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Science, Innovation and Electronic Information Division

Conceptualizing and Measuring Business Incubation

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p	preliminary
r	revised
x	suppressed to meet the confidentiality requirements of the <i>Statistics Act</i>
E	use with caution
F	too unreliable to be published

Note

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Statistics Canada
Science, Innovation and Electronic Information Division (SIEID)

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Note of appreciation

Canada owes the success of its statistical system to a long-standing partnership between Statistics Canada, the citizens of Canada, its businesses and governments. Accurate and timely statistical information could not be produced without their continued cooperation and goodwill.

The science and innovation information program

The purpose of this program is to develop **useful indicators of science and technology activity** in Canada based on a framework that ties them together into a coherent picture. To achieve the purpose, statistical indicators are being developed in five key entities:

- **Actors:** are persons and institutions engaged in S&T activities. Measures include distinguishing R&D performers, identifying universities that license their technologies, and determining the field of study of graduates.
- **Activities:** include the creation, transmission or use of S&T knowledge including research and development, innovation, and use of technologies.
- **Linkages:** are the means by which S&T knowledge is transferred among actors. Measures include the flow of graduates to industries, the licensing of a university's technology to a company, co-authorship of scientific papers, the source of ideas for innovation in industry.
- **Outcomes:** are the medium-term consequences of activities. An outcome of an innovation in a firm may be more highly skilled jobs. An outcome of a firm adopting a new technology may be a greater market share for that firm.
- **Impacts:** are the longer-term consequences of activities, linkages and outcomes. Wireless telephony is the result of many activities, linkages and outcomes. It has wide-ranging economic and social impacts such as increased connectedness.

The development of these indicators and their further elaboration is being done at Statistics Canada, in collaboration with other government departments and agencies, and a network of contractors.

Prior to the start of this work, the ongoing measurements of S&T activities were limited to the investment of money and human resources in research and development (R&D). For governments, there were also measures of related scientific activity (RSA) such as surveys and routine testing. These measures presented a limited picture of science and technology in Canada. More measures were needed to improve the picture.

Innovation makes firms competitive and we are continuing with our efforts to understand the characteristics of innovative and non-innovative firms, especially in the service sector that dominates the Canadian Economy. The capacity to innovate resides in people and measures are being developed of the characteristics of people in those industries that lead science and technology activity. In these same industries, measures are being made of the creation and the loss of jobs as part of understanding the impact of technological change.

The federal government is a principal player in science and technology in which it invests over five billion dollars each year. In the past, it has been possible to say only *how much* the federal government spends and *where* it spends it. Our report **Federal Scientific Activities, 1998** (Cat. no. 88-204) first published socio-economic objectives indicators to show *what* the S&T money is spent on. As well as offering a basis for a public debate on the priorities of government spending, all of this information has been used to provide a context for performance reports of individual departments and agencies.

As of April 1999, the Program has been established as a part of Statistics Canada's Science, Innovation and Electronic Information Division.

The final version of the framework that guides the future elaboration of indicators was published in December, 1998 (**Science and Technology Activities and Impacts: A Framework for a Statistical Information System**, Cat. no. 88-522). The framework has given rise to **A Five-Year Strategic Plan for the Development of an Information System for Science and Technology** (Cat. no. 88-523).

It is now possible to report on the Canadian system on science and technology and show the role of the federal government in that system.

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Conceptualizing and measuring business incubation

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Conceptualizing and measuring business incubation

Abstract

This paper conceptualizes business incubation and translates theoretical ideas into measurable metrics. Specifically, it explains and develops the concept, discusses the influence of major economic and technological events on its evolution, identifies different models and explains how business incubators create value. It then explains how these concepts have been implemented in Statistics Canada's first survey of business incubators.

Conceptualizing and measuring business incubation

1. Introduction

The purpose of this paper is to conceptualize business incubation and translate theoretical ideas into measurable metrics. Specifically, it explains and develops the concept, discusses the influence of major economic and technological events on its evolution, identifies different models and explains how business incubators create value. It further explains how these concepts have been implemented in Statistics Canada's first survey of business incubators, conducted recently in collaboration with Industry Canada.

Business incubation can be described as an innovative, evolving organizational form to create value by combining the entrepreneurial drive of a start-up with resources generally available to large or medium-sized firms. Business incubators nurture young firms during their formative years when they are most vulnerable, helping them to survive and grow into viable commercial enterprises.

Launching a new firm is a risky undertaking. Most of the start-ups fail. In Canada, two in three new ventures do not survive past the fifth year, and by the tenth year, four in five are out of business (Statistics Canada, 2006). Mortality rates are higher in industries that are on the leading edge of technological change (Hamdani, 1998).

Some ventures fail because they do not have sufficient resources, while others are not able to anticipate and provide for the future needs or do not have the competence to cope with unforeseen events. Business incubation concept rests on the argument that if weak but promising new businesses with a high probability of growing into successful ventures can be identified at an early stage and helped, some of the resource loss associated with creative destruction can be avoided. Public intervention is especially advocated in situations where markets fail to allocate resources to produce desired outcomes because of externalities, monopoly power, imperfect information, etc.

