2005; Aernoudt, 2004). As a result, there is no clear understanding regarding successful venture incubation (Hackett & Dilts, 2004a,b). In particular, our understanding of how to enable the successful incubation of NTBFs is limited and in need of further research (Shane and Venkataraman, 2003). Prior research suggests that interactions with incubator management, in the form of direct counseling and networking interactions, enable the successful incubation of affiliated ventures through business- and technical-related assistance (Hansen et al., 2000; Vedovello, 1997; Hackett & Dilts, 2004a) with the intensity, time, and readiness of both parties in these interactions serving as important factors (Rice, 2002). However, past research has also provided us with an unclear understanding regarding the relationship between these types of interactions and subsequent assistance. While Rice (2002), in an exploratory study, suggests
that incubator management and NTBFs engage in counseling and networking interactions to co-produce assistance, details regarding these interactions and specific types of venture assistance outcomes remain unclear. Hackett and Dilts (2004a) have argued that counseling interactions are best for business assistance. Meanwhile, others have argued that business assistance is enabled through both counseling and networking interactions (Rice and Matthews, 1995). Regarding technical assistance, past researchers have argued that this can be gained through counseling interactions (Hannon, 2005; Hackett and Dilts, 2004b) or through networking interactions (Hansen et al., 2000; Scillitoe and Chakrabarti, 2005).

To better understand the dynamics associated with the relationship between incubator interactions and venture assistance, in this study we empirically test two specific and valuable types of business and technical assistance for ventures, learning buyer preferences and learning technological know-how skills, respectively, to offer a more detailed understanding of the types of assistance incubator interactions enable. In addition, we view NTBF and incubator management interactions from a predominately social capital perspective further explore issues associated with the time and intensity dimensions of these interactions and the role of the incubator manager as both a provider and intermediary, identified as key factors in the assistance process (Rice, 2002).

This study begins with a review of the incubator and incubation literature. This is followed with a discussion on the importance of both business and technical assistance as intermediaries in the incubation process. Then, a discussion is presented on a social capital perspective of the types of interactions affiliated ventures have with incubator management. Several hypotheses are then proposed, followed by an empirical analysis, results, discussion, conclusions, implications, limitations, and future research.

2. Theory and hypotheses

2.1. Incubation in Finland and the US

The incubation of ventures within Finland and the US is the focus of this study. Ventures within these countries were chosen as important to study because Finland and the US were ranked first and second, respectively, for global competitiveness among 102 countries at the time of data collection (WEF, 2004). The criteria for the Global Competitiveness Report are predominately based upon technological sophistication, innovation, information and communication technology, R&D intensity, and patents and these criteria are also associated with the successful creation and development of technology-based entrepreneurial ventures (Abetti, 2004).

While both the US and Finnish incubation systems appear to support venture growth how these incubators are set up and provide support to affiliated ventures varies. Abetti (2004) discusses culture and infrastructure as key differences between the US and Finnish incubation systems that can influence incubated venture success. Abetti argues that national culture, based upon Hofstede’s (1991) dimensions of power distance, uncertainty avoidance, and individualism are relatively similar among Finland and the US. However, the nations differ along the masculinity/femininity dimension. The masculinity/femininity dimension describes the degree to which masculine attributes such as assertiveness, performance, success, and competition prevail over feminine issues such as quality of life, relationships, and service (Hofstede, 1991). Finnish culture has a relatively low degree of masculinity in comparison to the US. As a result, Finnish incubators and firms may be more likely than US incubators and firms to cooperate and find agreement with partnering organizations (Abetti, 2004). Thus, Finnish ventures may be more willing to work more closely with incubator management and utilize their support than US incubated ventures.

In terms of infrastructure, the Finnish incubation system has predominately focused on the technological areas of information and communication technology, biotechnology, materials technology, and new production technology and processes to coincide with government funding foci available through Tekes, the Finnish National Technology Agency. Tekes distributes their funding among large, medium, and small firms, and universities to jointly work on designated projects associated with the above technological areas (Tekes, 2005). Also, there are centralized incubator management training sessions sponsored by the TECenter, the Finnish Employment and Economic Development Center, where incubator managers work together and benchmark their incubators in terms of quality, training, marketing, and strategy. Outcomes of these sessions include quality standards and protocols for incubator management, marketing of standardized information on all incubators to potential tenants, sharing of technical, industry, and marketing know-how across incubators, and a centralized database of experts for networking (Abetti, 2004). In addition, Spinno TM, a centralized business service program offered throughout Finland as an incubator associated offering, offers training programs and courses for entrepreneurs to develop their business skills (Spinno, 2007).

In contrast, US incubators are typically uncoordinated and individualized initiatives of universities, state governments, municipalities, private companies, and/or other organizations which has resulted in a duplication of efforts, competition for funds for both the incubators and tenants, political lobbying, over-emphasis on popular technologies and neglectful of less glamorous technologies, a high mortality rate of incubators (Abetti, 2004), and greater emphasis by incubator management on incubator marketing and operational funding than NTBF support (Scillitoe and Chakrabarti, 2005). As a result, US incubators and their tenants likely have less expertise at their disposal, tenants are not necessarily placed in the best incubator for their needs, and less attention is paid to NTBF support than in the Finnish incubator system. It is important to link entrepreneurs to the most appropriate networks available through the incubator (Totterman and Sten, 2005). The result of this is that the affiliated ventures may receive less value from interactions with incubator management in the US than in Finland due to these infrastructure differences. In addition, firms affiliated with Finnish incubators will likely gain greater focused support in the technological areas associated with Tekes funding than US firms.

However, even with these cultural and infrastructure differences, evidence exists that both the US and Finnish systems create value. Incubators have been found to contribute to local and regional economies in both the US and Finland. Incubators became a popular mode for economic growth beginning in the early 1980s in both the US and Finland (NBIA, 2006; Tekes, 2005). It is estimated that within the US, incubated ventures have created approximately 500,000 jobs since 1980 (NBIA, 2006). In 2001 alone, US incubators assisted 35,000 start-up ventures to create full-time employment for 82,000 workers and generate annual revenue of more than $7 billion (NBIA, 2006). By 2001, incubators in Finland have supported 1949 incubated firms, creating 20,000 direct and indirect jobs, and achieving 160% average sales growth annually (Abetti, 2004). In addition, US incubators on average create 702 total jobs, have a lower cost per job creation than the annual cost of welfare, generate tax revenue
through incubated firms at the rate of $5 for every $1 invested, and incubate firms that average annual sales growth of 400% per year (Molnar et al., 1997). By the year 2000, 3,352,859 total jobs were created by Finnish incubators, the costs per job creation were lower than welfare costs per person, and sales growth averaged 160% per year for firms. Thus, further study of firms from these nations would provide valuable insights on factors that enable incubation success.

