Incubating Success.

Incubation Best Practices That Lead to Successful New Ventures

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Incubating Success: Incubation Best Practices That Lead to Successful New Ventures
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Institute for Research on Labor, Employment, and the Economy, University of Michigan, Ann Arbor, Michigan
Printed in the United States of America

I. ACKNOWLEDGMENTS

This project was funded by a grant from the U.S. Department of Commerce Economic Development Administration (EDA). Special thanks to the EDA staff that contributed to the project:

- John Fernandez, Assistant Secretary of Commerce for Economic Development
- Bryan Borlik, Director of Performance and National Programs, Economic Development Administration
- Hillary Sherman-Zelenka, Program Analyst, Economic Development Administration

A special acknowledgment is due to the National Business Incubation Association (NBIA) for invaluable assistance in developing the project survey instrument, for providing contact information for business incubators in the U.S., and for sharing knowledge of the incubator industry to benefit the project. Thank you to those from NBIA who significantly contributed to the project:

- David Monkman, President & CEO, NBIA
- Tracy Kitts, Vice President & Chief Operating Officer, NBIA
- Dinah Adkins, Former President & CEO, NBIA

The project research team expresses its gratitude to the Peer Review Panel, which provided valuable input throughout the project, particularly during the research methodology and design development. The Peer Review Panel was comprised of Mark Rice, Worcester Polytechnic Institute (formerly with Babson College); David Dilts, Oregon Health and Science University; George Fulton, University of Michigan; Sean Hackett, Drexel University; Thomas Lyons, Baruch University; and Susan Matlock, Innovation Depot.

The research team is also grateful to Robert Groves of the University of Michigan Institute for Social Research, who provided review of the research design, survey development, and analytic methods.

The research team offers a special thanks to the administrative staff of the University of Michigan, the National Business Incubation Association, the University at Albany – State University of New York, and Cybergroup, Inc., who assisted with the project each day.

We're also grateful to the incubator managers and companies who helped to develop the survey instruments. Our final round of thanks goes to those who took time to respond to the survey, for their generous participation has made this entire project possible.

Special Thanks and Acknowledgment

Greg Bean, Cybergroup, Inc.
Carmen Wells Quigg, Project Manager, University of Michigan
Eileen Quintero, Research Associate, University of Michigan
Catherine Laurion, Research Associate, University of Michigan
John Westenberg, Graduate Student Researcher, University at Albany, SUNY
Niki Vick, Business Administrator, University of Michigan
Kimberly Reid, Administrative Assistant, University of Michigan

The researchers and authors of the report owe a debt of gratitude to the staff of research associates and University of Michigan graduate and undergraduate students who contributed to this work. For a complete listing of these students, please see the online appendix at http://EDAincubatortool.org.

II. EXECUTIVE SUMMARY

Overview

With the help of targeted business assistance, entrepreneurs are better prepared to turn business ideas into successful new ventures that have a greater-than-average chance of success. Since the first business incubator opened in Batavia, N.Y., in 1959, *business incubation programs*[1] have helped new business owners access the resources and assistance they need to grow successful firms. For more than 50 years, these programs have played an important role in improving struggling economies, creating jobs, and encouraging innovation.

Business incubation programs are designed to accelerate the successful development of entrepreneurial companies through an array of business support resources and services, developed or orchestrated by the *incubation program manager*, and offered both in the incubator and through its network of contacts. A business incubation program's main goal is to produce successful firms that will leave the program financially viable and freestanding. Critical to the definition of an incubator is the provision of management guidance, technical assistance, and consulting tailored to the needs of new enterprises.

The U.S. Department of Commerce Economic Development Administration (EDA), a longtime financial supporter of business incubators, funded this research study to examine the relationship between incubator best practices and client outcomes. This research – conducted by the University of Michigan's Institute for Research on Labor, Employment and the Economy; the State University of New York at Albany, the National Business Incubation Association, and Cybergroup Inc. – used a robust methodology to collect and statistically analyze data, and determine specific relationships between how an incubation program operates and how its *client companies* perform, as measured by a number of outcomes. The purpose of this study is to test whether there is a causal relationship between business incubation practices and client firm success, particularly after these firms have moved out of – or graduated from – the incubation program. Using the results of this study, the research team also created a Web-based tool for incubation practitioners that measures their program's performance compared with industry best practices and provides feedback about how they can improve their performance (see http:// EDAincubatortool.org).

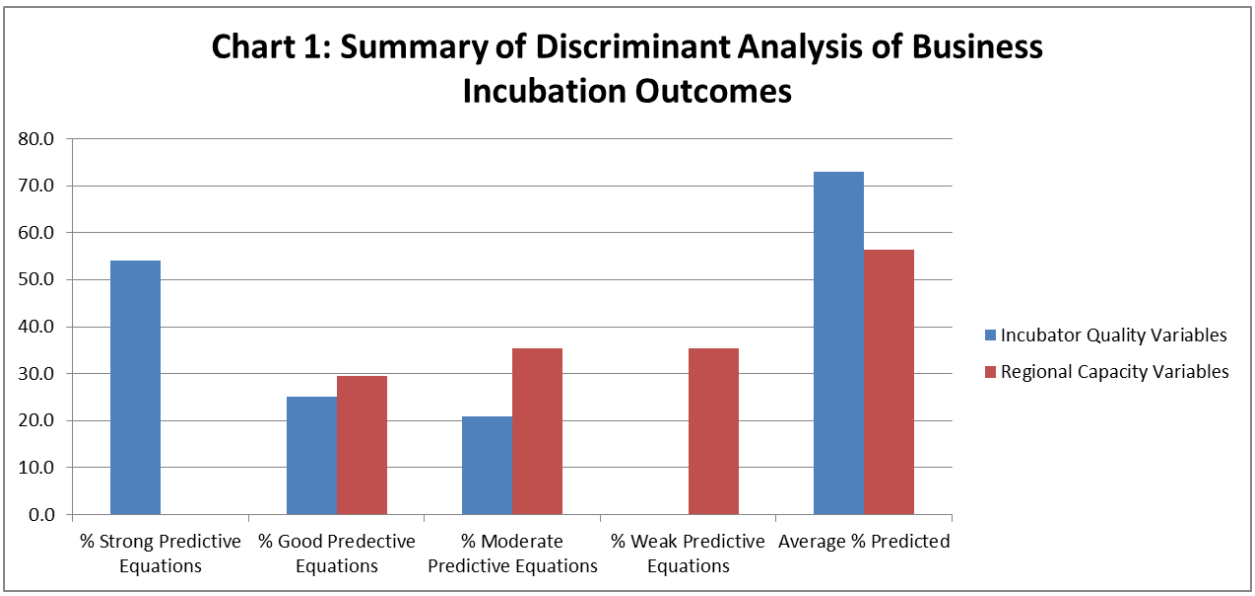
Although other industry studies have examined business incubation best practices and trends, this work is one of the first to employ a rigorous methodology to ensure that the surveyed programs meet a minimum threshold of what an incubator is (and is not). To be included in this

[1] Words and phrases printed in italic are defined in the glossary, which begins on page 107 of this report.

study, incubation programs had to have correct and verified contact information, to have been in operation at least five years, to target start-up firms, and to offer at least five commonly provided incubator services, such as help with business basics, networking activities among incubation program clients, marketing assistance, help with accounting or financial management, access to capital, or linkages to higher education resources and/or strategic partners.

The research team invited 376 incubator managers whose programs met the study's definition of an incubator to complete an online survey. At the completion of the six-month survey period, the research team had received 116 responses, of which 111 were valid, yielding a 29.5% effective response rate. The respondents were representative of the geographic distribution of business incubation programs throughout the United States and across incubator industry sectors. This study substantially extends industry knowledge of the predictive power of incubator practices on firm success. Further, many predictive models based on incubation program attributes were highly accurate in predicting program success (up to 80%).

The analysis of both the qualitative and empirical data point to the same conclusion: Business incubation practices matter more than program age or size or the host region's capacity for innovation and entrepreneurship when it comes to incubator success (see Chart 1). Aggregating the findings from the discriminant analysis of 24 business incubation program outcome variables indicates that, on average, incubator program quality variables predicted 72.9% of the outcomes correctly, compared with 56.3% predicted by regional capacity variables. Furthermore, 79.2% of discriminant analysis equations of incubator outcomes that used only incubator quality variables to predict the outcome have either good or strong predictive power. The discriminant analysis of the regional capacity variables reveals that host region characteristics are weaker predictors of business incubation program success.



By building on existing knowledge about business incubation, identifying best practices in a range of incubation activities, and providing an evaluation tool for incubation practitioners, this study provides valuable information and recommendations for policymakers at the federal, state, and regional levels. With fundamental transitions occurring in the U.S. economy, government officials and others recognize that the new economy must feature innovation, entrepreneurship, technology commercialization, new venture creation, and business incubation and acceleration as fundamental elements. While there is no one solution for overall economic development, the findings from this study suggest that business incubation positively influences entrepreneurial success. In that regard, this study provides a reliable overview of the positive impacts that well-developed and well-operated business incubation programs can have on their communities, which can serve as a guide to industry leaders and policymakers in the coming years.

The remainder of the Executive Summary highlights key findings of the research and summarizes policy recommendations based on the industry best practices identified through survey research and data collection and analysis.

Key Findings

1) **No one incubator practice, policy, or service is guaranteed to produce incubation program success. Instead, it's the synergy among multiple practices, policies, and services that produce optimal outcomes.** In other words, there is no "magic bullet." As previous research has demonstrated, the needs of incubator clients vary depending on their level of development, industry sector, and management skills. The communities served by incubators differ in terms of capacity, and *sponsors* (see "primary sponsor") vary in resources, mission, and requirements. Thus, it's the relationship between helpful policies and services that matter most to incubator success.

2) **Top-performing incubation programs often share common management practices.** Practices most represented among high-achieving programs are having a written mission statement, selecting clients based on cultural fit, selecting clients based on potential for success, reviewing client needs at entry, showcasing clients to the community and potential funders, and having a robust payment plan for rents and service fees. All of these practices are highly correlated with client success. Conversely, incubation programs with lax or no exit policies typically have less-than-optimal performance.

3) **Incubator advisory board composition matters.** Having an incubator *graduate firm* and a technology transfer specialist on an incubator's *advisory board* correlates with many measures of success. Additionally, accounting, intellectual property (patent assistance), and general legal expertise on the incubator board often result in better-

performing programs. This study found that government and economic development agency representatives also play key roles in enhanced client firm performance, as their presence ensures that the incubator is embedded in the community, which is necessary for its success. Local government and economic development officials also help educate critical funding sources about the incubation program and its successes.

4) **Neither the size of an incubator facility nor the age of a program is a strong predictor of client firm success.** Many incubator funders and practitioners perceive that the size and age of an incubator are key determinants of success. However, this research underscores that it is the incubator's programming and management that matter most. For example, staff-to-client ratios are strongly correlated to client firm performance.

5) **High-achieving incubators collect client outcome data more often and for longer periods of time than their peers.** Overall, two-thirds of top-performing incubators (66.7%) collect outcome data. More than half collect this information for two or more years, while slightly over 30% collect data for five or more years. Collected data include client and graduate firm revenues and employment, firm graduation and survival rates, and information on the success of specific program activities and services. This finding could suggest that collecting outcome data demonstrates a positive return on investment and ensures continued program funding, leading to a situation in which success breeds success. It could also mean that incubation programs with the capacity to collect outcome data also have to resources to implement best practices covering the array of management practices and services that lead to client firm success.

6) **Most high-achieving incubators are not-for-profit models.** All but one of the top-performing incubators in this study were nonprofits, as were 93% of the respondent population. This finding suggests that incubation programs focused on earning profits are not strongly correlated to client success. Instead, the most important goals of top-performing incubation programs are creating jobs and fostering the entrepreneurial climate in the community, followed by diversifying the local economy, building or accelerating new industries and businesses, and attracting or retaining businesses to the host region.

7) **Public sector support also contributes to program success.** Only three of the top-performing incubation programs in this study operate without public sector support from local government agencies, economic development groups, colleges or universities, or other incubator sponsors. On average, nearly 60% of an incubator's budget is accounted for by client rent and service fees. Thus, this research suggests that some level of public sector investment contributes to greater incubator outcomes in terms of job creation, graduation rates, etc.

8) **Incubation programs with larger budgets (both revenues and expenditures) typically outperform incubators with budget constraints.** Programs with more financial resources have more capacity to deliver critical client services and are more stable. However, the sources of incubation program revenues and the ways the incubator uses these resources also are important. This study found that incubators receiving a larger portion of revenues from rent and service fees perform better than other programs. On the expenditure side, the more programs invest in staffing and program delivery – relative to building maintenance or debt servicing – the higher the probability of improved client outcomes.

9) **All measures of the growth or size of a host region's economy are poor predictors of incubation program outcomes.** Incubator management practices are better predictors of incubator performance than the size or growth of the region's employment or GDP. Only the aggregate host region employment in 2007 was a strong predictor of any incubator outcome – change in *affiliate* firm FTE from 2003 to 2008.