Studies of business incubation are typically exploratory attempts to describe a young phenomenon. Moreover, researchers tend to treat some of its important aspects as integral parts of other fields. For example, start-ups, whether they function independently or reside in an incubator, are analyzed as part of the entrepreneurship literature.

This paper first presents a general summary. Main questions raised in the literature and principal findings are synthesized and summarized, at the risk of oversimplification, in Table 1 as a general introduction to the subject. Findings are grouped under five headings: incubator development; sources of value; success factors; impacts and finally theories of incubation. Where relevant and possible, incubator development and sources of value are further subdivided according to the main actor, namely the incubator, incubatee, and the community in which the incubator operates.

This is followed by a discussion of the core topics, including the concept and definition, historical trends and their influence on the governance, value proposition and configuration, how incubators create value and how their performance can be evaluated.

Finally, the analysis points out to what extent each major component of the incubation process has been captured in the survey instrument. This discussion is dispersed throughout the paper but a summary is brought together in Table 3 for easy reference. We should note that Table 3 shows only that part of the questionnaire content that is relevant to the scope of this paper. For the full content, the readers should refer to Statistics Canada (2005).

Table 1 Research questions and key findings in the literature on business incubators

Research Questions	Main Findings		
	A) <i>Incubator development</i>	B) <i>Sources of value</i>	D) <i>Impact studies</i>
<ol style="list-style-type: none"> 1. What is an incubator? 2. How does an incubator develop? 3. What is the life cycle of an incubator? 4. What are the critical factors for successful business incubation? 5. Does one type of incubator create more value than another? 6. How does the business incubation concept work in practice? 7. How do incubators select incubatees? 8. What is the process of new venture development in an incubator? 9. What is the role of planning and the business incubator manager? 10. Do incubators achieve what their stakeholders claim they do? 11. How can business incubation program outcomes be evaluated? 12. Have business incubators improved new venture survival rates, job creation, and industrial innovation rates? 13. What are the economic and fiscal impacts of an incubator? 	<p>Incubator:</p> <ol style="list-style-type: none"> 1. Incubators can be classified, according to financial sponsor, business focus of incubators or incubatees, etc. 2. They have a life cycle; 3. Low rents, shared services and entry/exit policies are their key characteristics; 4. Support networks and university ties are key characteristics. <p>Incubatee:</p> <ol style="list-style-type: none"> 1. Below market office rent is important; 2. Incubatees learn and sometimes purchase from one another; 3. Comprehensive business consulting services must be available to them; 4. University technology business incubators have positive environmental effects on incubatees. <p>Community:</p> <ol style="list-style-type: none"> 1. Incubator provides a protective environment in which new ventures grow, with opportunities for local economic expansion; 2. Business incubator is one element of economic development strategy; 3. Net job creation is minimal, but not insignificant. 	<p>Incubator to incubatee:</p> <ol style="list-style-type: none"> 1. Incubatee selection and monitoring; 2. Diagnosis of incubatee needs; 3. Access to capital; 4. Access to networks of expert and support systems; 5. Faster solution to problems; 6. Brand name. <p>Incubator to community:</p> <ol style="list-style-type: none"> 1. Designed to the cultural values of the community; 2. Contact with community leaders. <p>Incubatee to community and incubator:</p> <ol style="list-style-type: none"> 1. Economic development; 2. Technology diversification; 3. Job creation; 4. New products and processes 	<p>Incubator level:</p> <ol style="list-style-type: none"> 1. There are many proposed incubator measures from simple (sustainability) to complex (fit). 2. There are few empirical results. <p>Incubatee level:</p> <ol style="list-style-type: none"> 1. There is a wide spectrum of measures, most with little empirical support. <p>Community level:</p> <ol style="list-style-type: none"> 1. Incubators are not good job creators; but 2. they are more cost effective than other programs such as incentives to attract firms to a region.
		<p>C) Critical success factors of incubators</p> <ol style="list-style-type: none"> 1. Selection and monitoring for incubatees; 2. access to capital 3. on-site business expertise; 4. milestones with clear policies and procedures; 	<p>E) Theories underpinning incubation</p> <ol style="list-style-type: none"> 1. Transaction cost theory; 2. Knowledge-based theory; 3. Resource-based theory; 4. Real Options-driven theory

Source: Synthesized from Hackett and Dilts (2004a).

2. Definition

There is no one standard definition of business incubation. Nearly three dozen definitions are available in the academic literature and just as many have been adopted by industry associations and policymakers in different countries, reflecting local cultures and national policies. Germany, for example, targets innovative start-ups, while France and the Netherlands promote the university-incubator model (Aernoudt, 2003). Differences in definitions are largely in emphasis and detail although some are substantive. Furthermore, incubators go by different names in different countries. For example, in Canada, technology incubators sponsored by the National Research Council are called Industrial Partnership Facilities (See Carty, 2003).

It is useful to begin with a description of activities the incubators perform. Merrifield (1987) provides a list. According to him, incubators:

- provide secure, affordable, flexible, well equipped physical space in which the entrepreneur can work (often night and day);
- provide readily accessible support services;
- provide professional, business, management, and technical consulting together with access to seed and working capital, state and federal grants, loan financing, venture capital, and R&D partnership funding, public and private stock offering, and state equity financing;
- are often associated with a university that can provide additional access to highly specialized, analytical, computing and test facilities in an array of disciplines;
- create an interactive community of entrepreneurs, academic and business interests that stimulate and encourage the sometimes fragile incubation process; and finally
- often operate as a community bridge with the community, and established enterprises that seek a window on emerging technologies and may provide growth capital for equity participation.