2.2. Incubator—incubation research

The majority of prior research on business incubation has focused on incubator topics such as incubator development (e.g. Kuratko and LaFollette, 1987; Allen and McCluskey, 1990; Brooks, 1986), configuration (e.g. Campbell et al., 1985; Smilor, 1987), and impact (e.g. Udell, 1990; Allen and McCluskey, 1990; Aernoudt, 2004; Smilor and Gill, 1986). Findings of this research suggest that incubators of similar types are of unequal quality (Aernoudt, 2004), the initial objectives of incubators are often not aligned with incubatee objectives (Hackett and Dilts, 2004a), and incubator service and activities appear to be better guided by venture needs and resources available rather than standardized sets of offerings (Grimaldi and Grandi, 2005). Thus, the term incubator has become an umbrella concept utilized to describe a heterogeneous group of institutions (Aernoudt, 2004) and incubator-focused research has provided limited insights regarding the successful incubation of ventures (Hackett and Dilts, 2004a).

Studies specifically on the success of entrepreneurial firms have traditionally focused on economic development indicators such as innovation (Acs and Audretsch, 1992), the creation of new and high quality jobs, and the generation of profits (Reynolds and White, 1997; Birch, 1981). However, incubation research utilizing many of these measures to capture affiliated venture success has offered contradictory findings. For example, in a study of four US incubators, Mian (1997) found that the majority of affiliated firms exhibited sales and employment growth although this study sample was biased towards older firms who may be more likely to exhibit these attributes. Tamasy (2007), in a review of the outcomes of business incubation internationally, found that there was not a greater likelihood of survival, growth, and innovation for affiliated ventures. Colombo and Delmastro (2002), in a study of Italian firms, found that incubated firms exhibited greater job growth, innovation, technology adoption, and cooperative relations in the areas of commercialization and technology when comparing to a control group similar in age, sector, and geography of the incubated firms.

The conflicting results regarding incubatee success can be attributed to difficulties associated with control group sampling and a limited understanding of the incubation process. Control group sampling is limited because there are limited data sources on non-incubated ventures making sampling difficult, the need to account for incubator selection biases, the need to consider firm mission, location, and life-cycle, and the impact of business incubators in the local and regional areas beyond incubatees (Mian, 1997). In addition, current literature suggests that research focusing on the incubation process of individual ventures (Hackett and Dilts, 2004a; Grimaldi and Grandi, 2005), particularly the social aspects associated with incubation, holds the greatest research potential for understanding the incubation process (Totterman and Sten, 2005; Scillitoe and Chakrabarti, 2005).

In the following sections, we argue that business and technical assistance are useful intermediary measures of the incubation process of NTBFs that can be linked to incubation social capital.

2.3. Business and technical assistance

Business- and technical-related assistance have been identified as important intermediary outcomes in the incubation process, offering a glimpse of venture development within the incubation process. NTBFs need both business and technical assistance for successful development (Hackett and Dilts, 2004a; Mian, 1996) and sustainable growth (Cockburn et al., 2000).

Business assistance includes an array of support such as business planning, tax assistance, personnel recruiting, marketing, management, accounting, general legal expertise, accessing financial capital, and accessing business contacts (Smilor and Gill, 1986; Hansen et al., 2000; Mian, 1996). Technical assistance includes access to university research activity and technologies, laboratory and workshop space and facilities (Mian, 1996; Bakouros et al., 2002), industry contacts (Hansen et al., 2000), technology transfer processes, research and technology supply pipelines, intellectual property protection (Hannon, 2005), and technological know-how skills (Scillitoe and Chakrabarti, 2005).

In this study, we focus on two specific and important types of assistance that ventures can gain through interactions with incubator management: learning of buyer preferences and technological know-how skills. Firms particularly need business assistance associated with management, marketing, and attaining financing (Rice and Matthews, 1995) while marketing assistance through the incubator, in particular, offers significant value to affiliated ventures (Mian, 1996; Merrifield, 1987). The marketing assistance needed by incubated ventures involves understanding who will buy their products or services, in what form, and for what price (Rice and Matthews, 1995). Entrepreneurs launching new ventures have a tendency to focus on perfecting their invention, product, or service to their own expectations and run the risk of running out of time and money before getting to the market successfully (Rice and Matthews, 1995). Infusing an understanding of buyer needs during the early stages of product or service development can increase the potential success of the venture.

A particularly relevant form of technical assistance of value to NTBFs is learning technological know-how skills (Scillitoe and Chakrabarti, 2005; Deeds et al., 1999). Technological know-how skills include intellectual property protection, accessing and understanding complex technological or scientific knowledge, and design and production skills (Deeds et al., 1999). Most new ventures are founded upon a core technology learned or created by the entrepreneur or entrepreneurial team (Roberts, 1991). This technology serves as the primary source of potential competitive advantage for NTBFs (Roberts, 1991), with technological know-how enabling the development and commercialization of the firms products and services (Deeds et al., 1999; Lee et al., 2001) and subsequent firm financial success (Zahra et al., 2000). Technological know-how is often beyond the abilities of the new venture and requires external sources of competences for innovation (Deeds et al., 1999). As a result, new ventures must learn technological know-how skills from external sources during the early stages of development (Cockburn et al., 2000) and incubator management can serve as a valuable source (Scillitoe and Chakrabarti, 2005).

2.4. Social capital and incubation

Social capital can be defined as the goodwill or benefit available to actors within a social network (Adler and Kwon, 2002). In the context of incubators and incubation, there has been a limited amount of research focused on the social aspects of incubation yet social capital has been identified as a valuable
intangible capital associated with business incubators and the incubation process (Hansen et al., 2000; Totterman and Sten, 2005). In addition, although trust and networks, and to a lesser extent norms, have been identified as key components of social capital in the larger social capital literature (Schuller et al., 2000), prior research specific to incubators has suggested that organizational facilitation through paternalistic interactions with the incubator management serves as the primary source of beneficial social capital for affiliated ventures. Within incubators, patron-client relationships between NTBFs and incubator management form and, as a result, these ventures gain help in accessing benefits through the incubator network, mediating trust-and norm-based generated social capital within the incubator network (Scillitoe and Chakrabarti, 2005, 2009). Thus, for this study we seek to consider more closely the interactions between the incubator management and NTBFs that enhance venture business and technical assistance.