10) **Collectively, measures of a region's capacity to support entrepreneurship have limited effect on incubation program outcomes.** Compared with incubator quality variables, regional capacity variables have less predictive power. Among the regional capacity measures studied, only the proxies for urbanization, work force skills, availability of locally controlled capital, and higher educational attainment have moderate influence on incubator client outcomes.

11) **The findings provide empirical evidence that business incubation best practices are positively correlated to incubator success.** Specifically, practices related to the composition of advisory boards, hiring qualified staffs that spend sufficient time with clients, and tracking incubator outcomes result in more successful incubation programs, clients, and graduates.

Policy Recommendations

The empirical analysis presented in this report – coupled with previous research about the business incubation industry and practical knowledge of business incubator operations – can provide important information for policymakers, incubator funders, and the incubation community itself. The policy recommendations presented in this section are interdependent and targeted at two audiences: policymakers and funders interested in maximizing the results of public investments in business incubation programs, and incubation practitioners looking to start a new incubator or review an existing program and their governing boards.

Recommendations for Policymakers

- Incubation programs that receive public funding should be required to implement industry best practices. Additionally, *stakeholders* (see "primary stakeholders") should ensure that the incubators have the money they need to provide the entrepreneurial support services demonstrated to catalyze client success. Although most incubators aim to maximize the amount of money they bring in through client rent and service fees, many continue to need subsidies to help fund their operations. Of the top-performing incubation programs identified in this study, five reported operating subsidies that exceeded 53% of their revenue stream. In fact, only three of the top-performing programs in this study do not receive operating subsidies. To keep costs down, incubation programs can leverage existing institutional resources, such as Small Business Development Centers or higher education institutions, for the delivery of critical services. For example, an incubator could partner with a business school in the region to bring in graduate students to help with market research for clients or require that firms attend specific training sessions offered by the local SBDC.

- Funding agencies should require publicly funded incubation programs to collect outcome data to monitor the impact of public investments. Some recommended measures include jobs created by incubator clients and graduates, client and graduate revenues, annual number of graduates, survival rate of graduate firms, and retention of graduates in the incubator's host region. Tracking these figures over time can ensure that the incubator is accomplishing its goals of helping to build successful firms that create jobs, spark economic growth, etc.

- External, independent evaluators should conduct periodic assessments of business incubation programs receiving public support. Outcome evaluations need to control for the age of the program and the client base that is served.

- A nationwide database of incubation programs, which validates that each program meets the minimum criteria used in this study, should be further developed and maintained. The data set – which should be made available online for public use – should include incubation program characteristics, as well as area(s) of expertise. To encourage incubators to provide current information for the database, public funding agencies could tie incubator funding to registration. For example, to receive public funding, incubation programs could be required to complete a short survey that covers incubator demographics (e.g., incubator size, age, etc.) and program attributes that help ensure the entity is indeed an incubator (e.g., works with early-stage companies, has set entrance and exit criteria, provides key business assistance services, etc.).

- Programs receiving public support should be required to submit annual reports to their public funding source, so funders can monitor progress toward funding goals. These reports should include periodic independent audits of program budgets. By reviewing this data annually, public agencies could continually evaluate public investments in business incubators, ensure that funded programs are implementing best practices known to contribute to program and client success, and identify new industry trends that could affect program performance.

- Once incubation programs that receive public support are collecting adequate data and implementing industry best practices, other complementary policies should be considered. Such complementary policies may include providing seed funding for clients, creating appropriate graduate space, offering tax credits for client firms, conducting competitions for top incubation programs and incubator clients (by type), supporting the development of a business service provider network, and encouraging higher education institutions to support business incubation programs.

Recommendations for Incubation Practitioners

- Incubation advisory boards should include diverse expertise. These boards can help develop quality business assistance services for the incubation program, embed the program in the broader community, market the incubator, and provide effective program oversight. The evidence in this study suggests that advisory boards should have between 8 and 20 individuals and include the following types of professionals: (1) graduate firm; (2) *experienced entrepreneur*; (3) local economic development official; (4) corporate executive; (5) representative of the finance community; (6) business lawyer (and, in some cases, intellectual capital protection legal assistance); (7) university official; and (8) chamber of commerce representative. Other expertise that can play an important role in an incubation program – but that vary by incubator type and other local conditions – are marketing professional, production engineering specialist, local elected official, state economic development official, tech transfer specialist, incubator manager, and real estate manager/developer.

- Incubator management and stakeholders should review the current array of services provided through the incubation program and assess the effectiveness of those services periodically. Services that are statistically significantly related to client firm performance include: (1) providing entrepreneurial training (from business basics to comprehensive training in managing a new enterprise); (2) offering increased access to investment capital; (3) securing strong supportive relationships with local area higher education institution(s); (4) providing production assistance (from R&D and prototyping through to engineering production systems); and (5) developing strong mentor programs (e.g., shadow boards, loaned executives,

periodic engagement with incubator managers, participation in program activities). In addition, incubation programs should not overlook the obvious services needed by start-up businesses and provide high-speed broadband Internet access, shared administrative services and office equipment, and assistance with client presentation and business etiquette skills.

- As with any enterprise, having a competent staff with sufficient resources – including time – to effectively deliver key services is paramount. Staff also should implement the following management practices: (1) collecting outcome data; (2) providing *pre- and post- incubation services*; (3) conducting periodic reviews of the budget, service providers, and other program activities; (4) showcasing clients and otherwise marketing the program; and (5) developing effective entry and exit criteria for the incubator.

- Funders and incubation practitioners should evaluate incubation programs periodically through two different – though interdependent – units of analysis: outcomes and processes. Client firm performance (outcome analysis), as measured by various proxies (survival rates, jobs created, revenues, taxes paid, intellectual property created, etc.), is the first level of program evaluation. While data collection should occur at least annually, the analysis can be conducted every three to five years. Analysis of incubator processes should be conducted more frequently and cover a wide variety of systems. Services offered, advisory board composition, service providers, budgets, entry/exit criteria, and program effectiveness all should be reviewed periodically, although some more often than others. This evaluation should be linked to any public funding.

III. LITERATURE REVIEW

A. Introduction

The first U.S. business incubator opened in 1959, when Joseph Mancuso started the Batavia Industrial Center in Batavia, New York. Since that time, *business incubation programs* have emerged as successful economic development tools throughout the country and around the world. As of October 2006, approximately 1,400 business incubators operated in North America, including 1,115 in the U.S. Approximately 7,000 incubation programs are now in operation around the world.

As established through a seven-step validation process, 378 business incubation programs in the United States fit the criteria for this study (see the Survey Population section under Chapter IV: Study Design and Methods for more information on the validation process). The difference between previous industry estimates and this count most likely is the result of the more expansive definition of business incubation used in previous research, not because of a decline in the number of business incubation programs. As noted elsewhere in this report, this study included only incubation programs in operation for five years or more that met the minimum definition of what constitutes an incubator.

Through the years, analysts have separated incubators into several categories to identify and evaluate industry best practices and to evaluate outcomes. Each classification option has strengths and weaknesses in terms of organization, relevance, and the availability of reliable data. After careful consideration, the research team for this study decided to organize U.S. business incubation programs along two axes: industry segment and metropolitan region.

The National Business Incubation Association has defined the most common industry segments as: (1) *mixed-use*; (2) technology; (3) *service*; (4) *manufacturing*; and (5) other. For the purposes of this study, researchers used these categories, understanding that some incubation programs may not fit neatly into a single group.

Finally, there are debates within each segment of the business incubation industry that should be examined separately, as well as questions about the viability of incubators being financially *self-sustainable*. Other concerns relate to regional characteristics that influence the success or failure of incubation programs. In short, after the research has been divided into the above-specified categories, are there prevailing questions or trends that can be identified? Do these trends cross over business sectors and /or regional economies?

B. Trends

Much of the current literature on business incubation defines new models and, to a lesser degree, evaluates outcomes. In the mid-1980s, most research sought to define business incubators, explain how they functioned, and describe how to track the industry's trajectory. By the early 1990s, the focus shifted to identifying industry "best practices" – primarily by conducting case studies of what industry experts deemed successful business incubation programs. During this time, the current definition of business incubation emerged, focusing on programs that provide an array of entrepreneurial business services that improve *client company* outcomes.

As the end of the 1990s approached, investigators began to examine whether business incubation provides value-added contributions to client firms that lead to improved outcomes, increased job formation, and other economic benefits. After the tech-bubble burst and for-profit dot-com incubators began to fail in large numbers, many industry observers including Nash-Hoff began to question the efficacy of business incubators. However, by this point, the industry had expanded globally and two distinct streams of research began to appear, as noted by Gatewood et al. (1986) and Peterson et al. (1985).

The first of those streams of research sought to identify emerging models of business incubation programs in the U.S. and abroad. The second stream of literature sought to understand the growth of business incubation across the globe. Researchers focusing on business incubation in the international context have begun to conduct cross-national studies, although the lack of reliable data, varied definitions of success, and diverse definitions of business incubation across national boundaries have significantly impeded empirical evaluation. Because of the vast differences in national economic structures and central government involvement – and the fact that cross-national research data is often both unreliable and incompatible – the international literature on business incubation is not central to our analysis.

C. Road Map

To provide a foundation and common language from which to examine the research, the research team began its review of relevant literature with defining and categorizing business incubation. The team then explored recent incubation industry trends. Because there is little academic research on these new trends, most evidence in this area is qualitative and anecdotal evidence.

The research team analyzed the literature on business incubation with four lenses to organize the large body of work: (1) sectoral focus; (2) organizational framework; (3) incubation model; and (4) locational factors. The last section highlights which business incubation practices have been linked to more successful outcomes for both the incubation program and its clients. This

section ends with an examination of the remaining questions and an explanation of how the analysis has shaped the project's research methods, survey instruments, and toolkit development.

D. Defining an Incubator

This literature review begins with a look at definitions for key terms to provide a degree of consistency with other studies. Some industry terms are used interchangeably, which might cause some confusion; others are relatively new to the lexicon. Moreover, the categories the research team used to filter incubators may not be fully understood by the average reader, so efforts have been made to make the definitions clear.

Definitions

Business incubation programs are designed to accelerate the successful development of entrepreneurial companies through an array of business support resources and services, developed or orchestrated by incubator management, and offered both in the incubator and through its network of contacts. A business incubation program's main goal is to produce successful firms that will leave the program financially viable and freestanding. Critical to the definition of an incubator is the provision of management guidance, technical assistance, and consulting tailored to young, growing companies.

In the practitioner's lexicon, "business incubation program" and "business incubator" often are used synonymously. However, the research team for this project defined a business incubator as a multitenant facility with on-site management that directs a business incubation program, as defined above. Business incubation programs usually provide clients access to appropriate rental space and flexible leases, shared basic business services and equipment, technology support services, and assistance in obtaining the financing necessary for company growth. Business incubation programs may also provide business assistance services for nontenant clients, also referred to as *virtual* or *affiliate clients*.

E. Prominent Business Incubation Models

For convenience, some researchers have divided incubators into four types: with walls, without walls (also called virtual incubators), international incubators, and accelerators. This typology distinguishes between business incubation models, although research has yet to provide a clear definition of an accelerator or international business incubator or to provide any empirical evaluation of these two models. The burgeoning body of research on business incubation from researchers such as Clarysse et al. (2005); Bøllingtoft and Ulhøi (2005); Lewis (2001); and Sherman (1999) has suggested programmatic and outcome differences between traditional business incubation programs, as defined above, and business incubators without walls/virtual business incubators.

With walls

An incubator with walls is a business incubation program with a multitenant *business incubator facility* and on-site management. Although an incubator with walls offers entrepreneurs space in which to operate their businesses, the focus of the program remains on the business assistance services provided to the start-ups, not on the building itself.

Virtual incubation

Incubators without walls and virtual business incubators are synonymous terms. Essentially, they are business incubators that do not offer on-site space for clients, although they may have a central office to coordinate services, house the management staff, meet with clients, and perhaps even provide conference rooms for clients. Virtual incubators may or may not be located in the same geographic area as their client companies, since a virtual presence is what defines an incubator without walls.

Virtual incubation programs tend to be less expensive to operate than traditional business incubators that have additional expenses related to the operation and management of a physical plant. In rural areas – where the client base is often spread out over large areas, making commutes difficult – virtual incubation may be a good alternative. Also, some entrepreneurs prefer not to locate in an incubator facility because they already have established offices elsewhere or need access to specialized equipment or facilities not present in the incubator. For these firms, virtual incubation or participation in an affiliate program at an incubation program with walls is a better option.

One significant challenge of virtual incubation is encouraging networking among clients. Having strong networks provides an environment that facilitates peer-to-peer learning, mutual support, and potential collaboration, as well as camaraderie – all of which are critical to client success. In addition, having clients located in close proximity within the incubator facility makes it easier for the incubator staff to deliver entrepreneurial support services. Some have compared virtual incubation with well-operated Small Business Development Centers. As with incubators with walls, virtual business incubation programs also face significant funding challenges.