Shared physical space and support services are the most common attributes found in nearly all of the definitions. Lately, provision of coaching, mentoring, IP (intellectual property) management, and networking has been receiving more attention (See Hansen, et al, 2000), although there is some confusion as to what exactly networking is in this context. Some authors use the term narrowly to refer to networking among incubatees within an incubator while others extend it to cover access to networks of outside experts, and in some cases it means networking between incubatees and graduates of an incubator.

A useful definition that covers almost all of the common elements of a vast majority of views is provided by Hackett and Dilts (2004a and b):

“A business incubator is a shared office space facility... that seeks to provide... a strategic, value adding intervention system of monitoring and business assistance... with the objective of facilitating the successful new venturing development while simultaneously containing the cost of their potential failure... It is important to keep in mind the totality of the incubator... It is a network of individuals and organizations.”

There are ambiguities about the concept of business incubation, in particular, how incubators differ from science and commercial innovation parks, and whether virtual incubators fall within the commonly understood definition of an incubator. Some writers tend to define the concept broadly while others use it

in a narrow sense. This issue has been addressed in detail by Schillo (2005). A few brief, supplementary remarks follow.

2.1. Innovation centres and science parks

Some writers see science parks, business innovation centres and incubators as a continuum in the innovation system, which begins with basic scientific research and culminates in the incubation of a firm, and, therefore, treat them as distinct and separate entities. Hackett and Dilts (2004a) argue, based on the U.S. experience, that a science park is a location for the conduct of basic research; a business innovation centre is a location for commercializing the outputs of basic research; and an incubator is a location for fostering the development of new or fledgling businesses. This neat demarcation is fine in principle, but as they recognize, in practice, activities that take place in these locations can and do overlap. Hence, the determining factor is the principal activity of these organizations, and not necessarily what they call themselves.

Individual country experiences can provide useful insights for understanding the general characteristics of the industry but national industry structures can also have distinct features because of the influence of local cultures and national policies and incentives on the governance structure, business focus and functions. For example, Schillo (2005) notes that innovation commercializing centre is a relatively new terminology in Canada and that incubators often use it to describe themselves.

2.2. Virtual incubators

A majority of writers who have explicitly dealt with the concept of business incubation argue against the inclusion of virtual incubators. They assert that the building provides more than subsidized rental offices, i.e. the environment that co-location within the physical infrastructure creates confers intangible benefits.

The environment within the incubator created through the interaction between the incubator manager and incubatees and among the incubatees is seen by a vast majority of writers as a very important facet of incubation. Several writers (Bullard, 1992; Feitus, 1993, Van Sac, 1991) note that the physical facility provides a fertile field, not just a building, and being located in the same building makes it easier to maintain a relationship, allowing for many brief, important discussions throughout the day, without having to make an appointment every time there is a question. Availability of on-site business expertise has been mentioned as a critical factor in the success of incubatees.

Being together within the same physical space can foster partnerships among start-ups, facilitating the flow of knowledge and forging of marketing and technology relationships among them.

While the Internet has made it easier for start-ups to procure some services at competitive rates, entrepreneurial team of a new venture still faces the transaction costs of negotiating and contracting, which incubators can substantially reduce.

Credibility acquired by affiliation with an established incubator and spread through the word of mouth by fellow-incubatees is worth much goodwill.

After a comprehensive review of business incubation, Hackett and Dilts (2004a) assert that if virtual incubators can be considered incubators, then any businesses providing business assistance can also be included in the category of incubators.

2.3. Managed workspaces

Incubators are also distinguished from managed workspaces, a term that is mainly used in the U.K. Managed workspaces share several similarities with incubators such as financial sponsorship by community groups and government and shared office space and services. The main differences are with

respect to admission criteria and graduation policies. Managed workspaces accept businesses that are already in existence and do not require most or many of the services on offer.

While some incubators early in their life cycle may accept such 'ineligible' applicants (see Section 5) it is a passing phase. However, it is not an anomaly for managed workspaces. Once admitted, the business may stay on because exit from a managed workspace, in principle, is a decision for the residents to make (Martin, 1997), unlike an incubator which has clearly defined exit policies with a ceiling on the incubation period.

2.4. Definition used in the survey instrument

While Statistics Canada's survey instrument did not provide a formal definition of business incubator, it approached the issue in a pragmatic manner, employing screening questions to rule out businesses that did not meet the minimum qualifications. Businesses providing shared space were screened in. Virtual incubators were excluded in keeping with the majority view in the literature. More detailed questions about services offered by the respondent provide flexibility in studying selected groups of incubators.

3. Evolution of business incubation concept

The business incubation concept has been influenced and shaped by three significant economic and technological developments since its inception, and its governance, value proposition and configuration have evolved. The main types of business incubation models that have emerged in response to changing incubatee needs are described in Table 2. Events shaping them are discussed below.