Incubator management are often central to affiliated venture networking as they are an available and willing resource and strive to support and accelerate the development of affiliated NTBFs (Mian, 1996). The ability of the incubator management to serve as a beneficial resource for each venture is contingent upon the time allocated by the incubator management to venture development, the intensity of engagement or interactions with the venture, and the readiness of the venture to gain such support (Rice, 2002). Through a social capital lens we seek to further explore the time and intensity of these interactions in the context of business and technical assistance. In addition, readiness on the part of the NTBF is critical for learning and is contingent upon venture leadership or founders. The leadership of an organization that desires to learn will support the learning process by encouraging employees to identify valuable external sources of knowledge and learn (Zietsma et al., 2002; Kim and Lee, 2002). As a result, the desire of the venture to learn about buyer preferences and technological know-how is also considered in the empirical portion of this study.

Thus, incubator management, whether comprised of a single individual or a team of incubator personnel, serve as a primary contact and source of social capital for incubatees and offer their knowledge and expertise as well as access to their network of contacts (Hansen et al., 2000; Vedovello, 1997). Rice (2002) coins the interactions among affiliated ventures and incubator management to enable this venture assistance as counseling and networking interactions.

In this paper we draw from Nahapiet and Ghoshal’s (1998) dimensions of structural and relational social capital to explore these important incubator management–NTBF interactions. The relational dimension of social capital reflects the strength of ties between a source and recipient while the structural dimension of social capital involves the existence of ties and patterns of interactions among actors, including the number of new contacts accessed by a focal or receiving firm through these interactions (Nahapiet and Ghoshal, 1998; Saporito and Decarolis, 2005). These two dimensions of social capital are further discussed below in the context of counseling and networking interactions.

2.4.1. Counseling interactions

Counseling interactions are direct interactions between the venture and incubator management that allows the transfer of knowledge and resources between these two actors for venture assistance (Rice, 2002). Counseling interactions can be viewed from the relational dimension of social capital where the strength of ties between a source and recipient can influence the exchange of knowledge (Nahapiet and Ghoshal, 1998). The strength of ties concept can be further characterized in terms of strong versus weak ties and can be characterized in terms of the frequency of interactions and the subsequent generation of affective bonds and relational trust (Granovetter, 1973; Nahapiet and Ghoshal, 1998). Stronger ties involve more frequent interactions and the greater generation of affective bonds and relational trust than weak ties. As a result, stronger ties better shelter actors from opportunism and uncertainty and enable benefits such as learning what new information an actor has and the transfer and learning of this new information (Zietsma et al., 2002; Aldrich, 1999).

Counseling interactions reflect the willingness and effort of both the incubator management and NTBF to work together in the incubation process. From a social capital perspective, more frequent counseling interactions better enable the creation of stronger ties that enable the transfer and learning of knowledge between the incubator management and venture, including venture learning from the incubator management and incubator management learning about the needs of the venture to offer relevant assistance. Ventures within an incubator have varying needs that must be met for successful incubation (Grimaldi and Grandi, 2005) and monitoring and understanding the needs of ventures facilitates the incubation process (Hackett and Dilts, 2004b).

As a result, we postulate that more frequent counseling interactions can better enable both business and technical assistance. Through more frequent counseling interactions, the incubator management is better able to learn about the needs of the venture, transfer their own pool of business and technical knowledge to the venture, and provide more relevant assistance. While incubator management, as a group, tends to have a wide variety of experiences and knowledge (Hannon, 2005) that must be accounted for, their ability to provide relevant assistance requires these counseling interactions.

Prior research supports the notion that counseling interactions enable valuable business assistance. Business assistance is a standard offering in business incubators (Mian, 1996; Hackett and Dilts, 2004a, 2004b; Grimaldi and Grandi, 2005; Pena, 2004) and is often enabled through interactions with the incubator management (Rice, 2002) who often have business assistance expertise or can access a network of providers. We further this argument to suggest that more frequent counseling interactions will better allow the incubator management to learn about the needs of the venture and offer more relevant business assistance (Hackett and Dilts, 2004a) and allow the transfer of related knowledge, either directly or by support to the venture to successfully utilize the incubator network (Rice, 2002). Thus,

Hypothesis 1. More frequent counseling interactions with incubator management will be positively related to NTBF business assistance.

While counseling interactions with incubator management can offer valuable business assistance, these interactions can also result in technical assistance. Incubator managers have been described as technology brokers, enabling the technological development of the firm (Hannon, 2005). Incubator managers come from a variety of backgrounds and often lack the detailed technological expertise directly related to incubatee core technology but they do provide valuable support towards the technological development of the firm (Hannon, 2005). From a social capital perspective, more frequent interactions with incubator management will result in stronger ties that help them better monitor incubatee progress, understand venture needs, help to develop venture capabilities to successfully utilize the incubator network, facilitate the creation and continuity of venture network relationships, and share knowledge and insights regarding technology supply pipelines, the commercialization process of
products/services, technology transfer mechanisms, and protection of intellectual property (Hackett and Dilts, 2004a; Hannon, 2005). Thus, we propose

**Hypothesis 2.** More frequent counseling interactions with incubator management will be positively related to NTBF technical assistance.

### 2.4.2. Networking interactions

Networking has been identified as an important aspect of the incubation process (Aernoudt, 2004; Phillimore, 1999) and incubators facilitate this networking for affiliated ventures (Hackett and Dilts, 2004a; Hansen et al., 2000; Scillitoe and Chakrabarti, 2005; Cooke et al., 2006). Hansen et al. (2000) argues that the best incubators offer an extensive network of business connections that forge both marketing- and technology-based relationships and the incubator management facilitates venture access to this incubator network (Scillitoe and Chakrabarti, 2005). These incubator network contacts are important since they significantly augment and exceed the few contacts of these ventures, serving as a valuable source of knowledge and new networking opportunities (Hansen et al., 2000). NTBF’s with greater opportunities to access external sources of knowledge then will have a greater potential to learn and exploit this knowledge (Almeida et al., 2003).

Networking interactions can be described as the extent that incubator management provides ventures with access to the incubator network to gain knowledge and resources not possessed by the incubator management (Rice, 2002). The incubator is not simply a facility that offers shared office space and infrastructure but includes a network of organizations and individuals, although the boundaries of this network can vary. This network can include universities, research institutes (Vedovello, 1997), other ventures (Bakouros et al., 2002), industry players (Hansen et al., 2000), government agencies, and service organizations (Phillimore, 1999). Incubator managers come from a variety of backgrounds, including prior incubator, business, and technical experience (Hannon, 2005) and, subsequently, bring a variety of network contacts to the incubator when hired.

Networking interactions can be viewed from the structural form of social capital. This form of social capital describes the existence of ties and patterns of interactions among actors, including the number of new contacts accessed by a focal firm (Saporito and Decarolis, 2005). Networking interactions within incubators involve the extent of referrals by the incubator management to their network of contacts for NTBF access. A greater number of new network ties enable ventures to gain diverse tie contacts that can offer new information or opportunities (Granovetter, 2000; Burt, 2001). These new network ties provide ventures with the benefit of a wide range of valuable information for learning such as potential markets, business locations, innovations, and sources of capital (Aldrich, 1999) that enhance the success of incubator affiliated ventures (Hansen et al., 2000; Scillitoe and Chakrabarti, 2005), offering information that would not be available to them otherwise (Adler and Kwon, 2002).