International

Recently, a new form of business incubation program has emerged, which focuses on helping foreign firms enter the U.S. market. These international business incubators provide the same set of entrepreneurial services as a typical incubator, but they concentrate on providing a "soft landing" for international firms that want to access U.S. markets, partner with U.S. firms, or access other resources. Some specialized services offered by international incubators that are above and beyond typical business incubation services include translation services, language training, help obtaining business and driver's licenses, cultural training, immigration and visa

assistance, and housing assistance. Immigration services are often extended to trailing spouses and children, making it easier for foreign entrepreneurs to settle into their new location.

Accelerators

The business incubation industry has inspired the development of the "business accelerator." While no definitive definition of business accelerator exists in the literature, it may be broadly defined either as: (1) a late-stage incubation program, assisting entrepreneurial firms that are more mature and ready for external financing; or (2) a facility that houses a modified business incubation program designed for incubator graduates as they ease into the market. A third definition – which is both more expansive and less measurable – is similar to the virtual incubator model. Finally, some industry professionals use the terms business incubator and business accelerator interchangeably.

F. A Sectoral Typology of Business Incubation Programs

Incubator models have changed over time as the needs of communities and the overall national economic climate have evolved. The research team arrived at the categories used in this project after careful consideration, based on their relevance to the study, the number of incubators adequately described by the category, and the availability of data. Having clear definitions allows the team to compare operational and outcome differences across the different models and sectors of business incubation programs (Lewis and Frisch 2008).

For this research study, the team determined that the best way to categorize business incubators is by their industry focus, including manufacturing, mixed-use, technology, and service. A fifth category, "other," is a catch-all for the significant number of business incubation programs that do not fit neatly into the four primary categories. For example, kitchen incubators and incubation programs that focus on developing artists and craftspeople as entrepreneurs would fall into the "other" category.

Manufacturing

A manufacturing incubation program is designed to assist new enterprises primarily engaged in the manufacturing sector. Because clients typically require manufacturing space in addition to office space, manufacturing incubators tend to occupy more square footage than do other types of incubators. Generally, to be considered a manufacturing incubator, at least 50% of the client firms should be manufacturing-oriented.

Mixed-Use

A mixed-use incubator (also called general purpose incubator) is a business incubation program that fosters the growth of all kinds of companies; the businesses in a mixed-use incubator are not required to fit into any specialized niche. Companies in mixed-use incubators may include service, manufacturing, technology, and other types of firms.

Technology[2]

A technology incubator is a program that fosters the growth of companies involved in emerging technologies such as software, biotechnology, robotics, or instrumentation. At least 50% of the clients should be technology-oriented to be classified as a technology incubator.

Service

A service incubation program fosters the development of entrepreneurial firms in the service sector. Firms may range from landscapers, graphic designers, and accountants to Internet-based companies and Web development firms. An incubation program may target a segment of the service industry or a range of service-oriented firms. Again, at least 50% of the client companies should be service firms to be categorized as a service incubator.

G. Current Trends in Incubation

Growth and distribution

Business incubation is a relatively new phenomenon. The industry began in the late 1950s, experienced early-stage development in the 1980s, and grew steadily through today. Business incubation research also has evolved as the industry has grown.

In their 2004 study, Hackett and Dilts reviewed incubator research over the industry's first years and beyond. This review, which covered from the mid-1980s through the year 2000, provides insight into the primary research orientations analyzing the industry. Hackett and Dilts' study examined incubator development studies, incubator taxonomies, policy prescriptions, key findings, incubation configuration studies and frameworks, incubatee development studies, impact studies, measures of success, theories of incubation, and suggestions for further research.

Many other incubation observers have documented the industry's maturation and growing sophistication. This growth demonstrates the ability of incubation programs to adapt to a changing economic landscape, while continuing to provide services valued by entrepreneurs. Much of the success can be directly linked to public support that enables incubation programs to develop new services, enhance entrepreneurial training programs, and increase their visibility in their host communities.

The growing number of business incubators operating in North America suggests that many governments, local communities, and private investors believe that it is desirable to try to help

[2] Defining "technology firms" is a moving target, as there is no clear consensus among academics, economic development organizations, and/or firms about what a technology firm is and is not. The definition can be as simplistic as "you know it when you see it." For start-up firms, this definition has merit, as the North American Industrial Classification System and other measures fail to capture emerging firms (and new technologies). Other definitions use various metrics to define technology firms, such as the percentage of sales invested in R&D or the percentage of workers in particular occupational categories. For a more detailed discussion, see Lewis (2002) pages 65-67.

"weak-but-promising" firms to avoid failure by incubating them until they have developed self-sustaining business structures, according to Hackett and Dilts.

Nonprofit Incubators

This study and other research have repeatedly found that most incubators are nonprofit, operated by groups ranging from community development organizations to municipal governments seeking to create new jobs and increase local tax bases.

In the United States, the majority of business incubation programs receive start-up funding, as well as ongoing operational support and in-kind contributions. Best estimates suggest that approximately 85% of business incubation programs receive ongoing public support for their annual operating budgets (Lewis 2008). Nonprofit incubators receive the majority of this public support, but a small minority of for-profit incubators also has received some public funding.

Others: Minority Incubators

Minority incubation programs are a sub-type of incubator – sometimes called empowerment incubators – on which there is little or no research available. Minority can refer to ethnic, racial, religious, gender, disadvantaged populations, persons with disabilities, and other population subgroups.

Greene and Butler conducted a 1996 study using the minority community as the basis of the research. In this work, the authors distinguish between a "formal" business incubator and a "natural" business incubator. Formal business incubators meet certain minimum standards or criteria, such as admission requirements, on-site technical and management assistance, graduation requirements, etc. Greene and Butler's work builds on a theoretical framework identified as middleman theory, with the proposition that a minority is discriminated against by a majority; that the minority group tends to develop ventures in a group of industrial sectors; and that the minority group is characterized by solidarity among its members. The study concludes that the minority community provides many of the traditional roles of business incubation using many of the same tools.

H. Alternative Approaches to Incubation

Differences in how incubation programs operate and relate to their clients play an important role in incubation best practices. In general, incubators provide a range of services based on their client's changing requirements and needs.

In a 2005 study, Grimaldi and Grandi used two models, *Model 1* and *Model 2*, to describe differences in the way incubators operate their programs. They concluded that business incubators offer different programs and services depending on the type of clients they serve, since businesses have different objectives and requirements. Model 1 incubators focus on

reducing start-up costs for small entrepreneurial initiatives that target local markets and are more anchored to the old economy. Model 2 incubators are designed to accelerate the start of highly promising entrepreneurial initiatives that are attractive in terms of investment size. These firms often are looking for high-value services from incubation programs.

I. By Sector

Technology

Several previous research studies have found that technology incubation programs often receive the most attention – especially in regions close to higher education institutions. A 1996 study conducted for NBIA by Tornatzky et al. examined best practices, strategies, and tools from more than 50 technology incubation programs in the United States. The study examined a number of incubation practices relative to business practice, including finance and capitalization, research and technology, management, business planning, legal/regulatory, physical infrastructure, markets and products, and structure/operations. The study is primarily descriptive of the surveyed incubation programs, but it identifies recommended next steps for future incubator research in the United States.

Several previous research studies examining business incubation best practices have focused special attention on technology business incubators. In a national study conducted for NBIA in 2000, Tornatzky, Sherman, and Adkins divided incubator client outcomes into two categories: primary outcomes (employment and sales revenue growth) and secondary outcomes (obtaining financing and securing intellectual property protection). The team then analyzed how primary and secondary outcomes varied as a function of clients' technology focus or their business emphasis. This NBIA research study yielded no strong statistical relationship between incubator business assistance practices and primary outcomes, but revealed a predictive relationship between business assistance practices and secondary business outcomes – which researchers think are important precursors to the primary outcomes. Among the 79 technology incubators in the study, researchers also identified 17 best-in-class incubators based on the primary outcome criteria. After conducting qualitative interviews with the managers of these programs, Tornatzky, Sherman, and Adkins found that, in addition to providing a full array of incubator services, the majority of best-in-class programs had either linkages to research universities and laboratories, or locations in areas that had a high concentration of technology-based companies and associated business support firms.

Some technology incubators are co-located with science/technology parks. Researchers Phan, Siegel, and Wright suggested in a 2005 study that a systematic framework is needed to understand the dynamic nature of science parks and incubators and the companies located within them. These researchers also suggest that assessing the performance of science parks and incubators can be problematic. They call for a more rigorous theoretical foundation for the study of science parks and incubators and the associated dependent variable and for new research to develop a broader body of literature on the topic.

Researchers also have studied how effective business incubators are in transferring technology. A 2002 study by Phillips examined the types of technology business incubators, identified technology business incubators and their characteristics, compared technology incubators with other types of business incubators, and discussed findings relative to university-based technology business incubators. Phillips also makes note of the paucity of studies targeting technology business incubation.

Lewis' 2005 study of technology incubation supports evolutionary theory that as incubator clients mature, regional capacity matters more than the quality of the incubation program to company employment growth. The study also found that the quality of the incubation program significantly contributes to the growth of client firm employment and revenues, compensating for the lack of regional capacity. Lewis found that incubators on academic campuses with an optimal mix of *advisory board* members and experienced management are better positioned to overcome regional capacity deficiencies.

J. By Lead Organization

University / Higher Education

As the number of technology incubation programs in the United States has grown, so has interest in technology transfer and commercialization and the potential for new venture creation. In a study of the relationship between business incubation and technology transfer, Ventriss and Gurdon (2006) provide an overview of incubation in higher education, describe the economic strategy of university-based technology incubators, provide a map illustrating the linkages between *stakeholders* (see "primary stakeholders") in a technology incubation environment, and describe policy implications in the formation of technology incubation programs.

Another study of university-sponsored business incubators in the United States by Mian (1994) explores performance from several key dimensions, including organizational design, client performance, funding sources, targeted technologies, strategic operational policies, services and their value-added component, and growth of client firms. Mian's work examines these dimensions within two types of university-sponsored incubators: those that were based in state institutions and those in private institutions. The study found no significant difference in performance between the two types of programs but did find that university-sponsored technology incubators have a positive effect on client firm survival and growth, as measured by jobs and sales.

As the U.S. higher education system becomes more engaged in forming the future economy, technology transfer, new venture creation, faculty innovation, and entrepreneurship become important components of any discussion of the role colleges and universities play in economic development. In a 2005 study, Voisey, Gornall, Jones, and Thomas examined linkages between

business incubation programs and higher education institutions and the potential for improved outcomes. Their work resulted in a conceptual framework for an incubation model that was described as a "ladder of incubation" linked to higher education institutions. Through a series of case studies, they examined seven incubation programs and provided a suggested framework for developing networks and collaborations between incubator providers and stakeholders that is different from previous approaches.

In a 2004 study, Schulte suggests that universities become more entrepreneurial and encourage the entrepreneurial spirit within their students. He suggests that one way to accomplish these goals is by establishing appropriate professorships to advance an entrepreneurial culture within the institution and with graduates. The study notes that to be successful, these efforts need sufficient funding and management and leadership who are committed to the program.

Within the U.S. higher education system, community colleges are increasingly viewed as fertile ground for establishing business incubation-related curricula and programs. In 2005, McCabe described how a community college transformed an abandoned industrial facility into a business incubator, resulting in millions of dollars of revenue for the local economy. The program also has created hundreds of new jobs, millions of dollars in payroll, increased purchasing power in the region, tax benefits for local jurisdictions, increases in net asset valuation, and more new venture creation.

Hernandez-Gantes, Sorensen, and Nieri examined the potential for higher education to foster entrepreneurship in the United States in a 1996 study that surveyed business incubator managers and clients. Most of the authors' conclusions were consistent with previous business incubation research, but they did note that there was relatively less business incubation-related activity in two-year colleges, although these programs exhibited slightly more diversity in the entrepreneurial population.

For-Profit

For-profit incubators became somewhat synonymous with the dot-com boom and bust of the late 1990s. However, a careful analysis of many so-called dot-com incubators reveals that they would not have met our definition of a business incubation program because they lacked coordinated entrepreneurial business services. In addition, the business models of many for-profit dot-coms failed to consider that, on average, it takes slightly more than three years to successfully incubate a client firm – and perhaps up to six years or more for that firm to realize significant growth. However, interviews with former managers of dot-com programs suggest that their business plans speculated that clients would begin to turn a profit in 12 to 18 months – or even as few as six months. This flaw in the model most likely contributed to the rapid decline of the dot-com incubator. Thus, for the purposes of this study, the team does not consider this as a distinct model of business incubation (Nash-Hoff 1998).

State

Georgia has provided one of the better environments for new business formation and growth in the United States over the past 20 years. Research by Malizia and Winders (1999) demonstrates that rather than trying to assist young businesses directly, economic developers are advised to take an indirect approach. The study recommends that economic developers focus on community development to improve the locality's overall competitiveness and quality of life. As a result, the improved local business climate should support business expansion and attraction, as well as creation.

In a study of the Michigan incubator industry, Molnar, DePietro, and Gillette (1996) asked incubator managers about their program's practices and the characteristics of their client and *graduate firms*. The study addressed the economic impact of the state's incubators in terms of job creation, wages, and tax revenue. The study also examined actual revenue growth of graduate and client firms, as well as anticipated revenue growth, and the profitability of graduate firms and their satisfaction with incubator services. In the examination of incubator performance, the study addressed services provided to incubator clients, as well as incubator financial performance. The study also addressed survival rates of incubator graduates and their location following graduation, in terms of geographic proximity to the region in which they were incubated.