3.1. Urban renewal and community development

In their early development, business incubators were primarily seen as an instrument of urban renewal and community development. First business incubators were conceived as a result of the difficulty some landlords faced finding tenants for their vacant buildings. These buildings were factories that had curtailed or ceased operation because of industrial restructuring and re-location of production facilities, schools experiencing declining enrolment or other types of buildings left vacant by emigrating companies. Faced with the difficulty of finding a single tenant for the entire building, their owners started partitioning them and renting them out as units to different tenants.

Thus the use of the term 'tenant' to describe residents of a business incubator, which emphasizes the rental relationship, is not entirely coincidental. It is a reflection of the focus of the early incubators' activities, although it continues to be used even today when provision of rental space is one of their many activities.

Given government concern with revitalizing decaying urban areas and creating employment opportunities in close proximity to where communities lived, combined with the fact that some of these buildings were public property, the early business incubators tended to be joint private-public partnerships or were subsidized by government. In the mid-1980s, in the U.S. the Small Business Administration undertook a number of initiatives to strengthen the incubation movement, including regional conferences, handbooks and newsletters on business incubation, and supporting the formation of a national association (Woggins and Gibson, 2003).

3.2. Commercialization of outputs of basic scientific research

In the 1970s, interest in commercializing university research and technologies began to reshape the industry. Beginning in 1973, the U.S. National Science Foundation supported programs with innovation centres through its Experimental Research and Development Program (Scheirer et al, 1985). The

Table 2 Principal characteristics of the main business incubation models

Configuration	Private-public model	Institution-backed	Venture capital model	Corporate sponsored
Profit orientation	Non-profit	Depends on institution	Profit motive very strong	Profit-oriented
Governance or sponsors	Corporate and institutional stakeholders	Corporate and institutional stakeholders	Individuals, angels and venture capital funds	Corporation
Main Services provided	Rental space, shared services	Rental space, shared services, access to knowledge	Access to equity capital	Space, shared services and networks of experts
Sources of funding	Subsidies, fees and rents	Subsidies, fees and rents	Equity and fees	Equity, fees, sales
Incubation period	About 3 years	About 3 years	Shorter; can be months	No standard period
Entry criteria	Promising idea or technology	Promising idea or technology	Promising technology, usually at a more developed stage	Promising technology or idea that will enhance incubator's position
Graduation criteria	Viability of business on its own	Viability of business on its own	Readiness for a liquidity event, i.e. IPO, M&A.	Incubator's discretion
Objectives	Local economic diversification, retaining businesses in the community, growing SMEs	Technology transfer, commercialization, clusters and developing entrepreneurship	Capitalize on investment and technological opportunities	Develop new and complementary technologies
Industry sector	Usually small service companies	Usually leading edge technologies	New and emerging technologies	Technologies related to incubator's line of business
Management control	Management advice	Management advice	Management control	Direct or indirect management control
Relationship after graduation	None or casual	None or informal	None	Control or strong interest maintained

program grew and is credited with being the basis of university efforts to launch incubation centres (Allen and Weinberg, 1988).

A related and significant development was the growing attention to the interests of the producers of intellectual property (IP). Concurrently, there was a concern in the U.S. that other countries were narrowing the invention and technology gap (Merrifield, 1987). Creating, protecting and commercializing IP was seen as a major factor of competitive advantage for the U.S. manufacturing firms, which were being challenged by low cost producers in other countries. Beginning in the mid-1980s, business incubation activity began to increase significantly, attributed mainly to:

- reduced uncertainty about commercializing the outputs of federally funded basic research and the passage of the Bayh-Dole Act in the U.S. in 1980;
- increasing recognition in the legal system of the importance of innovation and IP rights protection; and
- profit opportunities offered by the commercialization of biomedical research.

3.3. Rapid technological change and receptive equity markets

The concept was influenced in the 1990s by three concurrent technological and capital market events: penetration of information and communication technologies in all sectors of the economy; rapid technological obsolescence; and easy access to equity markets and rise of angels. These developments offered new opportunities and ideas and created demand for new services. For example, start-ups with novel ideas needed not only the services incubators traditionally provided but also assistance with getting new products to the market as quickly as possible and ahead of their competitors.

While incubators adapted to these developments by offering additional services, growth of on-line commerce gave rise to virtual incubators and on-line businesses. Moreover, eager to take advantage of new technologies, which created opportunities for leveraging such assets as purchasing power and big customer base, large corporations introduced new models to suit their particular needs. Whereas business incubation models that were introduced to commercialize outputs of basic scientific research differed from the archetype with respect mainly to sponsors and services, developments in the 1990s created models that were different in more fundamental ways. Four models are identified and outlined in Table 2. In the absence of a standard terminology, we have used descriptive titles, indicating main sponsors: private-public, institution-backed, venture capital model and corporate sponsored model.

As incubation models responded to emerging phenomena, they adopted new business strategies and governance structures and their objectives and services changed accordingly. Their entry and exit rules also reflected the new business focus. For example, logistical services were important in the beginning when urban renewal and community development were the main concerns. While these services continued to be offered by the models that emerged in 1990s, other services became more important. For instance, the need to be the first in the market with a new product required access to risk capital (Grimaldi and Grandi, 2005), networking (Hansen et al, 2000), and marketing expertise.