Prior research suggests that both business and technical assistance can be gained through networking interactions. While business assistance can be gained and supported through counseling interactions, networking interactions offer NTBFs the opportunity to gain expertise beyond the incubator management through the incubator network (Rice, 2002; Rice and Matthews, 1995). Thus, we argue that more networking interactions with incubator management will offer a larger number of contacts that will, in turn, offer NTBFs new and diverse information that will enable greater business assistance. Therefore,

**Hypothesis 3.** More networking interactions with the incubator management will be positively related to NTBF business assistance.

In addition to business assistance, networking interactions can offer greater technical assistance. Technical assistance is gained primarily through the incubator network (Vedovello, 1997) with facilitated networking support gained primarily through the incubator (Hansen et al., 2000). While a synergistic incubator network can provide the greatest benefit for innovation (Phillimore, 1999; Hansen et al., 2000), the incubator management plays the key role in facilitating venture access to these valuable contacts for technology development (Scillitoe and Chakrabarti, 2005). Thus, similar to the above argument for business assistance, more networking interactions can offer NTBFs access to a larger and more diverse pool of contacts that can provide technical assistance. Therefore, we propose

**Hypothesis 4.** More networking interactions with the incubator management will be positively related to NTBF technical assistance.

### 3. Methods

The purpose of this study is to understand the impact of NTBF counseling and networking interactions with incubator management on the business and technical assistance of incubator affiliated NTBF’s. Following is a discussion of the study sample selection and measures used for empirical analysis.

#### 3.1. Study sample

We used a web-based survey administered during the years 2003–2004 with data collected from NTBFs that had a contractual relationship with an incubator in Finland or the United States. As a result, this study offers a firm-level perspective on the incubation process, rather than an incubator perspective. The large majority of prior incubator/incubation literature has focused on an incubator level of analysis (Hackett and Dilts, 2004a; Aernoudt, 2004; Grimaldi and Grandi, 2005). In addition, for those studies that did consider venture-level incubation, more detailed measures of business and technical assistance were not offered. We believe this has led to the contradictory findings among prior research. This study measures specific types of business and technical assistance. As a result, valid and reliable measurement scales of the constructs used in this study were adapted from research beyond the incubator literature. These constructs and scales are discussed in more detail below.

Once the survey instrument was designed, several colleagues in Finland and the US reviewed it to ensure the questions and instructions were clear and understandable. Pilot testing was not performed due to sample constraints. Typically, pilot testing of a survey instrument requires elimination of those respondents from the study sample. The expected sample for this study was not large enough to permit a pilot test of the survey instruments. With surveys, pilot studies are not always feasible due to concerns of a small sample size so it is often necessary to evaluate validity and reliability post-measurement (Nardi, 2003: p. 49).

A few months prior to the administration of the web-based survey, interviews were conducted by the authors with several incubator managers in the US and Finland to understand the issues associated with incubation and to solicit their support to access affiliated incubatees for the survey. These interviews were
mostly qualitative in nature, asking the incubator manager open-ended questions such as “What services does the incubator offer?” and “How does the incubator support the development of ventures?” with written notes taken by the interviewer. Additional pointed questions, such as the expertise of the incubator management, were also asked. Quotations from these interviews are used within the Discussion section to offer insights into the findings of this study. All incubator managers and ventures in this sample were promised confidentiality.

Ventures located within Finland and the US were selected for sampling in this study partly due to convenient access to incubators and affiliated ventures through contacts in these countries and partly because the Global Competitiveness Report by the 2004 World Economic Forum (WEF, 2004) ranked the US and Finland as the top two countries for economic competitiveness and growth for the past four years, as discussed in more detail in Section 2.1.

Incubators were identified through prior awareness by the study authors, recommendations by researchers, recommendations from incubator managers, and the National Business Incubation Association (NBIA) website. Those included were incubators that had contractual relationships with NTBFs. Some of the incubators supported both non-technical and technical ventures while others supported only technical ventures. A total of 47 incubators were identified; 39 in the US and eight in Finland. From these incubators, founders of 527 technology-based ventures were invited to participate in the web-based survey. Consistent with prior research, ventures associated with advanced technology-based (Zahra et al., 2000). Follow-up emails were sent to the respondents for this study; 28 US NTBFs and 14 Finnish NTBFs were affiliated with 11 US incubators and 6 Finnish incubators.

Table 1 offers descriptive information regarding the ventures sampled for this study. In summary, the US ventures were older, had founders with more education in business and technology/science and industry experience, were slightly less likely to be located on the incubator owned premises, had a larger full-time management staff, less frequent interactions with incubator management, and more network contacts gained than the Finnish ventures.

Table 2 offers descriptive information regarding the incubators the ventures sampled for this study were affiliated with. In summary, the US incubators were older, had less common areas, a larger management staff, fewer contacts, more client ventures, and offered more seminar/training programs and social activities than the Finnish incubators. Interestingly, the US incubators had a lesser extent of attendance among client ventures at these seminar/training programs and had a greater extent of attendance among client ventures at these social activities than the Finnish incubators.

3.2. Measures

Control, independent, and dependent variables were used in this study. The measurement of each variable is provided below.

3.2.1. Predictor variables

COUNSEL (counseling interactions): Counseling interactions are measured as the frequency of interactions between the NTBF founders and the incubator management. This is measured by asking NTBF founders “How often does your firm interact with its incubator personnel. Use a scale of 1 to 7, with one being less than once per month and seven being several times per day.” The term incubator personnel was used for this and other survey questions because there does not appear to be a standardized set of titles for individuals working within incubators. Individuals responsible for incubators can have a variety of titles such as Manager, President, Director, and CEO of the incubator but these individuals also often have a team of people supporting incubatees who also have a variety of titles such as Manager and Associate Director. Using the term incubator management or manager rather than incubator personnel for this question would likely create confusion for NTBF respondents based upon these varying titles. When we refer to incubator management within this study, we are referring to this team of personnel who support the development of affiliated incubatees.
3.2.2. Control variables

NATION (national location of NTBF): The location of the NTBF can influence the extent of relevant assistance offered to the NTBF through the incubator management or incubator network, particularly in the nations sampled for this study. NATION is measured by noting the physical location of the incubator (Finland or US) that the NTBF has a contractual arrangement with. NATION was coded in the following manner: 0=Finland; 1=USA.