Nation

A United Nations study that examined international business incubation programs found significant variation across countries. This finding is not surprising given that the study included both developed industrial countries and less-developed nations, including those formerly part of the Soviet Union. Of course, there also are some similarities and common approaches across the population of incubators included in the study. The study provides an interesting view of various approaches to business incubation around the world in terms of guiding principles, objectives, business environments, services, structures, strengths and weaknesses, finances, customers, and legal status and regulatory legislation. The study also provides insight into many functions of incubators and different types of organizations approach business incubation.

K. Economic Development Theory

Business incubation is an important economic development tool that – when conducted in accordance with best practices and based on due diligence – can foster job creation, increase wealth creation, and serve as an important contributor to the national economy. As such, business incubation has played an important role in economic development theory. In a 1934 study, Schumpeter examined economic development theory as it relates to entrepreneurship. Schumpeter's work, which preceded the business incubation model, serves as the foundation for much of the modern literature on the subject. In this perspective, economic development is defined as changes in economic life that come from within, as opposed to forces that are

generated outside an economy. Entrepreneurial profit is considered a function of an excess of total revenue over total costs of an enterprise, a definition that can be applied to the business incubator as well as its clients and graduates.

Enterprise development is growing in popularity as an approach to community economic development. Its goals are to create wealth for owners and employees by helping entrepreneurs start and grow businesses. Previous research by Harrison and Kanter (1978); Dabson, Rist and Schweke (1996); and Lyons and Hamlin (1991) found that enterprise development is more sustainable, more cost-effective, and more attuned to community development than its sister economic development strategies of business attraction and business retention/expansion.

L. Regional Program Development

By working with local entrepreneurs, most business incubation programs target individuals with strong ties and connections to the community. Through the qualitative analysis of seven rural entrepreneurs, Jack and Anderson (2002) examined the role of community embeddedness on the creation and operation of businesses. Being socially embedded allows entrepreneurs to understand the local structure and become part of it. It also helps small business owners draw upon local resources and obtain a unique competitive advantage. The study also suggests that recognizing and realizing commercial opportunity are conditioned by the dynamics of the entrepreneur and the social structure. The social context does not always benefit the entrepreneurial process.

M. Findings

Incubation program management

A best practice incubation program should be operated as a business itself. It has a mission, goals, objectives, strategies, payroll, staff, cash flow, and most other business characteristics. The incubator, therefore, is a business that helps to create and nurture new businesses.

In a 2002 study, Rice found that the relationship between business *incubator management* and the program of support for its clients is an interdependent one, in which a type of co-production relationship is formed. In this work, Rice addresses several areas of incubator-client interaction and proposes factors that affect the variability of the impact of the co-production process. This exploration reveals the types of incubator-client interactions that lead to the most successful client outcomes. In the eight incubators Rice studied, he found that the gap between the knowledge, competencies, and resources of the incubator managers and that of their clients is generally substantial. Hence, there is significant potential for driving the flow of knowledge from the incubator manager to the entrepreneur.

In an NBIA research project conducted by Wolfe, Adkins, and Sherman in 2000, researchers examined business incubator best practices in ten major domains. These areas included comprehensive business assistance program, professional infrastructure, client capitalization

and financing, client networking, technology licensing and commercialization, university and federal laboratory linkages, facility basics, governance and staffing, client screening and graduation, and incubator evaluation. In each domain, the study provided an overview of the importance of the particular practice to incubator and company success, components of the practice, and examples of the best practice in action. This study examined new data from current programs and information from NBIA award winners and incubators that have achieved national or international prominence. The publication also featured eight incubators – six in the U.S., one in Israel, and one in the United Kingdom – as case studies to represent best practice or innovative approaches in a comprehensive incubation program.

Because incubation programs select which applicants they will admit, it is important to know which factors and characteristics are the most important predictors of client success – both while within the incubation program and upon graduation. Lumpkin and Ireland (1988) conducted a study of these critical factors, through which they identified and evaluated personal characteristics of the management team, market factors, entrance requirements, incubator characteristics, and analysis techniques. The study examined the screening processes of business incubators. Overall, the study found that a high percentage of incubator managers applied specific criteria during the selection process, although entrance criteria differed somewhat across incubator types. One-half of incubators sponsored by private corporations conducted no screening, however. This group also reported relatively low incubator occupancy rates.

Business incubation performance is measured by how the client company's growth and financial performance at the time of incubator exit. Operationally, there are five mutually exclusive outcomes at the completion of the incubation process:

1. The company is surviving and growing profitably.
2. The company is surviving and growing and is on a path toward profitability.
3. The company is surviving but is not growing and is not profitable or is only marginally profitable.
4. Company operations were terminated while still in the incubator, but losses were minimized.
5. Company operations were terminated while still in the incubator, and the losses were large.

Historically, the literature has suggested that the first three outcomes are indicative of incubation success, and the last two outcomes are indicative of failure (Hackett and Dilts 2004). However, in the book *The Real Options-Driven Theory of Business Incubation*, Hackett and Dilts say that a real options perspective can be used to argue that, in addition to the first two outcomes, the fourth outcome also is a success because the cost of failure has been limited to the cost of creating the option less any remaining option value. Additionally, they

recommend that the third outcome be considered a failure: The incubation of "zombie companies" is not identified in any known incubator's mission statement.

Guided by Campbell et al.'s (1985) description of the value-added contributions of business incubators, Hackett and Dilts conducted a systematic review of the literature and fieldwork in North America and Asia. Their review identified the principal elements of the incubation process to be client selection, monitoring and assistance, and resource infusion (see Table 1 on next page).

Briefly, the model indicates that incubator clients are selected from a pool of candidates, monitored and assisted, and provided with resources during their earliest stages. Outcomes refer to the company's survival or failure when it exits the incubator. Controls include regional differences in economic dynamism, level of incubator development, and size of incubator. The model is atemporal, with arrows indicating the relationships amongst the constructs. The arrows that lie between constructs point out that we do not know whether these constructs overlap; the possibility for interaction must be depicted.

In a 1987 study, Smilor examined incubator services in terms of the incubator's performance. The study evaluated the importance of services such as business planning, marketing assistance, accounting, managerial assistance, financial advice, loans and grants, general counseling, loan packaging, and introduction to *venture capitalists*. Smilor's work also addressed important elements to consider when applying admission criteria to prospective incubator clients, including job creation, operating costs, business plan development, uniqueness of opportunity, stage of creation, local ownership, and growth potential. The study suggested incubator characteristics that relate to measures of success, including a new/attractive facility, affiliation with key institutions, experienced management, key board of directors and advisory council, a promising group of start-ups, and successful graduates.

Allen and McCluskey (1990) studied variation in the characteristics of individual incubation programs and their influence on performance. Elements studied included facility objectives, building ownership by type of management, stakeholder policies, acceptable client types, exit policy criteria, client access to business assistance, incubator size, and occupancy rates. Among the study's findings was that private incubators are less selective in admitting clients and less likely to require that firms graduate.

Table 1: Business Incubation Best Practices	
Category	
Management of the Program	
	Conduct a feasibility study before starting a program
	Develop a consensus-driven mission statement
	Establish client entry & exit criteria
	Collect outcome data
	Provide networking opportunities between client firms
	Establish effective tools to deliver support services
	Build networks with area business services providers
	Market incubators beyond the entrepreneurial community (i.e. embed the program in the fabric of the host community)
Key Entrepreneurial Support Services	
	Business plan writing and business basics
	Legal assistance, including but not limited to:
	General legal services
	Intellectual property protection
	Incorporation or other legal business structure
	Import/export requirements
	Access to capital
	Marketing assistance
	Access to broadband high-speed Internet
	Mentoring boards for clients with area business service providers
	Close ties with higher education institutions (where possible)
	Accounting and financial management services
	Networking with other entrepreneurs, particularly other clients
	Networking with area business community
	Assistance in developing presentation skills
	Assistance in developing business etiquette
Additional Key Services for Technology Business Incubation Programs	
	Technology commercialization assistance
	Access to specialized equipment and laboratories at reduced rates
	Intellectual property management assistance

Sources: Rice and Mathews (1995), Lewis (2001), Tornatzky et al. (1996), Campbell et al. (1988), Clarysse et al. (2005), Hackett and Dilts (2004), Hernadez-Gantes et al. (1995), and Lichtenstein (1992).

Notes: The management practices and entrepreneurial support services are not listed in hierarchical order. Interviews with industry experts and Lewis (2003) document that it is the synergistic combination of these factors that matters. In other words, there is no one or two silver bullet management practice or set of services that matter most.

Incubation research

Hackett and Dilts (2004) drew upon options theory to construct a theory of business incubation. Their study examined alternative theoretical foundations for the incubation process, including behavioral theories, economic theories, resource and knowledge-based views, dynamic capabilities theory, agency theory, institutional theory, structuration theory, scaffolding theory, and options theory. They concluded that options theory was best-suited to the business incubation model.

Sherman and Chappell (1998) conducted a study that used different methodologies to assess impacts of incubation programs on local communities. These methodologies included a quasi-experimental research design, macroeconomic modeling (REMI), and stakeholder analysis. Like other researchers, Sherman and Chappell concluded that it was not possible to identify a control group for purposes of the research. The study recommended establishing a national database of performance outcomes for benchmarking and encouraging the use of consistent measures throughout the industry.

Impact on economy

Sherman (1999) studied the effectiveness of interventions within business incubation programs in a study that addressed job creation, cost per job created, growth rates of client firms, and perceptions of key incubator stakeholders. His research suggested that incubator firms are more likely to survive than nonincubated firms. The study suggested that business incubation is only part of a very complex process; a wide range of support for entrepreneurship and new ventures is needed for a business incubation program to be most successful. Another key element of incubator success is that *sponsors* (see "primary sponsor") recognize the critical role that managers play in contributing to incubator client success and that managers be allowed – and even encouraged – to spend the majority of their time assisting clients.

Using stakeholder analysis and macroeconomic analysis tools in the pilot test of another study, Sherman and Chappell (1998) found that business incubators can be effective economic development tools in terms of creating jobs and helping new businesses survive and grow.

Job creation

In a study of the economic and fiscal impacts of a single business incubation program, Markley and McNamara (1995) described how an incubator can create jobs and income in a local community. The study showed that incubators help firms create linkages with other firms, both inside and outside the local economy. Their research also found that the cost of creating jobs through business incubation is competitive with costs of attracting manufacturing investment into a local community and that incubator impacts can serve communities that are not well-positioned for business attraction.

Through his 1979 research, Birch used a sample of 5.6 million businesses to examine how the behavior of individual firms causes change, with a major focus on employment growth. This work found that about 60% of all jobs in the U.S. were generated by firms with 20 or fewer employees, making small firms the major generators of new jobs – especially in slower-growing areas. The study also suggested that smaller and younger firms often produced more jobs; the job-generating power of small businesses over four years old declined substantially. While the impact on public policy and research regarding small businesses is evident, some researchers have critiqued the methodology, suggesting it over estimates the impact and importance of small businesses in the US economy (Harrison 1994).

In a 1994 book, Kirchhoff examined the role entrepreneurship plays in business formation and growth through both theoretical foundation (as a critic of the general equilibrium theory) and empirical research (which shows that small firms create most new jobs in the United States). Kirchhoff described a process through which entrepreneurs enter into the market and compete for market shares with older and established firms by producing innovative products and services. This process not only produces economic growth, but also creates and redistributes wealth, hence being called dynamic capitalism. It is an economic system characterized by "the dynamics of new, small firms forming and growing, and old, large firms declining and failing." By blending economics, business, and governmental policy, the author provides a dynamic capitalism typology to help build predictive theory and to guide government policy development. Kirchoff suggests that government leaders should focus on policies to encourage new firm formations and growth in all domestic and international markets.

Most start-ups derive from individuals seeking self-employment rather than an entrepreneurial effort to create new products, markets, or technologies, according to Bhide's 2000 work. The typical business starts small and stays small. Although two-thirds of net new jobs in the private sector have originated from small firms in the past 25 years, these jobs have emerged from only a few rapidly growing companies. There is an argument that venture capitalists fund too many start-ups by pulling inventions out of existing companies. This point raises a basic question about whether public policies should even try to favor new or transitional businesses over established corporations.

Bhide's literature says only a small proportion of new businesses – 5% to 10% – make much of a contribution to economic growth or job creation or have the potential to provide significant returns to their owners. The rest of the "marginal" microenterprises, which have a high rate of appearance and disappearance, have limited economic significance.

At the heart of *The E-Myth Revisited* (Gerber 1995) is the concept that businesses are not started by entrepreneurs. According to Gerber, technicians – people with narrowly defined skill

sets, such as plumbers, doctors, accountants, contractors, etc. – are accountable for most small business start-up activity, yet most are not adequately prepared to successfully run a business.