By focusing on the provision of risk capital, the venture capital model satisfied a critical need, as Grimaldi and Grandi (2003) correctly point out, but in doing so it raised the bar for admission to an incubator. To qualify for risk capital, more stringent criteria had to be met than was necessary in the previous models e.g. applicants had to have a more developed technology. Other start-ups with less developed technologies but promising prospects still had to rely on archetypal incubators.

This led to a debate whether some variants of the new models such as accelerators, econets, and Internet kieretsus fell within the meaning of an incubator. High mortality rates experienced by some of them in the sharp stock market decline early in this decade appeared to vindicate the argument that these models were the result of the stock market exuberance rather than a sound new incubation model. However, the continued rise in the number of incubators after the stock market decline is used by others as a counterpoint.

Two points should be noted about the models presented in Table 2. Although they are meant to trace chronological developments, they can also be viewed as representing a taxonomy based on financial sponsorship. This is not surprising because a majority of incubators are small in terms of revenue, and, therefore, sources of funding have played an important role in their development, whether they were government subsidies, angels or corporations taking equity positions.

Second, they capture quite well the principal characteristics of the numerous variants of business incubation models. In this respect, they represent a meaningful compromise between the detail in Grimaldi and Grandi (2005) which gives profiles of eight major business incubators some of which are too similar to be distinct, and the highly specialized focus of Johnsrude, Theis and Bezerra (2003) on only the post-1990s incubators.

Table 3 Coverage of the main business incubation features in the Canadian survey instrument

Feature	Reference and treatment in the questionnaire
Definition and scope of industry	<ul style="list-style-type: none"> Provision of space, Q1.1.a. is the minimum qualification for eligibility as an incubator; thus virtual incubators are excluded; A comprehensive question, Q5.1, on services on offer gives the flexibility of defining the industry in various ways.
Governance structure or sponsors	<ul style="list-style-type: none"> Q2.1 provides data on affiliation, stakeholders, and performance agreements with and activities of stakeholders.
Services provided	<ul style="list-style-type: none"> Q5.1 has a comprehensive list of services on offer, in-house and via links to other sources; Offer of a comprehensive menu of services, even if some are under-utilized, is regarded as critical factors in success.
Sources of funding	<ul style="list-style-type: none"> Sources of funds for the incubator covered in Q2.3. Sources of funds raised by incubatees are available in Q6.2. The source of finance is an indication of confidence in an incubatees' prospects
Incubation period	<ul style="list-style-type: none"> No question specifically deals with this; some indirect information can be derived from rental policy, Q3.7, which is used by some incubators to encourage non-performing incubatees to leave.
Entry criteria	<ul style="list-style-type: none"> Covered in Q3.2. Screening-in 'weak but promising' businesses is one of core value added functions;
Graduation criteria	<ul style="list-style-type: none"> Covered in Q3.3.
Objectives	<ul style="list-style-type: none"> Q3.1 provides a comprehensive list of objectives.
Industry sector	<ul style="list-style-type: none"> Q4.8.
Inputs	<ul style="list-style-type: none"> Quantity - Q2.2.b, Q2.2.c; expertise – Q7.1; quality – Q7.2 and Q7.3; No question dealing with intensity of use;
Indicators of success	<ul style="list-style-type: none"> Jobs created by incubatees, Q4.5; Number of incubatees performing R&D, Q4.6; Number of incubatees having sales revenue, number of graduates, number merged or bought out, number closed, Q6.1; equity vs. loans raised by incubatees, Q6.2; Most of the measures are economic or financial; Goals-related outcomes to be considered in future as an indicator of success. For example, if the goal is to retain businesses in the community (Q3.1) then knowing how many graduates (Q6.1) stayed in the community would be useful. Evaluation of an incubator's performance from incubatees' perspective and data on graduates' activities would give useful insights.

4. Taxonomies

Business incubation models presented in Table 2 are helpful in explaining the evolution of the concept and accompanying changes in their objectives, governance and services. But they do not have explanatory or predictive power with respect to the outcomes.

Other criteria have been employed to categorize them in different ways in order to find patterns in their behaviour. Criteria range from their origin to functional characteristics and type of market failure addressed. An inventory of taxonomies is provided below, arranged in a chronological order. There is no presumption that those developed later represent an improvement over the earlier ones. Each needs to be judged on its own merit in light of its relevance to the researcher's interest. They are, based on:

- a) origin, i.e. spin-offs or start-ups (Plosila and Allen, 1985);
- b) business focus of the incubatees (Plosila and Allen, 1985; and Sherman 1999)

- c) business focus of the incubator (Brooks, 1986);
- d) financial sponsorship (Kuratko and LaFollete, 1987; Smilor, 1987b; Temali and Campbell, 1984);
- e) admission criteria (Lumpkin and Ireland, 1988)
- f) networked and others (Hansen, 2000);
- g) specialist (with new products) or generalist (Bhabra-Remedios and Cornelius, 2003); and
- h) type of market failure addressed (Aernoudt, 2003).