NTBFSIZE (NTBF size): NTBF size is measured as the number of full time and part-time employees of the NTBF. While a larger team of employees can increase the knowledge base and expertise internal to the firm and subsequently reduce the need for the firm to learn new knowledge, a larger team of employees can also increase the opportunities of the NTBF to learn from the incubator management and access network contacts when there is a desire to learn. Firms with more employees have greater human resource contacts to build social ties for learning (Almeida et al., 2003). NTBFSIZE was measured by asking NTBF founders “How many full time workers are currently employed by your firm?” and “How many part-time workers are currently employed by your firm?” Each part-time employee was counted as 0.5 workers and each full time employee was counted as 1 worker and then a sum of these numbers was used in the analysis.

INCEXPBUS (incubator management expertise in business): The expertise and subsequent networks of incubator management can vary widely (Hannon, 2005). Thus, the expertise of the incubator management must be considered in regard to their ability to offer business and technical assistance. For the regression on business assistance, INCEXPBUS was used and measured by asking the incubator manager “Does the management team of your incubator have significant experience and/or training in Sales?” Yes was coded as “1”, No was coded as “0”.

INCEXTPCH (incubator management expertise in technology): For the regression on technical assistance, INCEXTPCH was measured by asking the incubator manager “Does the management team of your incubator have significant experience and/or training in Technology or Science?” Yes was coded as “1”, No was coded as “0”.

DESIREBUS (desire of founding team to learn from business assistance): The desire of the NTBF founding team to learn from either business assistance or technical assistance reflects the support and willingness of the founding team for learning. Entrepreneurs of incubated ventures must have a willingness to gain assistance from the incubator (Rice and Matthews, 1995; Rice, 2002) and promote learning within the venture (Zietsma et al., 2002). DESIREBUS is measured by asking NTBF founders “Which of the following areas in regard to buyer preferences did your firm desire to learn while having a contractual arrangement with the incubator? Integration with other products or systems, features, and maintenance?” Each area checked was coded as a “1”, with areas not checked coded as “0”. Reliability assessment of the components of this measure was good with a Cronbach’s alpha coefficient of 0.713. Cronbach alphas above 0.60 are within the limits of acceptable reliability (Hair et al., 1998).

3.2.3. Dependent variables

BUSASST (business assistance). Business assistance refers to the assistance provided to the NTBF through the incubator management that supports the business development of the firm. For this study, BUSASST is specifically measured as the learning of buyer preferences, asking NTBF founders “To what extent has your firm learned about buyer preferences in the following areas? Use a scale of 1 to 7, with one being basic understanding and seven being complete understanding. Integration with other products or systems, features, and maintenance”. This scale was adapted from Von Hippel’s (1995) scale on buyer preferences. Reliability assessment of the components of this measure was high with a Cronbach’s alpha coefficient of 0.927. Exploratory factor analysis was conducted and a single factor was found with factor loadings of 0.92, 0.95, 0.93 (Eigen value=2.621; 87.365% of variance; Barlett test of sphericity=133.735, p < 0.000; KMO=0.751).

TECHASST (technical assistance): Technical assistance reflects the assistance NTBFs gain from the incubator management that helps develop the firm’s core technology for commercialization. In this study, technical assistance is measured as the speed of technological learning. This measure is adapted from the technological learning scale used by Zahra et al. (2000). The measure for speed was used in this study since the acceleration of the development of NTBFs is a main goal of technology incubators (Mian, 1996). TECHASST was measured as a survey question to NTBF founders asking “At what speed did your firm learn about each of the following for your products or services? Use a scale of 1 to 7, with 1 being very slow and 7 being very fast. Sourcing technology, integrating new technologies, and protecting trade secrets”. Reliability assessment of the components of this measure was high with a Cronbach’s alpha coefficient of 0.87. Exploratory factor analysis was conducted and a single factor was found with factor loadings of 0.94, 0.88, 0.70 (Eigen value=2.137; 71.228 % of variance; Barlett test of sphericity=94.60, p < 0.000; KMO=0.700), consistent with Zahra et al.’s (2000) findings of a single factor.

In addition to the factor analyses discussed above, correlation and multicollinearity analyses were performed prior to regression analysis. Subsequently, hierarchical multiple linear regression was performed. See Table 3 for the variable correlation matrix.

4. Results

4.1. Regression results

Tables 4 and 5 present the regression results of this study for two dependent variables. Table 4 presents Models 1–3 with the
Hierarchical regression results—business assistance. 

<table>
<thead>
<tr>
<th>Mean</th>
<th>SD</th>
<th>1</th>
<th>2</th>
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<tr>
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<td>−0.19</td>
<td>−0.03</td>
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<tr>
<td><strong>DESIREEBUS</strong></td>
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<td>1.05</td>
<td>0.41**</td>
<td>0.43***</td>
<td>−0.07</td>
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<tr>
<td><strong>DESIREETECH</strong></td>
<td>0.00</td>
<td>1.03</td>
<td>0.23</td>
<td>0.39*</td>
<td>−0.06</td>
<td>−0.08</td>
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<td>0.34*</td>
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<td>0.11</td>
<td>−0.30*</td>
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</table>

N=42.

* p < 0.10

* * p < 0.05

** * * * p < 0.001

Hierarchical regression results—technical assistance. 

<table>
<thead>
<tr>
<th>Mean</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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<td>−0.30</td>
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</tr>
<tr>
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<td>0.41*</td>
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</tr>
<tr>
<td><strong>DESIREBUS</strong></td>
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<td>0.18</td>
<td>0.07</td>
<td>0.18</td>
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</tr>
<tr>
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<td>0.085</td>
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<tr>
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<tr>
<td><strong>Fvalue</strong></td>
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<td>2.218*</td>
<td>3.565*</td>
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<tr>
<td><strong>AdjR²</strong></td>
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<td><strong>R²change</strong></td>
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</tbody>
</table>

N=42.

* p < 0.10

* * p < 0.05

** * * * p < 0.001

results of business assistance, specifically learning buyer preferences, regressed on the control and independent variables. **Table 5** presents Models 4–6 with the results of technical assistance, specifically speed of technological learning, on the control and independent variables.

For **Table 4**, all three models were statistically significant. Model 1 presents the results of the dependent variable, business assistance, regressed on the control variables. Model 1 was found to be significant (F=3.592; p < 0.05) and explains 20.2% of the variance. This model suggests that the business experience of the incubator management (B=0.30; p < 0.05) and the desire of the venture founding team to learn about buyer preferences (B=0.44; p < 0.01) were related to venture learning of buyer preferences. The national location of the NTBF and the number of employees of the NTBF were not significant.