The formation and growth of new businesses in the United States have a substantial impact on the job creation. Since Birch's 1979 study of the impact of new and small firms on creating new jobs, researchers – including Kirchhoff (1994) and Reynolds and White (1997) – have generated a considerable body of evidence that supports Birch's conclusions that small firms are the major source of employment growth in the U.S. economy. But more recent assessments have indicated that the original focus was misplaced. In 1999, Acs, Armington, and Robb found that new firms – not necessarily small firms – are the dominant source of net job growth; there is a net job loss among older firms, whether small or large.

The Panel Study of Entrepreneurial Dynamics (PSED) looked at information about the proportion and characteristics of the adult population involved in starting new businesses, the kinds of activities nascent entrepreneurs undertake during the business start-up process, and the proportion and characteristics of the start-up efforts that become infant firms. This study suggested that a lot of energy is being devoted to creating new businesses in the United States. A 2002 study by Ruef et al. found that the average start-up team is about 1.8 people, even though over 40% are sole-proprietorships. Work by Reynolds, Carter, Gartner, and Greene (2004) found that this suggests that 10.1 million nascent entrepreneurs are attempting to put 5.6 million new firms in place.

Return on investment

A business incubator's success is strongly tied to the outcomes of its clients and graduates. The investment of funds, time, and expertise by incubator management and the technical assistance provided by professional service providers are expected to yield a return – and that return on investment is an important measure of incubator success (see Table 2 on next page).

Table 2: Public Sector Cost per Direct Job Created by Business Incubators

Author	Year	Geography	Public Sector Cost per Job
Grant Thornton	2009	National	$144 - $216
DiGiovanna and Lewis	1998	New Jersey	$3,000
Culp	1996	Georgia	$3,785
Markley and McNamara	1995	Confidential*	$6,580
Human Resource Investments	1994	Ohio	$6,609
Human Resource Investments	1994	Random	$11,353
Maryland Department of Economic & Employment Development	1990	Maryland	$3,000
Roberts et al.	1990	Iowa	$5,916

Source: Lewis, D.A. (2010). Testimony to the U.S. House of Representatives Committee on Small Business: Business Incubators as Job Creators, Wednesday, March 17, 2010. Washington, DC: U.S. House of Representatives.

Note: Dollars are expressed in current year dollars for the year of the study.

** This study used input-output modeling to estimate the impacts of one manufacturing incubator. The location of the incubator is intentionally obscured to protect the identity of participating firms that responded to a survey of all clients and graduates.*

In a study that examined maximizing the return on incubator investments, Rice and Abetti (1992) identified two groups of entrepreneurs that benefit from incubator interventions: Group I are entrepreneurs who are relatively successful in the intervention process, and Group II are those entrepreneurs who are relatively unsuccessful in the intervention process. Researchers looked at factors such as physical space, equipment, business services, networking with other client firms, and other passive forms of intervention. The study found that more experienced managers tended to see themselves as intervening more with Group I entrepreneurs than with Group II entrepreneurs, and they tended to be more conservative than their clients. Managers with less experience tended to be more focused on the political necessities of their positions and perceived much more intervention activity than their clients.

Studies that seek to measure the outcomes and impacts of business incubation programs focus generally on the economic-related value of the return on investment. In a 2001 study of technology business incubation programs in the state of Maryland, Regional Economic Studies Institute (RESI) identified shortfalls in prior analyses, including lack of a control group, failure to quantify fiscal impacts, failure to recognize linkages between incubator firms and the regional economy, and failure to use distinct methodologies to calculate the impact of different types of incubators. RESI's methodology included a survey of current incubator clients and graduate firms in Maryland. The researchers gathered data from respondent firms, including the number of employees, revenues, grants/investments, and cash purchases. The study used the econometric modeling system IMPLAN to estimate economic impacts, and used three

methodologies: survival rate differential, public works evaluation, and *equity* percentage (baseline). Findings include information on employee growth and totals in client and graduate firms, revenue totals of client and graduate firms, and, through the multiplier effect, an estimate of total economic impact of business incubators in the state.

In a study funded by the U.S. Economic Development Administration, Molnar, Grimes, et al. (1997) employed three methodologies in an attempt to establish a best practice way of determining incubator impacts. The methods included surveying companies currently or previously involved in incubation programs, surveying incubator stakeholders, and using a regional macroeconomic model (REMI). Key findings of the study include that business incubation programs help companies create many new jobs; incubation programs provide a substantial return on investment and create new jobs for a low subsidy cost ($1,109 per job); incubator companies experience very healthy growth; business incubation programs produce graduate firms with high survival rates; most incubator graduates remain in their communities; most incubator firms provide employee benefits; and EDA-funded incubators exhibit strong performance (see Table 3).

Table 3: Return on Public Investment in Business Incubation

Study	Type of Incubator(s) Studied	Geography	# in Study	ROI
RESI (2001)*	Technology	Maryland	6	$31.6 m - $151.9 m
Molnar et al. (1997)	Multiple	U.S.	4	5 to 1
Markley & McNamara (1995)	Manufacturing	Small Metro	1	1.21 to 1
Battelle (1995)	Technology	Virginia	1	7 to 1

Sources: RESI (2001), Molnar et al. (1997), Markley and McNamara (1995), and Battelle (1995).

** The figure presented here is the mid-range estimate from the RESI (2001) study.*

Graduation rates

In another study examining the role of incubators in entrepreneurial development, Rice, Peters, and Sundararajan (2004) investigated whether incubators facilitate the entrepreneurial process and, if so, how. They proposed two hypotheses – the reduction of transaction costs and the increase in learning and information – to explain how incubators affect the entrepreneurial process. With a focus on how incubator services such as infrastructure, coaching, and networks affect incubator graduation rates, researchers attempted to test the differences among three types of incubators: for-profit, nonprofit, and university-based. However, this approach was not very effective. Through in-depth interviews with incubator directors, researchers found that graduation rate is only a very rough measure of an incubator's ability to accelerate the entrepreneurial process, due to some internal management issues across incubators. In addition,

other factors, including the client selection process, will also affect outcomes such as graduation rates.

Firm survival

Businesses start and fail in the United States at an increasingly staggering rate. According to Gerber, over a million people in this country start a business each year. Statistics say that by the end of the first year, at least 40% of them will be out of business. Within five years, more than 80% of them – 800,000 – will have failed. And the bad news doesn't end there; more than 80% of the small businesses that survive the first five years fail in the second five (see Table 4 for a summary of research on incubator graduate survival rates).

Table 4: Graduate Firm Survival Rates

Study	Type of Incubator(s) Studied	Geography	Number in Study	Survival Rate
Lewis (2003)	Technology	US	147	70% - 80%
RESI (2001)*	Technology	MD	6	70%
DiGiovanna and Lewis (1998)	Technology	NJ	6	85%
Molnar et al. (1997)	All types	US	50	87%
Allen and Bazan (1990)	All types	PA	32	68%
Campbell et al. (1988)	All types	US	13	86%

Sources: Lewis (2003), RESI (2001), DiGiovanna and Lewis (1998), Molnar et al. (1997), Campbell et al. (1988), and Allen and Bazan (1990).

Note: Each study calculates the survival rate differently. The minimum standard for survival is that the graduate firm must be operating for at least one year post graduation.

** The figure presented here is the mid-range estimate from the RESI (2001) study.*

A study of the real options theoretical focus by McGrath (1999) suggests that real options reasoning allows more benefits of failure to be captured and the most egregious of its costs to be contained. The research suggests that the key issue is not avoiding failure but managing its costs by limiting exposure to the downsides while preserving access to attractive opportunities and maximizing gains. A high failure rate can even be positive, provided that the cost of failing is bounded.

Sitkin (1992) explained that one reason why failure offers benefits is because it is often easier to pinpoint why a failure has occurred than to explain a success, making failure analysis a powerful mechanism for resolving uncertainty. According to Black and Scholes (1973), scholars can begin to make systematic progress on better analytical models of entrepreneurial value creation by carefully analyzing failures.

Firm location

Several researchers have studied the relationship between business incubators and their graduates as another way to evaluate the effect of incubators (see Table 5). In a study focused on incubator organizations and entrepreneurs, Cooper (1985) examined four factors: the location of the new firm, the nature of the business of the new firm, and the type and size of incubation organizations. With a sample of 161 new and growth-oriented firms, the study found that entrepreneurs in most industry categories do not change geographic location (remaining geographically close to their incubator organizations). In most technical industries, entrepreneurs usually start businesses related to what they did before. Thus, the researcher argued that because most entrepreneurs do not move to start a business, the possibilities for high-technology start-ups may be very limited in many geographic regions. The findings of this study seem to be generally consistent with other research and suggest that incubation organizations play an important role in the founding of growth-oriented firms. However, this work also suggested that the role universities play in this process appears to be less direct than is often assumed, creating space for policy intervention.

Table 5: Retention Rate for Incubator Graduates Remaining in the Host Region

Study	Type of Incubator(s) Studied	Geography	Number in Study	Retention Rate
Lewis (2005)	Technology	US	147	70%-80%
DiGiovanna and Lewis (1998)	Technology	NJ	6	85%
Molnar et al. (1997)	All types	US	50	84%
Allen and Bazan (1990)*	All types	PA	32	76%
Campbell et al. (1988)	All types	US & Canada	13	86%

Sources: Lewis (2005); DiGiovanna and Lewis (1998); Molnar et al. (1997); Campbell et al. (1988); and Allen and Bazan (1990).

Note: Retention rate is defined as the percent of graduate firms that locate in the host MSA after leaving the incubator, except in the case of DiGiovanna and Lewis (1998).

* Allen and Bazan (1990) study population was all incubators receiving funding from the Commonwealth of Pennsylvania.

IV. STUDY DESIGN AND METHODS

This study employed responses from a national survey of business incubator managers to achieve two objectives. The first goal was to update industry knowledge on business incubation trends, practices, and outcomes. The second objective was to collect comprehensive data to allow for rigorous statistical analysis to assess factors that affect incubator success. The research team performed descriptive statistical analysis, correlation analysis, and discriminant analysis to meet these objectives.

A. Data Sources

This study employed two data sources for the analysis. The primary source of data comes came from responses submitted by business incubator managers to an online survey. Each survey record was enhanced with regional economic variables derived from secondary federal data sources, such as the U.S. Census Bureau, at the metropolitan statistical area (MSA) and county levels to allow the research team to consider how regional economic variables affect incubation outcomes.

B. Primary Data Collection

The survey was administered to the managers of the entire population of validated business incubation programs (376) (see the Survey Population section later in this chapter for more information on the validation process).

C. Survey Design

The research team began by reviewing several existing survey instruments related to business incubation practices and outcomes. The team built on these instruments by refining the relevant questions and adding additional ones as necessary to meet the objectives of this study. The group also consulted with a peer review panel of incubation experts to further refine the comprehensive survey.

The final survey instrument comprised 74 questions covering the following six broad topic areas about incubation programs: (1) demographics; (2) management, staff, and service providers; (3) clients; (4) services; (5) finances; and (6) outcomes. A copy of the final survey instrument is available online (see http:// EDAincubatortool.org). Based on our pilot study, the research team estimated that the survey would take approximately 45 minutes to complete. However, the amount of time actually required could vary tremendously, depending on the manager's knowledge of the program and the availability of the requested information.

Prior to launching the survey, the researchers conducted a pilot test to assess the instrument's clarity, user-friendliness, and online technical functionality. The population for the pilot test

included 10 former incubator managers and five managers of incubators that were less than five years old (and hence did not qualify for the survey population). The research team identified pilot study participants based on members' contacts and affiliations. Before sending out the online survey invitation, research team members contacted potential participants with a letter and a phone call. Of the 15 invited, 13 participated in the pilot survey. Based on their feedback, the team revised the draft survey instrument, which was sent to the U.S. Economic Development Administration and the peer review panel.

D. Survey Population

Prior to this study, there was no comprehensive source of data containing validated records on all of the incubation programs in the United States. Therefore, the research team had to construct an original database using multiple sources. Also, because no uniform definition and criteria for business incubation programs existed, the team had to validate each case to ensure that the programs met the established study criteria.

The largest amount of data came from a database provided by the National Business Incubation Association (NBIA). The NBIA database contained both NBIA member data and nonmember records. The team combined the NBIA data with lists of business incubation programs from the U.S. Department of Housing and Urban Development (HUD), U.S. Economic Development Administration (EDA), U.S. Department of Agriculture (USDA), Tennessee Valley Authority (TVA), and Appalachian Regional Commission (ARC). The final database of potential incubator study participants consisted of 1,171 cases (see Table 6).

Table 6: Sources for Potential Incubator Programs

	Number	Percent
NBIA	1,119	95.6%
HUD	20	1.7%
EDA	17	1.5%
USDA	8	0.7%
TVA	5	0.4%
ARC	2	0.2%
Total Potential Incubators	1,171	100.1%*

* Total does not add to 100% due to rounding.

The researchers employed a rigorous validation process to determine whether each individual case qualified for inclusion in the survey population. In order for an incubator to be validated for inclusion, it had to meet certain requirements: Contact information for the incubator manager had to be correct and verified; incubators had to be at least five years old at the time of validation and had to target start-up businesses; and incubators had to offer at least five of the following commonly provided incubator services, as listed on the next page.