The available research shows that these taxonomies do not reveal any behavioural differences in the grouping they identify. For example, while a taxonomy based on sponsorship is useful to indicate that incubators can differ in their motivation, Allen and McCluskey (1990) found little variations in the services they offered or activities they undertook. Similarly, in their review of a large body of literature, Hackett and Dilts (2004a) did not find no studies that established a link between incubator type and their outcomes, or demonstrated their ability to predict or explain variations in incubation outcomes.

However, they are a useful means of organizing a mass of data into manageable groupings in order to detect emerging and notable trends in how the industry structure is developing.

5. Life cycle

Attention to the life cycle filled some of the gap, by providing indirect insights into the relationship between the life cycle and outcomes of an incubator. Some writers, notably Plosila and Allen (1986) and Allen and Weinberg (1988), argue that as an incubator progresses through its life, its focus shifts and, with it, its recruitment programs, admission and graduation policies change. An incubator trying to establish itself is less likely to be concerned with developing or enforcing stringent admission policies than achieving a reasonable occupancy rate, and it may be willing to admit companies that are further along their development than a start-up. Indeed, it could be so occupied with achieving a high occupancy rate that attention to incubatees might suffer. Recognizing this possibility, some writers have suggested using the ratio of start-ups to total residents of an incubator as a factor in evaluating an incubator's performance.

A brief description of the three phases, start-up, business development and maturity, is given in Table 4. In the start-up phase, an incubator does not have or strictly enforce admission criteria and incubatees are less likely to receive the attention they expected. By some accounts, this phase can last up to five years. In the second phase, highlighted by full or near-full occupancy rate, the emphasis shifts from recruitment policies to admission criteria, and entrepreneurial development becomes the focus of attention. In the third and final phase, the incubator is well established, demand exceeds capacity and it contemplates expansion.

Like taxonomies, there are no studies relating phases of life cycle to outcomes. However, it is hard to dispute that well established incubators are likely to contribute more value to their incubatees than their counterparts that are still in the early stage of development. A relevant piece of evidence was provided by Allen and McCluskey (1990) who found that about one half of the variation in the outcomes of incubators that they analyzed could be explained by age. Age can be proxy for many characteristics, among which experience is probably the most important. This supports the argument that an incubatee is likely to benefit more from an experienced and, by extension, well developed incubator than its less experienced counterparts. An important corollary of this is the importance of "would-be-incubatees performing due diligence on the incubator in order to determine whether the incubator has the core competencies in business assistance and the resources to provide the kind of value demanded by the venture's management team" (Hackett and Dilts, 2004a, p. 60).

Table 4 Life cycle of a business incubator

Phase	Profile	Comments
Start-up	<p>A high occupancy rate is the primary concern:</p> <ul style="list-style-type: none"> • Start-ups as well as other ventures that have been in business (for up to three years) are admitted; • Their may not be any pre-determined business profile or sectoral preferences for admission; • Incubator manager is often not in a position to devote much attention to start-ups; • Breakeven point occurs when full or near full occupancy is achieved 	<ul style="list-style-type: none"> • Need for ongoing funding and subsidies is the greatest at this stage; • By some estimate, this phase might last for up to five years
Business development stage	<p>High occupancy rates have been achieved and attention shifts from property development to enterprise development or firm formation</p> <p>It becomes more selective in the selection of tenants;</p> <ul style="list-style-type: none"> • Increase in the frequency of interaction between the incubator manager and incubatees; • More attention is paid to the needs of existing tenants than recruiting new ones; • Synergies begin to develop through networking among the tenants, or by default if the central support is not sufficient or relevant; • Stable demand for space within the incubator 	
Maturity	<p>In this phase, demand for admission exceeds space and tenants need comprehensive services:</p> <ul style="list-style-type: none"> • Admission and exit criteria become more stringent; • Lack of space because of high demand for admission and growing needs of the existing tenants leads some incubators to expand 	

Source: Adapted from Allen (1988), Allen and McCluskey (1990) and Martin (1997).

5.1. Life cycle in the questionnaire

The issue of life cycle is not addressed directly. However, there are a number of items in various questions that reveal the phase of an incubator's life cycle. For example, very high application acceptance rates (Q4.1 and Q4.2) would suggest an overly strong emphasis on recruitment program vis-à-vis admission criteria, which is generally a characteristic of incubators in their early stages of development. High dependence on grants and subsidies as a source of finance (Q6.2) is another indicator, as is the low capacity utilization rate (Q2.2.d and Q2.2.f).

6. How business incubators create value

How business incubators help transform a business proposal into a successful final outcome depends on how they are conceptualized. Over time, business incubation has been viewed as a tool of urban renewal, a community development program, a means of technology transfer, a commercialization mechanism and an enabling technology for entrepreneurship. However, their role as an entrepreneurship strategy has been consistently present and lately dominant in the literature (OECD, 1999), whether entrepreneurship means helping new or fledgling firms get established in designated areas for community development and urban revitalization or anywhere in the country.

Secondly, views on sources of value and their relative importance vary, depending on how their proponents see incubators bringing various activities together to transform a proposal into a deliverable outcome. In the very first formulations, the emphasis was entirely on factors internal to the incubator

(Campbell *et al.*, 1985). Subsequently, interactions with other organizations, notably government, local community and research institutions were added (Smilor and Gill, 1986), and finally its value as part of the innovation continuum was explicitly recognized (Hisrich, 1988).