Model 2 presents the business assistance regressed on the control variables and counseling interactions as the main effect variable. Model 2 was also statistically significant (F=3.802; p < 0.01) and explains 25.5% of the variance. Results of this model suggest that counseling interactions with incubator management are important for venture learning of buyer preferences (B=0.28; p < 0.10), supporting hypothesis 1. Model 3 presents business assistance regressed on networking interactions. This model was statistically significant (F=2.851; p < 0.05) but suggests that networking interactions have no relationship with venture learning of buyer preferences. Thus, hypothesis 2 is not supported.

**Table 5** presents the regression results for Models 4–6, reflecting the interactions with incubator management on venture technical assistance. Model 4 presents the dependent variable, technical assistance, regressed on the control variables and the model was significant (F=2.567; p < 0.05) and explains 13.3% of the variance. The results of this model suggest that the desire for the founding team to learn from technical assistance was significant (B=0.38; p < 0.05). The results of this model also suggest that the national location of the venture, the number of venture employees, and the technical expertise of the incubator management played no role in venture technical assistance. Model 5 presents technical assistance regressed on counseling interactions and was significant (F=2.218; p < 0.10). Results of this model suggest that counseling interactions do not enable venture technical assistance. Thus, hypothesis 3 was not...
supported. Finally, Model 6 presents technical assistance regressed on networking interactions and was significant \( F=3.565; p < 0.05 \) and explains 23.8% of the variance. Model 6 results suggest that networking interactions enable technical assistance, specifically speed of technological learning, supporting hypothesis 4.

5. Discussion

The incubation process of incubator affiliated NTBFs includes gaining business and technical assistance through the incubator management (Hackett and Dilts, 2004a). This assistance has been described as an intermediary in the incubation process that helps sustain and grow a business and incubator management provide this assistance through counseling and networking interactions (Rice, 2002). Counseling interactions involve, for this study, frequent interactions between the incubator management and NTBFs that allow the incubator management to learn about venture needs and offer relevant assistance. Networking interactions, for this study, involve the extent incubator management provide NTBFs with access to their network of contacts, offering new knowledge to the ventures. However, the link between these types of interactions and types of assistance has been unclear and sometimes contradictory in past literature.

In this study, we empirically tested the importance of counseling and networking interactions on two specific forms of business and technical assistance: learning buyer preferences and learning technological know-how skills, respectively, among a sample of US and Finnish NTBFs affiliated with a business incubator. Results of this study suggest that differing interactions with incubator management offer differing types of assistance, suggesting that both counseling and networking interactions are valuable for different types of assistance (see Fig. 1). We elaborate further below.

Within our discussion of US and Finnish incubators, we identified two key differentiating dimensions across these nations that influence the incubation of ventures: national culture and infrastructure. Concerning the culture dimension, it is expected that Finnish ventures will be more likely to cooperate and agree with partnering organizations. As a result, it is expected that Finnish ventures would be more likely to cooperate and work with the incubator management and the network contacts gained from the incubator management than US ventures within the incubation process. However, this cultural difference reflects a propensity to cooperate and can be distinguished from the desire to learn based upon existing internal knowledge and founder views. Also, the incubation infrastructure differences between the US and Finland suggest that Finnish firms may have access to greater network contacts and are located in more technology-focused incubators that offer greater technological support. Consistent with this argument, the number of network contacts available, reported by the incubator management, is higher for Finnish incubators and also fewer industries are represented in Finnish versus US incubators (see Table 2). However, as Abetti (2004) and others noted and as discussed previously, despite these differences success through incubators exists within both the US and Finland. Our results suggest a similar phenomenon. We see that in regard to learning buyer preferences and learning technological know-how skills, there is no significant difference between the US and Finnish ventures, even when accounting for counseling and networking interactions and other control variables. But, it should be considered that the process of incubation may vary across these nations influencing ventures in sometimes different ways.

In regard to the interactions that influence incubation, results of this study suggest that differing interactions with incubator management influence business and technical assistance. When considering counseling interactions, results of this study suggest that learning buyer preferences, as a type of business assistance, is best enabled through more counseling interactions with the incubator management. Counseling interactions were measured as the frequency of interactions of the NTBF with incubator management. This means that incubator management that directly interact with NTBFs on a frequent basis will learn about the needs and development of the venture and are better able to offer relevant business assistance in the form of learning about buyer preferences. This finding is consistent with the work by Rice (2002) and Hackett and Dilts (2004a) which suggests that business assistance is best supported through direct interactions with incubator management. Frequent direct interactions with the incubator management can result in stronger ties that enable the incubator management to understand the needs of the venture, generate a more trusting relationship among the actors, and enable the venture to learn about buyer preferences as part of the incubation process that will help the firm grow. The following quote from a US entrepreneur highlights the importance of counseling interactions and regular review of firm business needs:

![Fig. 1. Incubator interactions and venture assistance.](image-url)
and development by the incubator management in the ongoing development of incubated ventures:

“The incubator management should provide an ongoing critique—a real, honest business critique. What am I doing? Am I floundering and, if so, why? Any company wants to belong to an incubator should be subjected to an ongoing review, and I don’t mean just superficial review.” (Entrepreneur of an US incubated firm; Rice, 2002)

When considering the US versus Finnish context of how incubation occurs, we observe that US firms are less likely to have frequent interactions with incubator management than their Finnish counterparts. This appears to be consistent with Abetti’s (2004) view that Finnish firms would be more likely to seek and gain cooperation from other organizations, such as an incubator, than US firms due to cultural differences. Interestingly, our results suggest that counseling interactions did not enable faster learning of technological know-how skills by the NTBF. This finding somewhat contradicts the view that incubator management can support the technological development of the venture directly through their role as a technology broker (Hannon, 2005). While incubator managers often lack the detailed technological expertise directly related to the core technology of the NTBF, prior research has argued that incubator management could provide technical assistance by facilitating the creation and continuity of venture network relationships and share insights regarding technology pipelines, commercialization processes, technology transfer mechanisms, and protection of intellectual property (Hannon, 2005).

The findings of this study suggest that, specific to the sourcing and integration of technologies, and protection of intellectual property, ventures are not able to acquire these skills faster than without regular interactions with the incubator management. One potential explanation is that the expertise of the incubator management in the science and technology areas is not sufficient to offer technology broker support. This may be especially true in the sample used in this study where the ventures were affiliated with incubators that supported multiple industries on average. Within the US system there is less of a focus on specific industries or technologies by incubators than in Finland (Abetti, 2004), consistent with a distinction in the number of industries represented by incubator clients in this sample (see Table 2). However, on average the incubators still supported multiple industries diluting the technological focus of the incubator management efforts. A more specific explanation that is consistent with the findings associated with networking interactions and technical assistance discussed below is that the incubator management do desire to serve as technology brokers but the time spent learning about venture need through frequent interactions does not provide faster technical assistance to the NTBF. In addition, the broker support can be generic in nature, and, at times, slow the learning process instead. As technology brokers, the incubator management, must learn about venture needs but seem to mostly use this knowledge to connect the NTBF to an actor with relevant knowledge. Thus, the time spent gaining this knowledge through frequent interactions is not offering direct technical assistance benefit, specifically faster learning of technological know-how skills, to the venture. An incubator manager that can understand venture needs faster would possibly provide greater technical assistance benefit.