1. Help with business basics
2. Networking activities among incubation program clients
3. Marketing assistance
4. Help with accounting or financial management
5. Access to capital (e.g., loans, *equity*, etc.)
6. Linkages to higher education resources
7. Linkages to strategic partners

When the validation process was complete, 376 of the 1,171 cases considered were validated as incubation programs that met the study's criteria. The original strategy was to draw a stratified random sample from the validated population, but the relatively small population size enabled the research team to survey the entire population of validated incubation programs.

The researchers experienced several challenges in validating incubation programs. The three most prominent challenges were: (1) Either the contact information and/or the incubation program characteristics could not be verified (50% of rejected cases); (2) The incubators were too young (less than five years old) (27% of rejected cases); or (3) The incubator did not meet the study's definition of business incubators (16% of rejected cases). Other reasons that programs were dropped from the population included having incomplete information or that the entity was no longer an incubator.

E. Survey Implementation

The research team began conducting the survey in December 2009 and continued through May 2010. For incubation programs that had been validated, the team sent an initial e-mail to program managers informing them that their organization had been chosen for the study and that they would receive further instructions in a few days. Two days later, the team sent a second e-mail inviting each manager to participate in the survey. The invitation included a Web link to the survey instrument and a unique username and password. The team sent two reminder e-mails to programs that had not responded. In an effort to increase the response rate, researchers raffled off a gift certificate redeemable for merchandise from the NBIA Bookstore amongst survey participants.

At each step in the process, a number of e-mails either bounced back immediately as undeliverable or generated a delayed delivery e-mail message. The research team also received a few manual responses that either included corrected contact information or expressed the manager's inability or unwillingness to participate. Members of the team researched bounce-back cases to confirm and/or correct contact information for program managers. When researchers could obtain corrected information, the team followed the same process with invitations and reminders. If researchers obtained no corrected information after exhaustive efforts, the team dropped the case from the population.

Once the original data collection process was completed, researchers examined the data to see how representative it was of the industry as a whole on two parameters: geography and incubator type. The team determined that the sample was statistically representative by incubator type. However, the research team needed additional surveys from a few regions where respondents were underrepresented relative to the survey population. A more detailed look at the survey data revealed that a number of respondents left a significant portion of the survey blank – particularly survey questions that were important for answering the study's main research questions. It was not feasible to eliminate these respondents from the analysis because it would have decreased the response rate below the target of 30%. Instead, the research team sent letters to respondents with incomplete surveys, asking them to complete their responses.

A few factors affecting the survey response are worth noting. The most prominent factor was the economy's effect on incubator survival. Data collection occurred during the greatest recession in nearly 40 years. Several of the programs contacted during the validation phase had closed down or changed their format (i.e., were no longer business incubation programs). The economic effect also meant that many incubator managers had smaller staffs, meaning they were sometimes unavailable to answer calls or perhaps did not want to devote limited staff time to survey participation.

When the data collection process was completed, the research team had 111 useable survey responses, representing a 29.5% response rate based on the number of surveys that were successfully delivered.

F. Data Analysis

Discriminant analysis is closely related to multinominal regression analysis. The dependent variable can be either binomial or ranked-ordered, and the statistical operation uses the independent variables (predictor variables) to predict which category or rank the dependent variables are in. The strength of the analysis is determined by examining four key output measures. One measure is the percentage of cases predicted accurately by the multivariate discriminant equation(s). A general rule of thumb for a three-category ranked-order independent variable (e.g., low, moderate, and high) is that below 45% is low to poor predictive power; 45% to 55% is moderate predictive power; 55% to 70% is good predictive power; and over 70% is strong predictive power.

The reliability or statistical power of the casual relationship between the independent variables and the dependent variables is determined by analyzing the Eigen values, the canonical correlation, and the Wilkes Lambda likelihood probability. Larger Eigen values indicate stronger statistical relationships. Canonical correlation ranges are interpreted as: (1) between 0.00 and 0.33 is a weak relationship; (2) between 0.33 and 0.45 a moderate relationship; (3) between 0.45 and 0.70 a strong relationship; and over 0.70 an excellent relationship. Wilkes

Lambda is a standardized likelihood probability score that measures the reliability of predictive power for discriminate equations. The lower the score, the more reliable the predictive power. A good general rule for Wilkes Lambda interpretation is that between 1.00 and 0.75 is considered poor reliability; between 0.75 and 0.50 is considered weak reliability; between 0.50 and 0.33 indicates good reliability; and below 0.33 is considered strong reliability.

The Data Analysis Process

In this study, determining the best predictor variables for the 24[3] measures of success for incubator clients was a multistage process. Detailed tables are available in the online appendices (see http:// EDAincubatortool.org).

1) The research team analyzed each independent and dependent variable's descriptive statistics to determine the suitability for further inquiry. The team based its determination on both the distribution and the sample size. Any variable with a valid sample of less than 30 was dropped from further analysis. Researchers then examined the distribution of all continuous and proportional variables to determine if the variable was normally distributed. In the case of dependent variables, all were strongly skewed right. Given the relatively small dataset, the team recoded outliers (defined as cases more than three standard deviations from the mean) to preserve as many valid cases as possible. To "normalize" the data, the researchers recoded outliers to be at the mean plus three standard deviations from the mean. The research team repeated this process for all independent variables.
2) Once suitability was determined, the team conducted a bivariate Spearman's correlation analysis. This was a three-part process: (1) correlations between the independent variables; (2) correlations between the dependent variables; and (3) correlations between the independent and dependent variables. The research team examined the relationship between independent variables to determine the degree of multicolinearity between similar predictor variables. This analysis also informed the process of building constructed variables for services offered, advisory board membership, management practices, and incubator goals.
3) Even with normalizing the dependent variables, the relatively small number of cases and the still-skewed distribution required the researchers to recode the dependent variables. The team recoded each of the 24 outcome variables into ranked-ordered variables with three categories. The cut-off points for the three categories (low=1; moderate=2; and high=3) were determined by the mean and median of their distributions. The research team ranked those below the median as

[3] The correlation and chi-square analyses both began with 31 outcome variables. The difference in the number of outcome variables used in the discriminant analysis is the result of the need for a minimum of 30 cases, which requires that each of these cases must have valid data in all the cells of the independent variables. If this is not the case, the outcome variable is dropped.

low; those between the median and the mean as moderate; and those above the mean as high. For *graduate firm* and *affiliate* firm revenues, the distribution prevented the use of the above process. Instead, researchers used histograms to provide a more equal distribution across the three categories.

4) Once the team had recorded all of the dependent variables, researchers repeated the Spearman's correlation analysis in step 2, analyzing only the independent variables' (including the newly constructed indexes') bivariate correlation to the dependent variables. The research team used this analysis to determine which independent variables had statistically significant relationships to the dependent variables.
5) The research team also conducted a chi-square analysis to test the strength of the relationship between categorical and ranked-ordered independent variables and the dependent variables.
6) Researchers analyzed the regional characteristic variables to determine suitability for analysis before conducting the discriminant tests. The team used the same process to determine if a regional characteristic was appropriate for further analysis.
7) The research team conducted the discriminant analysis in five phases:
    a. The team tested each independent variable as the sole predictor variable with every outcome measure. Researchers also tested all independent variables against each index as the sole predictor to determine which index to use based on the Eigen value (+); canonical correlation (+); and Wilkes Lambda (p smaller). For example, there are four indexes for services; the research team ran each independently to determine which to use in the general predictive model.
    b. This test was repeated for all single independent variables vs. all other independent variables as the sole predictor to determine which index to use based on the Eigen value (+); canonical correlation (+); and Wilkes Lambda (p smaller).
    c. Using the combined table, the research team selected a set of independent variables to enter in the general incubator quality model.
    d. Researchers also tested the regional characteristics as sole predictors of all dependent variables to determine which characteristics to enter into the general regional characteristics model.
    e. The team compared the results of the general models based on regional characteristics with the incubator quality model to determine which was the better predictor of client firm outcomes.
8) The final step was to analyze the regional and incubator characteristics of the top-performing incubators – the incubators with the highest aggregate or relative growth in outcomes for employment, revenues, survival rates, graduation rates, etc.

V. DATA ANALYSIS

A. Sample Bias Analysis

Following data collection, the research team tested the respondent data against the surveyed population on two critical variables: (1) geographic distribution; and (2) incubator type (i.e., mixed-use, technology, service, manufacturing, or other). Chi-square statistical tests indicated no statistically significant difference between the distribution of the population of validated incubators and the respondent group. The researchers conducted the spatial test at two scales: (1) the four broad Census-defined regions; and (2) the nine subregions in the United States, as defined by the U.S. Census Bureau. This finding, combined with an effective response rate of 29.5% (111 of 376), suggests that the respondents are a representative sample of the targeted incubator population.

Population of Business Incubators Accepting Clients for at Least Five Years

The descriptive analysis of the targeted business incubator population parallels prior research regarding size, management practices, services delivered, and other characteristics. The one area where there appears to be significant differences is in the number of clients and the average number of jobs produced by clients. The averages for the study population are somewhat lower than typically reported by incubation program managers in the National Business Incubation Association's State of the Business Incubation Industry Surveys. The most likely reason for the discrepancy is that during the process of validating incubators, the research team eliminated entities with larger client bases that did not fit the study's precise definition of a business incubation program. This study's findings are similar to those from other research that had a more rigorous definition of the target population.

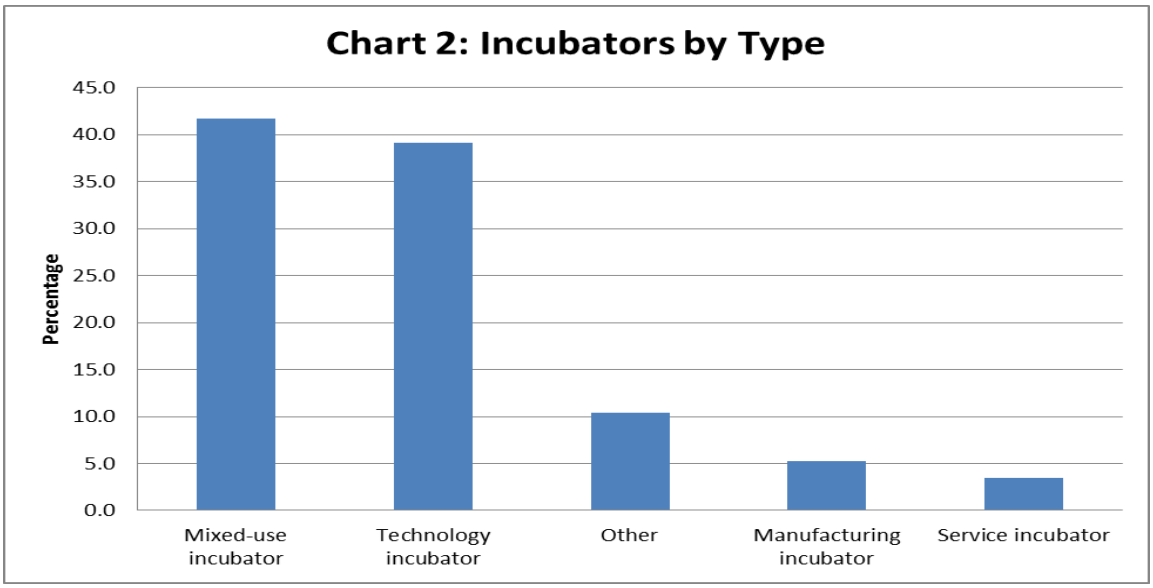
Facility Size and Age of the Target Population

This study required participating incubation programs to have been in operation for at least five years. The research team found that, on average, these programs have been operating for 15 years. The population is skewed right by one incubator that has been in operation for over 50 years. The median (13 years) and the mode (7 years) are both less than the mean, indicating that there are really two distinct groups in the study population. One is a set of pioneering incubation programs that have been operating at least 15 years; the other is a group of incubators that are younger, clustering around seven or eight years of operation.

After recoding one outlier case of over three standard deviations from the mean, (287,000 square feet), the average facility size is 32,981 square feet; incubator size ranges from 1,200 square feet to 138,000 square feet. Typically, incubators dedicate about 63% of their facilities for client firms, 15% for *anchor tenants*, and roughly 10% each to common areas and administrative offices.

Services and Management Practices

The descriptive analysis of the business incubator population holds few surprises. For example, 93% of incubators are led by not-for-profit organizations, and over 80% are either mixed-use (41.7%) or technology incubators (39.1%) (see Chart 2). Roughly 65% of incubators target entrepreneurs with a specific socio-demographic group. The largest among these are *microentrepreneurs* (23.5%) (see Chart 3). The next largest groups are college students and low-income individuals (11.3% each). Of the 44.3% of incubators that target specific industrial sectors, the most common are life sciences (45.1%), information technologies (29.4%), energy (23.5%), computer software (19.6%), medical devices (19.6%), and advanced materials (15.7%). All other industrial sectors are less than 14% (see Table 7 on the next page).