Business incubators add value in a number of ways, but their main value proposition is in their core function, which is to help new and fledgling ventures survive in the early stages of operations. Dynamic economies go through a process of continuous rejuvenation. New technologies replace the old ones. New firms enter the market to test new ideas and products, driving out old that do not adapt to change. But launching a new firm requires human and capital resources and organizational, managerial, technological and marketing competencies to anticipate and deal with unforeseen needs and demands. Failure rates are high and sometimes costly. In Canada, two in three firms that started up during the 1990s closed down within the first five years; four in five did not make it past the tenth year (Statistics Canada, 2006).

While the process of creative destruction, as formalized in the evolutionary theories of economic growth, inheres in market economies, studies of innovation show that chances of an idea reaching fruition can be significantly improved through a formal process of screening and monitoring (Cooper, 1993), freeing resources that might otherwise be absorbed by unpromising ideas and devoting them to ideas that have a higher probability of making it to the market and succeeding there. Success is not guaranteed but the probability of success improves rather significantly.

As there are thousands of ideas floating around evaluating them for viability is a critical function. Once the entrepreneur decides to proceed with the idea, incubators can play a significant role in evaluating it and help the entrepreneur to carry it through to completion. This value added role begins with identifying:

- applicants that cannot be helped through business incubation i.e. initial analysis shows that the chances of their survival are slim;
- applicants that are weak but promising i.e. there is a resource gap and if helped, they have a high probability of growing into viable businesses; and finally
- applicants that are promising but not weak, i.e. they can proceed on their own and will likely succeed.

Formalization of an efficient system of screening applicants minimizes the number of candidates that cannot be helped or do not need help and ensure that as many deserving and promising applicants get in as possible. Monitoring ensures that non-performing incubatees are removed as quickly as it can be established that the probability of their viability is slim.

A list of sources of value is provided below:

Internal (Campbell et al, 1985):

1. selecting and monitoring of application of business services;
2. diagnosis of business needs;
3. provision of financing; and
4. provision of access to the incubator's network.

External (Smilor (1987; Smilor and Gill (1987):

1. development of credibility;
2. shortening of the entrepreneurial learning curve;
3. quicker solutions of problems; and
4. access to an entrepreneurial network

Other (Hisrich (1988):

1. design the incubator to suit local culture;
2. having a highly placed champion to promote it;
3. educating public and private sector leaders

6.1. Value added activities in the questionnaire

Value added activities are captured in several questions, but the principal functions that contribute to the incubator's unique role are contained in Q4 and Q6.1. Data on the number of proposals received by an incubator (Q4.1) and approvals (Q4.2) provides insights into due diligence performed by them in screening in needy but promising ventures. Also of interest for analysis in the future would be the breakdown of rejected applicants, by reason, specifically

- those that did not appear to have sufficient merit to succeed; and
- those that had good prospects but did not require incubation.

Once, the candidates enter the incubator, the process of monitoring their needs and progress takes over. This is captured in several questions notably Q6.1 pertaining to the number of graduates, of incubatees merged or bought out, and of incubatees asked to leave before the incubation term is up. The latter is subject to conflicting interpretations: it indicates flaws in the screening process, but it also reflects the effectiveness of monitoring activities in detecting incubatees not showing sufficient progress and terminating their incubation period before the full term, without incurring further investment of resources. On the whole, the gating system works and adds value.

7. How incubators select candidates

If identifying weak but promising start-ups and helping them is one of the most critical functions of an incubator, then how it evaluates hundreds of proposals and chooses a few. How does it ensure that any promising but needy applicants have not been screened out or any 'ineligible' applicants have not been selected? Although screening criteria have received more attention in the literature than most of the other individual components of the incubation process, these questions continue to be debated.

Two methodologies have been developed. Lumpkin and Ireland (1988) employ cluster analysis to identify critical factors, while the U.S. Department of Commerce has developed constraint analysis for this purpose.

The U.S. Department of Commerce has developed screening tools and computer simulation models that aid in the identification of new ventures with a high probability of achieving commercial success. These tools go through a three-stage process which seeks to determine first the attractiveness of the business a venture intends to enter, then the fit between the applicant and the business, and finally whether incubation is the best way to proceed. The following is a brief description, based on Merrifield (1987).

The analysis is grounded in three questions:

1. Is this a good business?
2. If yes, does the applicant have the competence to engage in it?
3. Is incubation the most appropriate way to pursue it?

Attractiveness of business is evaluated on six factors, which cover:

- i. sales and profit potential;
- ii. regulatory and social constraints, e.g. antitrust, environmental;
- iii. growth potential of the business;
- iv. competitive environment, including proprietary technologies and patents, rate of product and technological obsolescence, monopolies, etc.;

- v. risk distribution by ensuring sufficient differentiation among selected candidates to pre-empt cannibalization among them; and finally
- vi. the scope of opportunities offered by industry to segment the market or create new markets.