The following quote regarding incubator managers suggests that the support incubator managers provide is reflected in their ability to understand venture needs, can sometimes be applicable for multiple types of assistance rather than only technical assistance, and may slow down the learning process.

“The firm was facing a series of negotiations with potential alliance partners related to licensing of its proprietary technology. The incubator manager not only delivered the entrepreneurs his knowledge related to negotiation, he also engaged in role-playing and sat in on the initial negotiating sessions. This allowed him to provide on-the-spot counsel. In addition, later on he provided feedback to the entrepreneurs on their performance—which assisted their development as negotiators, thereby leading to improved performance in subsequent negotiations.” (Rice, 2002)

In the above instance, the venture gained negotiation skills through the help and active involvement of the incubator management. While the negotiation was with an alliance partner in the context of licensing technology, the negotiation skill gained could be related to multiple contexts, not solely related to technical assistance. In addition, the involvement of the incubator management, such as role-playing exercises, may have slowed the process of alliance formation, and subsequent technological learning, for the venture rather than speeding it up. Thus, speed of technological learning, as a specific kind of technical assistance does not appear to be enabled through counseling interactions with incubator management.

In regard to networking interactions, the results of this study suggest that these interactions do enable NTBF faster learning of technological know-how skills. Networking interactions, as measured in this study, result in ventures access to a larger number of contacts that will offer new and diverse information and expertise beyond the incubator management (Hackett and Dilts, 2004a; Hansen et.al., 2000). This finding is consistent with the findings of past research that access to the incubator network will enable the technological development of the venture (Hansen et.al., 2000), particularly more contacts from the incubator network (Scillitoe and Chakrabarti, 2005).

Interestingly though, while the results of this study suggest that a greater number of networking contacts enabled technical assistance, for US and Finnish ventures within this study the number of networking contacts NTBFs gained on average was between approximately one and six contacts (see Table 1). This significantly contrasts with the number of contacts incubator managers claim to have access to (see Table 2) which is over 150. Thus, our findings suggest that more relevant contacts are likely key to venture technical assistance, not solely a larger number that the NTBF must wade through to find needed technological know-how skills. This is particularly salient for Finnish ventures that had even fewer networking contacts from incubator management than the US firms although the incubator management had access to more contacts than US incubator management. This further suggests that the ability of the incubator manager to understand venture needs is important in finding these relevant contacts, similar to the technology broker role discussed above, and in Finland the incubator management may be better suited to offer more relevant technological contacts given the more technology-focused incubators and likely subsequent adsorptive capacity. In addition, there is a possibility that these contacts may also be gained specifically through seminar/training and social opportunities through the incubators since the incubators in the sample did offer such programs on average with a history of adsorptive capacity. Interestingly though, while the results of this study suggest that a greater number of networking contacts enabled technical assistance, for US and Finnish ventures within this study the number of networking contacts NTBFs gained on average was between approximately one and six contacts (see Table 1). This significantly contrasts with the number of contacts incubator managers claim to have access to (see Table 2) which is over 150. Thus, our findings suggest that more relevant contacts are likely key to venture technical assistance, not solely a larger number that the NTBF must wade through to find needed technological know-how skills. This is particularly salient for Finnish ventures that had even fewer networking contacts from incubator management than the US firms although the incubator management had access to more contacts than US incubator management. This further suggests that the ability of the incubator manager to understand venture needs is important in finding these relevant contacts, similar to the technology broker role discussed above, and in Finland the incubator management may be better suited to offer more relevant technological contacts given the more technology-focused incubators and likely subsequent adsorptive capacity. In addition, there is a possibility that these contacts may also be gained specifically through seminar/training and social opportunities through the incubators since the incubators in the sample did offer such programs on average with a history of NTBFs taking advantage of these opportunities.

The following excerpts from a conversation with incubator managers show how relevant networking contacts with incubator management support can speed access to relevant technological knowledge.

“We had a venture that developed a children’s educational software that was promising but was having trouble
distinguishing itself in the market. There was a lot of educational software on the market already. I connected the founder with a voice recognition expert within the university, making introductions and arranging meetings, and the outcome was an educational software for the disabled. The addition of the voice recognition technology helped the firm stand out in the market and generate sales.” (Incubator Manager, New York State, 2003)

“I have a team of science advisors affiliated with the incubator to help entrepreneurs identify researchers at affiliated universities or institutions that possess the technology needed. We ask that universities provide one central link so that the communication of technological need passes through a central person reducing any inefficiencies. This central person is a higher ranking person who is knowledgeable.” (Incubator Manager, Philadelphia, PA, 2003)

However, results of this study also suggest that networking interactions do not enable business assistance. This finding, at first glance, appears to contradict prior literature that has argued that the incubator network will help the business development of the venture (Rice and Matthews, 1995; Hansen et al., 2000). However, we offer an explanation that the incubator network does not enable business assistance but not through a large network of contacts, similar to the discussion above regarding networking interactions and technical assistance. Rather, beyond direct interactions and business support through counseling interactions, incubator management have developed a competent yet focused business network of contacts that can offer valuable support to NTBFs. The trend is that the large majority of business incubators offer business assistance as a standard offering (Mian, 1996) and likely tend to develop expertise in this area and develop a focused network of business assistance contacts, sometimes through business development centers or programs. This support can also be provided through incubator sponsored training programs. In the following quote from a US incubator manager, we can see how the Small Business Development Center (SBDC) is used as a focused network for incubatees of a US incubator.

“For marketing support, we try to offer two sources: access to library with electronic databases, periodical and journals and also, through the Small Business Development Center, a team of researchers in the state that work with them on market research. Many firms are frustrated with finding market information and many are not concerned; we try to challenge them. I ask them to identify ten people who would buy their product and then call them. Need to be specific in that regard.” (Incubator Manager, New York State, 2003)

The assistance gained through the SBDC would likely serve as a single contact, not a large network of contacts for the NTBF, although the center offers the expertise of a group of individuals. This is also true of the Finnish incubators that offer ventures access to a shared business service program called Spinno. Spinno is a business assistance program that provides support to ventures in many of the incubators within the nation. As a result, the incubator management, in general, may not offer a large number of network contacts for business assistance but rather may refer ventures to competent programs or centers with relevant expertise in business assistance. Thus, the ventures may be able to gain the support needed either through the incubator management or through a few or single network contact gained through the incubator management, not through access to a large network of contacts.