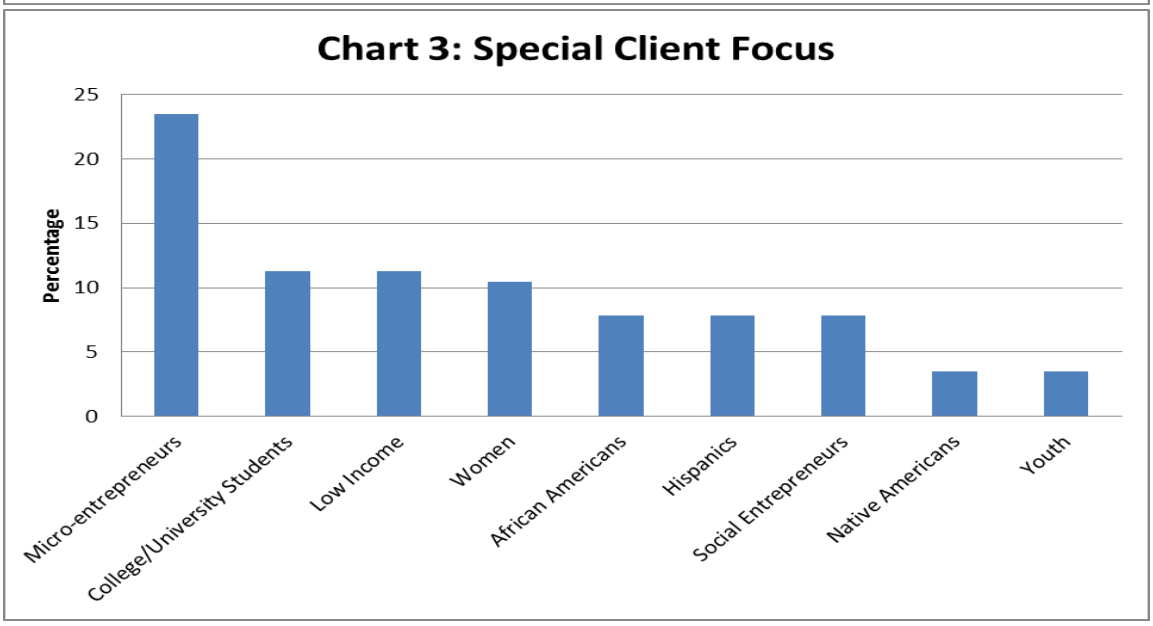
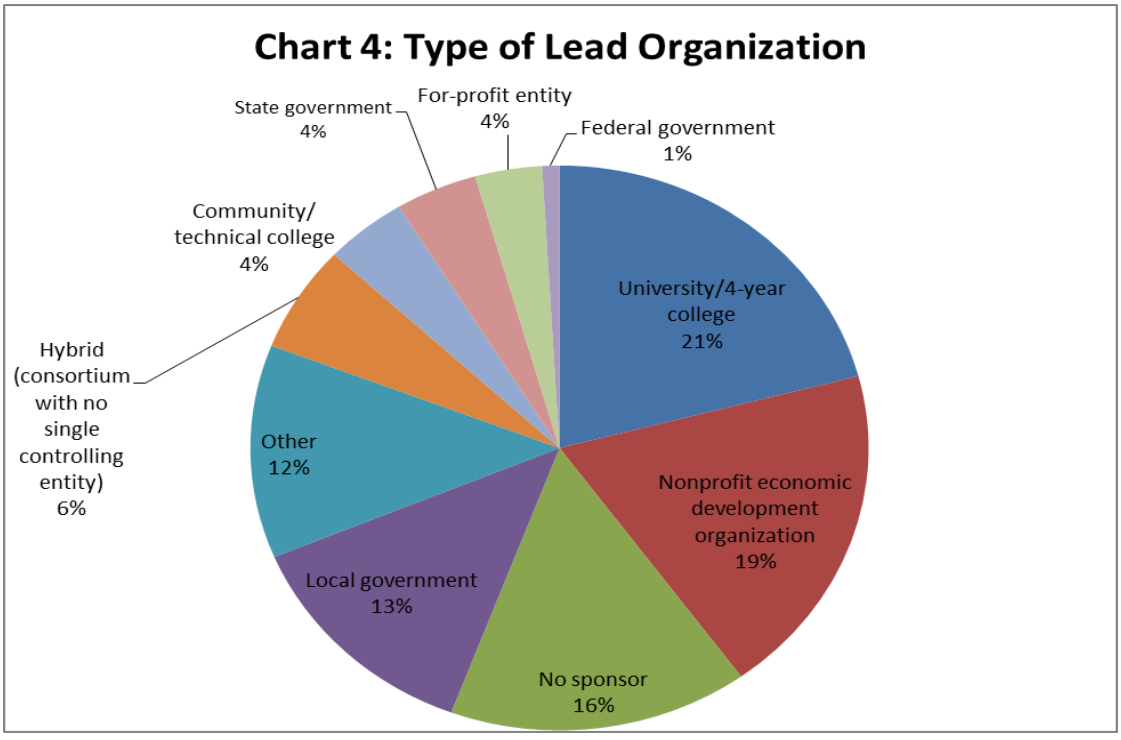


Table 7: Industrial Sectors Targeted by Incubation Programs

Category	%	Category	%
Bio-Science (Life Science)	45.1	Nonprofit Organizations	5.9
Information Technology	29.4	Retail	5.9
Energy	23.5	Telecommunications	3.9
Computer Software	19.6	Aerospace	3.9
Medical Devices	19.6	Arts	3.9
Advanced Materials	15.7	Computer Hardware	2.0
Professional Services	13.7	Wireless Technologies	2.0
Electronics/Microelectronics	11.8	Media	2.0
Health Care Technologies	11.8	Nanotechnology	2.0
Internet	9.8	Healthcare Services	2.0
Kitchen/Food	9.8	Wood/Forestry	2.0
Defense/Homeland Security	7.8	Construction	0.0
Environmental	7.8	Tourism	0.0
Bio-Science (Ag)	7.8	Fashion	0.0

The types of institutions that *sponsor* (see "primary sponsor") business incubation programs vary widely. Nearly 21% are hosted by universities or four-year colleges, while 19% are sponsored by a local economic development organization. The next closest group is local government agencies (13%), while 16% have no sponsor (see Chart 4).



Overwhelmingly, incubation programs define their primary mission as developing an entrepreneurial culture in their region and creating jobs. Also rated as important goals are building or accelerating the growth of new businesses, attracting or retaining businesses in the community, diversifying the local economy, and commercializing technologies (see Table 8). The difference in incubator goals is most likely related to the specific socio-demographic group or the industry sectors targeted by incubation programs.

Table 8: Ranked Importance of Incubator Goals*

Category	Mean
Foster an Entrepreneurial Culture	4.5
Creating Jobs	4.4
Building or Accelerating Growth of New Business/Industry	4.0
Retaining and/or Attracting Firms to Region	3.9
Diversifying Local/Regional Economy	3.9
Commercialize Technologies	3.7
Identifying Spin On/Spin Off Businesses	3.3
Generating Net Income for Sponsor	3.2
Encourage Minority and/or Women Entrepreneurs	3.0
Generating *Complementary Benefits*	2.9
Revitalize Distressed Neighborhood	2.6
Moving People from Welfare to Work	2.5
Other	3.1
Overall Mean	**3.5**

** Ranked on scale of 1 to 5, with 5 being most important*

As anticipated, the services provided by incubators vary, but there's a fair degree of consensus among managers about the services they believe are important to firm success. A few interesting findings about these services are worth noting: Basic shared office services ranked higher than average, while basic general legal counseling, e-commerce assistance, and international trade assistance ranked below average (see Table 9 on the next page).

Table 9: Importance of Services to Client Success

	Mean*	% Offered
Broadband/High-Speed Internet	4.4	97.6
Business Plan Development	4.3	100.0
Marketing Assistance	3.8	98.9
Specialized Equipment	3.7	84.7
Links to Higher Education	3.7	96.5
Accounting and Financial Management	3.6	98.8
Comprehensive Business Training Programs	3.5	96.5
Shadow Boards	3.5	91.8
Access to Venture Capitalists	3.5	91.8
Accessing Noncommercial Loan Fund	3.5	96.5
Tech Commercialization	3.4	96.5
Linkages to Strategic Partners	3.4	95.3
Accessing Commercial Loans	3.4	95.3
Intellectual Property Protection	3.3	92.9
Management Team Identification	3.3	96.5
Presentation Skills	3.3	95.3
Shared Administrative and Office Needs	3.3	96.5
In-house Investment Funds	2.9	67.1
Customer Assessment	2.9	95.3
Manufacturing Processes	2.9	85.9
E-Commerce	2.9	95.3
Regulatory Compliance	2.9	95.3
Human Resource Support/Train	2.8	97.6
General Legal Service	2.8	91.8
Federal Procurement	2.8	89.4
Product Design and Development	2.8	82.4
Business Etiquette	2.7	95.3
International Trade	2.6	84.7
Loaned Executive	2.5	77.6
Logistics Distribution Support/Train	2.5	91.8
Economic Literacy	2.5	85.9
Other	1.8	10.6
Overall Mean for Importance	**3.2**	

** Manager's rank on a scale of 1 to 5, with 5 being the most important to client firm success.*

Not all incubation programs have adopted policies that have been theorized – and in many cases empirically demonstrated – to have positive correlations with client firm success. While 93% have a means to ensure payment of rent and service fees, 80.8% have a written strategic plan, and 86.5% have a written mission statement, less than three-quarters have a written

sustainability (business) plan and only 57.7% collect graduate firm outcome data (see Tables 10 and 11). Programs that collect graduate data are fairly evenly distributed in how long they collect the data, ranging from one year to over five years. Also, less than one-quarter of incubators take an *equity* stake in client firms – 75% of those take equity in specific firms and 25% do so with all clients. Of the 74% of incubators that provide services for graduate firms, they do so, on average, for slightly less than two years (22.8 months).

Table 10: Key Incubator Management Policies

	%
Discusses alternatives to incubation (if client not meeting goals/milestones)	78.7
Regularly screens service providers	77.5
Evaluates program effectiveness	73.0
Establishes milestones and conducts follow-up	70.8
Has written marketing plan	62.9
Discusses exit and graduation strategies regularly	59.6

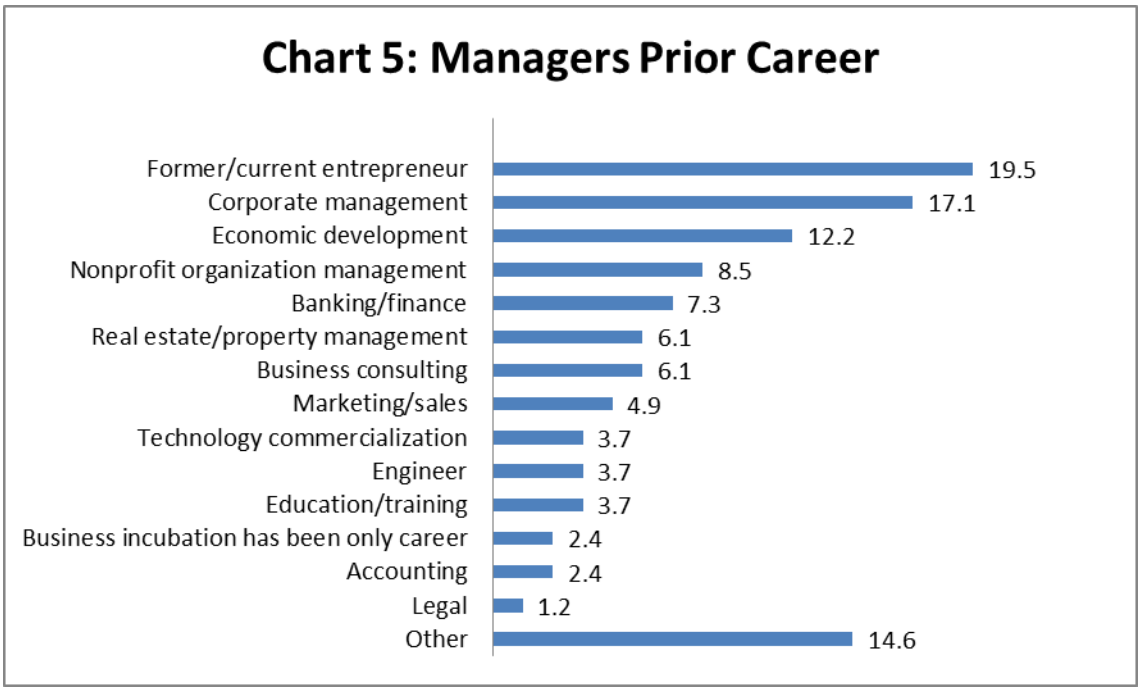
Table 11: Years of Graduate Data Collection

	%
Does not collect outcome data from graduate firms	42.3
1 Year	12.7
2 Years	9.9
3 Years	8.5
5 Years	14.1
More than 5 years	12.7

Staffing, Experience, and Available Expertise

On average, incubator managers have 8.1 years of experience in the business incubation industry, including 7.5 years at their current position. These averages are skewed higher due to a few long-term managers, some of whom have served more than two decades in their current position. Managers' average work week is 36.6 hours, during which they spend over half their time delivering client services (37.7%) and developing internal and external networks for the program (18.2%). They also devote 20% of their time to facility management. All other activities consume less than 10% of the managers' time. However, the standard deviations indicate that there are significant differences across programs.