If the applicant scores a specified score on business attractiveness, it is then tested for the fit, which covers the following:

- i. sufficient capital to fully exploit the opportunity;
- ii. competence to meet the growth potential of the market;
- iii. sufficient marketing and distribution competence to provide market penetration within the expected product life cycle;
- iv. sufficient technology base to provide customer service, product improvement and diversification;
- v. material availability; and
- vi. supportive top management.

The third and final question is meant for the incubator and it is to decide on the best strategy for the applicant to launch the venture. Is incubation the best route to take or would other methods of entry such as a joint venture be more appropriate?

Neither Lumpkin and Ireland (1988) nor Merrifield (1987) links the analysis to incubation outcomes to evaluate the effectiveness of their methods in helping incubators reach the right decisions.

8. Performance measures

While considerable progress was made in delineating and categorizing incubators, study of the characteristics of a successful incubator lagged. There continued to be no model for benchmarking an incubator's effectiveness (Mian, 1997; NBIA, 1993; Campbell et al, 1988). However, Campbell and Allen (1987) proposed the criteria by which to analyze the performance of an incubator. These included the following:

- creation of a responsive business consulting network;
- participation of financial intermediaries in incubatee capitalization;
- the point at which a majority of the residents of an incubator are start-up firms; and
- synergies, e.g. incubatees doing business with one another such as subcontracting and joint purchasing.

The earliest attempts to evaluate the performance of incubators had three features. They typically related to inputs; diverging from the evaluation criteria proposed by the earlier writers such as Campbell and Allen (1987), they analyzed incubators from the perspective of the incubatees; and they were economic and financial in nature. Mian (1996) studied incubatees' perception of the usefulness of specific inputs, including the incubator's image, laboratories and equipment, and technology transfer programs. As the choice of inputs included in his study suggest, the focus of his attention was on university-sponsored incubators. In other studies, Mian and other researchers added growth-related measures pertaining to the incubator (rentable space, employment, number of incubatees and graduates), and the performance of incubatees (survival rates, sales, etc.)

Earlier studies were constrained by the lack of relevant data. They had to rely on incomplete data or make use of proxies. Consequently, their findings were either inconclusive or questioned.

These studies tended to look upon incubators as either an economic development tool or a means of commercializing new ideas, and they had the underlying assumption that provision of appropriate amounts of inputs would satisfy the demand. But researchers studying incubators from a management and organizational point of view argued that while the variety and quantities were necessary metrics for benchmark analysis, the efficiency and effectiveness with which they were delivered would also matter in the performance of the incubator and the success of incubatees (Yasin, 2002). Therefore, it was necessary to understand why and how an incubator is successful (Bhabra-Remedios and Cornelius, 2003).

Consequently, performance measures derived from organization and management were added. It meant that the contribution of an incubator to entrepreneurship and the economy in the form of graduates and jobs was important, goals-related metrics were needed to compare inter-firm efficiency and get a better sense of factors responsible for success. However, such comparisons would be restricted to incubators pursuing similar goals or, in other words, generally confined to a particular business model. As Table 2 shows, each of the four business models pursues different objectives. Further, there can be variations in objectives among incubators pursuing the same business model.

The system approach is advanced to compensate for problems in the goal-based approach by considering the simultaneous achievement of multiple generic performance aspects. But, this fails to adequately provide an effective performance framework for analyzing organizations (Murphy, 1996, p. 16)

As statistical analysis of the performance of incubators is still in its early stages, a number of suggestions are available in the literature that can increase the chances of an incubator's success. These include:

- establishment of an advisory board with an expertise and sophisticated understanding of the market and in the process of venture formation;
- managing uncertainty associated with rental income because of the incubatee turnover. Pre-screened incubatees should be waiting in the admission pipeline prior to the departure of the current tenants in order to optimize rental income;
- developing and offering a comprehensive menu of support services even if some services are under-utilized in order to "induce 'self-reflexitive considerations' on the part of incubatees as to what is required for their new venture to develop" (Hackett and Dilts, 2004); and
- learning from the qualitative difference between applicants and candidates selected for admission.

8.1. Output metrics in the questionnaire

Nearly all of the performance indicators are economic or financial in nature. Most of these are enumerated in Q6 under the heading of 'Impact', but a good number of them are also found in Q4 under the heading 'Clients and activities'. In addition to measuring the impact, some of these questions provide insights into the degree of credibility some of the incubatees have established in money and equity markets.

In the future, additional information on goals-related performance evaluation can be conveniently added by relating impacts (Q6) to objectives (Q3.1), subject, of course, to the response burden constraint. For example, if the stated objective of an incubator is to retain businesses in the community, then a relevant performance-related metric would be the number of graduates that stayed in the community.

Incubatee perspective on the quality of service received from the incubator and their business success since leaving the incubator is another approach to performance evaluation. Information on the practice among incubators of gathering formal incubatee feedback would also enhance the analysis.

9. Concluding remarks

The research in business incubation has tended to be descriptive and focused on the individual components of the process. A complete evaluation framework that links these various elements, explains how an organization develops within the protected environment of an incubator, and allows for benchmarking outcomes has received little, if any, attention. Second, we know less about incubatees than incubators. This is, in part, due to the fact, that incubatees are discussed as part of the entrepreneurship literature without distinguishing them from other small enterprises. Partly, it reflects the difficulty of gathering statistical information on them through surveys.

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