6. Conclusions and implications

The results of this study offer valuable new insights regarding the incubation process of new ventures, specifically the differing roles of counseling and networking interactions on business and technical assistance. This study also offers more specific measures of venture assistance from past literature, testing learning about buyer preferences as a form of business assistance and technological learning as a form of technical assistance offering evidence of how these forms of assistance are affected by incubator interactions. For helping ventures learn about buyer preferences, frequent interactions with incubator management can be beneficial where the venture can get direct assistance and access to recommended programs or centers that offer business assistance. For helping ventures quickly learn technological-know skills, networking interactions through the incubator management are beneficial. The incubator management can offer a pool of relevant network contacts that will be beneficial to the venture.

In addition, the results of this study have specific implications for incubator management, NTBFs, and organizations that support the creation and sustenance of incubators. For incubator managers, this study offers insights on the best mechanisms to provide support to affiliated ventures. Incubator managers may have their own expertise to offer marketing support in terms of helping ventures learn about buyer preferences or may effectively identify relevant business assistance programs, centers, or specified contacts. However, incubator managers should also recognize their limited ability to provide technical assistance directly and that taking too much time to understand venture technological needs can slow down the incubation process. New ventures tend to be on the cutting edge in the area of their core technology and the ability of the incubator management to offer relevant support for the development of this technology is to provide access to a pool of relevant contacts. The size of the incubator management rolodex is less important than offering a quantity of relevant contacts to each venture. In some incubators, a team of personnel can help manage this process and it is possible that a more technology-focused incubator will also make technical assistance more streamlined.

Also, this study has implications for NTBFs. NTBFs should recognize that incubator management can serve as valuable support for both business and technical assistance. Learning about buyer preferences is best gained through the incubator management or recommended programs or services. However, incubator management lacks the depth of technical knowledge to understand their core technology well enough to offer direct technical assistance. However, if the venture is able to make the incubator management understand their technological needs or difficulties, then the relevant contacts that manager can provide may prove to be beneficial regarding learning technological-know skills. As a result, NTBFs should seek affiliation with incubators that have a common technological base to their firm's technology whenever possible.

Prior research on the time allocations by incubator manager suggest that they spend the majority of their time, up to 90%, marketing and managing the operations of the incubator, often as a result of pressure to achieve full tenancy and make the incubator financially self-sustaining, particularly US incubators (Rice and Matthews, 1995; Hackett and Dilts, 2004a; Abetti, 2004). This study highlights the importance of interactions with new ventures for both business and technical development. Thus, these findings have implications for organizations that support the development and sustenance of incubators. The time that incubator management spends supporting affiliated venture development, whether through one-on-one interactions or by helping the venture access relevant network contacts, is time well
spent. Often incubators are judged in terms of the number and quality of jobs created, number of firms graduated, and operational stability (Rice and Matthews, 1995). This study suggests that business and technical assistance, as intermediaries in venture development and growth, provide significant value to affiliated ventures and incubator management must have the resources available for such assistance. If incubator management is unable to provide this assistance due to competing demands, the success of the ventures may be sacrificed.

7. Limitations and future research

This study has several limitations associated with sampling, measures, network scope, and firm life-cycle development. In regarding to sampling, this study has methodological limitations associated with the sample that suggest some common method variance. The data used in this study are from a single respondent, an NTBF founder, for each venture surveyed, limiting the survey responses to a single source. The sample for this study is also cross-sectional in nature across incubators, industries, and countries and was not longitudinal in nature, allowing only for analysis at one point in time rather than over the course of time. The sample is also subject to independence issues since several NTBFs within each incubator were surveyed. While this study cites the value of sampling within the US and Finland as the top countries for economic competitiveness and growth, inclusive of technological sophistication and innovation, there is also an element of convenience sampling as a result of contacts available within these countries. In addition, this study only includes a sample of 42 NTBF’s and reflects a limited response rate of the targeted sample. Larger samples in future research will help determine whether the results in this study are generalizable to other ventures. Sample size also limits the number of variables that could be included for a fuller picture of the phenomenon studied, such as venture absorptive capacity. Finally, this study does not incorporate a control group to compare incubated ventures to non-incubated ventures. Identifying and testing additional sources of counseling and networking interactions for non-incubated ventures as a comparison group would offer interesting insights on whether incubators offer a competence in these paternalistic interactions.

There are also several measurement limitations associated with the learning, incubator management experience, interactions, assistance, and network contact measures. The control variables of desire to learn buyer preferences and technological know-how skills and incubator management experience used in this study are binary in nature. Using a Likert-type scale for future analyses that would provide greater variability is warranted. The measure for the number of network contacts is a count of the number of contacts NTBFs received from the incubator management. The measure used does not allow consideration of the type and relevance of each network contact and how many of each type the NTBF gained access to. Thus, an entropy type of measure that considers diversity, number, and relevance of contacts for each type of network contact is warranted for future studies. Also, the measures for business and technical assistance are biased, not capturing zero learning. Finally, the measures used for counseling interactions and networking interactions do not capture the trust and value embedded within these interactions and the impact of irrelevant contacts, although the number of contacts accessed by the venture appear to be much lower than the number available through the incubator management suggesting that the number of irrelevant contacts may be limited. Further exploration of these issues, perhaps through social networking measures, would offer additional insights.

This study is also limited in scope. Specifically, this study does not consider the assistance that NTBFs can gain through other actors such as universities, business consultants, funding organizations, government agencies, other ventures, etc. While research suggests that the technology incubator management serves as the primary source of beneficial network opportunities for NTBFs (Hansen et al., 2000; Scillitoe and Chakrabarti, 2005), understanding the dimensions of beneficial networking with other actors would be valuable. This study strictly observes the interactions NTBFs have with the business incubator management. Future research should consider the impact of these interactions from alternative actors. In addition, future research should include a comparative study between both the US and Finnish incubators/incubation systems and their relationship to incubator interactions and affiliated venture success. Viewing these multiple levels of analysis simultaneously would offer valuable insights into the incubation process.

Finally, this study lacks consideration of the life cycle of the firm. While the firms sampled within this study are younger ventures and likely in the early growth stages of development (see Dodge and Robbins, 1992), the need for business versus technical assistance can vary according to these stages, offering additional interesting insights. Future research should include this life-cycle consideration.

Acknowledgements

This study was graciously supported by Tekes, the National Technology Agency of Finland, the National Science Foundation, the Technology Management Center of Rutgers University, and Helsinki University of Technology. Without the support of these organizations, this research would not be possible. We also thank Professor Ela Jarvenpaa at the Helsinki University of Technology for her help in conducting the field study.

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