Incubator managers' prior careers cover a broad range of experiences. The most common are former/current entrepreneur (19.5%), corporate management (17.1%), and economic development professional (12.2%); all others fall below 10% (see Chart 5).



The number of staff employed by incubation programs varies greatly. This finding underscores the variety of ways in which incubators deliver client services. Some programs use a network of outside providers, including Small Business Development Centers, SCORE programs, higher education institutions, and private business service providers. Other incubators deliver services with in-house staff exclusively.

External expertise on incubator advisory boards is diverse, although some categories are more prominent. Advisory boards average about 11.8 members, with a range from zero to 30. These boards typically include entrepreneurs (40.9%), local economic development officials (37.4%), representatives of the finance community (35.7%), corporate executives (34.8%), and university officials (34.8%). Also represented on at least 24% of incubator advisory boards (above the average) are accountants, business attorneys, chambers of commerce executives, incubator managers, and local government officials. Marketing experts have below-average presence on advisory boards, at only one in five incubators (see Table 12 on the next page).

Table 12: Advisory Board Membership

Category	%	Category	%
Experienced Entrepreneur	40.9	Marketing Expert	20.0
Local Ec. Dev. Official	37.4	Tech Transfer Specialist	17.5
Finance Community	35.7	Graduate Firm	14.8
Corporate Executive	34.8	Real Estate (manager/developer)	13.0
University Official	34.8	State Ec. Dev. Official	7.8
Accountant	30.4	Patent Attorney	6.1
Business Attorney	29.6	State Government Official	5.2
Chamber of Commerce	27.0	Other	5.2
Incubator Manager	27.0	Federal Ec. Dev. Official	1.7
Local Government Official	24.3		
Overall Mean	21.7	**Average Size of Advisory Board**	11.8

Client Base

The study examined data on *resident*, *affiliate*, and *graduate firms*. The survey also analyzed *full-time* and *part-time* employment data for a five-year period (from 2003 to 2008). Using this information, the researchers were able to calculate the aggregate and relative growth for each of the employment-related metrics of success. Typically one or two outlier cases skewed the outcome variables to the right. To calculate the averages presented below, the research team eliminated the outliers by recoding the value to just within three standard deviations of the mean.

On average, the number of *resident clients* grew by 2.4% between 2003 and 2008; the overall average remained constant at 17.3 resident clients per incubator (see Table 13 on the next page). This finding demonstrates that some incubators served fewer resident clients in 2008 than they did in 2003. The growth rate ranged from a low of -1% to a high of 61%. These rates are conservative estimates, as the research team dropped all cases where the incubator was just starting to accept clients in 2003 (but did not yet have any) from the analysis. Typically, the growth rate of new incubators will be higher because they are not yet experiencing space limitations when they first open their doors.

Table 13: Client Firm Outcomes and Change, 2003 to 2008

	# Clients 2003	# Clients 2008	Total Change 2003-08	% Change 2003-08
Mean	12.3	17.3	5.4	2.4
Median	6.5	12.0	3.0	0.26
Std. Deviation	15.2	16.9	11.1	8.8
Minimum	0.0	0.0	-11.0	-0.7
Maximum	78.0	72.0	61.0	61.0

The graduate firm population grew at approximately the same rate (2.5%) as resident clients. In 2003 the average number of graduate firms was 33.8 per incubator; that figured had jumped to 55 by 2008 (see Table 14).

Table 14: Graduate Firm Outcomes and Change, 2003 to 2008

	# Graduates 2003	# Graduates 2008	Total Change 2003-08	% Change 2003-08
Mean	33.8	55.0	20.7	2.5
Median	6.0	19.0	8.0	0.5
Std. Deviation	78.1	94.4	35.5	9.4
Minimum	0.0	0.0	-10.0	-0.7
Maximum	550.0	600.0	218.0	5.9

The results for overall growth in the number of affiliate firms are distorted by the number of the incubators with affiliate firms in 2008 (38) relative to 2003 (20) (see Table 15). The average number of affiliate firms was 27.9 in 2003, growing to 31.9 in 2008. However, the median was much lower (8.5 in 2003 and 6 in 2008), indicating that the large number of affiliates at a few programs artificially inflated the mean.

Table 15: Affiliate Firm Outcomes and Change, 2003 to 2008

	# Affiliates 2003	# Affiliates 2008	Total Change 2003-08	% Change 2003-08
Mean	27.9	31.9	26.9	20.4
Median	8.5	6.0	6.0	8.0
Std. Deviation	51.4	66.6	59.7	43.5
Minimum	1.0	1.0	1.0	1.0
Maximum	200.0	300.0	300.0	200.0

Both resident firm full-time employment (FTE) and part-time employment (PTE) grew over the five-year study period (see Table 16). During the period, the average number of resident firm FTEs grew from 53.1 to 76.8, and PTEs increased from 13 to 19 during the period.

Table 16: Client Firm FTEs and PTEs Outcomes and Change, 2003 to 2008

	Avg. # FTEs 2003	Avg. # FTEs 2008	Total Change 2003-08	% Change 2003-08
Mean	53.1	76.8	23.9	7.2
Median	20.0	42.0	9.0	0.3
Std. Deviation	80.6	101.9	78.4	38.3
Minimum	0.0	0.0	-118.0	-0.8
Maximum	414.0	528.0	526.0	263.0

	Avg. # PTEs 2003	Avg. # PTEs 2008	Total Change 2003-08	% Change 2003-08
Mean	13.0	19.0	6.0	46.0
Median	1.0	7.0	6.0	600.0
Std. Deviation	26.3	40.8	28.3	2.7
Minimum	0.0	0.0	0.0	0.0
Maximum	150.0	250.0	250.0	250.0

After eliminating outliers – as well as cases that did not have graduate firms in 2003 or reported that the program did not collect graduate data – average graduate firm full-time employment increased from 615 in 2003 to 711 in 2008. Part-time employment also increased over the five-year study period (from 13.9 in 2003 to 34.4 in 2008) (see Table 17).

Table 17: Graduate Firm FTEs and PTEs Outcomes and Change, 2003 to 2008

	Avg. # FTEs 2003	Avg. # FTEs 2008	Total Change 2003-08	% Change 2003-08
Mean	615.0	711.0	296.0	0.9
Median	9.0	75.0	24.5	0.5
Std. Deviation	2,101.0	2,440.0	1,033.0	1.4
Minimum	0.0	0.0	-8.0	-0.8
Maximum	12,000.0	15,000.0	5,800.0	4.8

Table 17: Graduate Firm FTEs and PTEs Outcomes and Change, 2003 to 2008 (cont.)

	Avg. # PTEs 2003	Avg. # PTEs 2008	Total Change 2003-08	% Change 2003-08
Mean	13.9	34.4	16.4	2.2
Median	0.0	10.0	4.0	1.0
Std. Deviation	47.0	88.7	47.5	3.0
Minimum	0.0	0.0	0.0	0.0
Maximum	250.0	500.0	250.0	9.5

Affiliate firm FTEs and PTEs grew from 2003 to 2008. The average number of FTE positions created by affiliate firms increased from 19.4 in 2003 to 47.3 in 2008, while PTEs grew from 30 to 57 over the study period (see Table 18).

Table 18: Affiliate Firm FTEs and PTEs Outcomes and Change, 2003 to 2008

	Avg. # FTEs 2003	Avg. # FTEs 2008	Total Change 2003-08	% Change 2003-08
Mean	19.4	47.3	296.0	0.9
Median	0.0	3.0	24.5	0.5
Std. Deviation	80.2	165.3	1,033.0	1.4
Minimum	0.0	0.0	-8.0	-0.8
Maximum	500	1000	5,800.0	4.8

	Avg. # PTEs 2003	Avg. # PTEs 2008	Total Change 2003-08	% Change 2003-08
Mean	30.0	56.6	16.4	2.2
Median	0.0	0.0	4.0	1.0
Std. Deviation	164.1	315.4	47.5	3.0
Minimum	0.0	0.0	0.0	0.0
Maximum	1,000.0	2,000.0	250.0	9.5

A rough estimate of total incubator client firm employment may be calculated by multiplying the average for the population by the total number of incubators. Although the research team put forth great effort to validate all incubation programs over five years old, there are bound to be some true incubators that were not confirmed and thus were not included. Therefore, the calculated employment impact should be considered a conservative estimate. For 2008,

estimated total full-time employment for incubator firms (resident clients, affiliate clients, and graduate firms) is 315,294; part-time employment is estimated to be 41,336. Graduate firms employ the lion's share of full-time workers (85%), while affiliate firms account for slightly over half of the part-time employment (51.3%).

Overall, incubator client firms generated approximately $18.7 billion in total revenues in 2008. On average, in 2008 for one incubator, total resident clients' revenues were $6,120,389; graduate firms' revenues were $39,449,059; and affiliate firms' revenues were $9,662,899.

The average five-year survival rate for incubator graduates is 75%. Incubation programs produce an estimated 4.3 graduates per year, translating into approximately 21-22 new graduate firms over a five-year period. Of those, the community can anticipate 16 will survive at least three years. Though the data is limited, approximately 73.4% of these firms will locate in the host region (defined as the metropolitan area; see the Regional Analysis section later in this chapter for a complete description of metropolitan statistical areas).

B. Spearman's Correlation Analysis

The research team conducted the bivariate correlation analysis in four stages. During the first stage, the team analyzed the correlation between incubator outcome variables. Researchers then examined the multicolinearity between independent variables. The high degree of colinearity between some predictor variables catalyzed the researchers to construct index variables for the predictive variables that were highly intercorrelated. In the final step, the group conducted the analysis between the outcome measures and the predictor variables.

Dependent Variable Correlation

The purpose of correlation analysis is to ensure that no two outcome variables measure the same effect. Given researchers' prior knowledge about the variables involved in this study, the team anticipated a high degree of intercorrelation. For example, the growth in the number of resident clients between 2003 and 2008 was highly correlated with the growth of resident firm FTEs, as anticipated. In the end, there was sufficient difference between all outcome measures to use each separately.

Predictor Variables Correlation

Prior research has demonstrated that there is no one policy, advisory board composition, goal, or other program attribute that results in enhanced client firm performance. Rather, client firm success is predicated through the interplay of key policies and services and how well the program is embedded in its community. Thus, the research team designed the survey to capture the subtle relationships between an array of incubation program characteristics. As expected, the survey design (with over 100 incubator characteristics) produced a high degree of multicolinearity among the potential predictor variables.

The bivariate correlation analysis confirmed a high degree of multicolinearity within the following five categories of predictor variables: (1) services offered by the incubation program; (2) stated incubator goals; (3) advisory board membership; (4) collection of outcome measures from client firms; and (5) various management practices. Researchers analyzed each of these groupings based on four planes: (1) the degree of colinearity between them; (2) the strength of the predictor variable's correlation with the measures of success; (3) a comparison with findings from prior research regarding the relationship between each predictor variable and measures of success; and (4) a comparison with the theory of business incubation practices regarding each predictor variable's relationship to measures of success.

Correlation of Predictor Variables and Outcome Measures

The study's bivariate correlation analysis overwhelmingly supports current theory on business incubation. Some factors that are correlated with incubation program quality and client firm success measures include staffing, manager's experience, program revenues and expenditures, and collection of outcome data. Further, the array of entrepreneurial services provided and other management practices followed have, to varying degrees, positive and statistically significant relationships with one or more measures of client firm success.

Staffing

As with any organization, appropriate staffing is critical to an incubator's performance. The results of the correlation analysis suggest that additional staffing beyond the manager is positively and statistically significantly correlated with nine measures of client performance. Furthermore, the number of hours the staff works per week is statistically significantly related to five measures of success. Similarly, there is a positive and statistically significant relationship between the average number of hours per week the manager is engaged with the program and seven outcome measures. It is not just the size of the staff that matters, though. Resident client-to-staff ratio – either as the proportional variable or recoded into a low-, medium-, and high-ranked order variable – also is strongly correlated to the success of client firms. What activities the manager focuses on matters as well. The three activities most correlated to measures of client success are the delivery of client services, developing networks internal and external to the incubation program, and fundraising.

The positive and statistically significant relationship between improved client firm performance and the manager's experience in the incubation industry and her/his tenure with the current program suggests two critical points. First, more experienced managers are more effective. The manager's experience is positively correlated with 11 measures of success at a statistically significant level. Second, the incubator manager's stability (length of tenure with an incubation program) creates the opportunity to develop networks with key *stakeholders* (see "primary stakeholders") and enhance trust, both of which contribute to boosting client firm outcomes.

Budgets

A strong correlation exists between the size of a business incubation program's budget (both revenues and expenditures individually) and program success (i.e., larger budget = greater success). Of course, one would anticipate that programs with larger budgets have more capacity to deliver critical services and are more stable. However, it is also important to look at revenue sources and how the incubator uses its resources. This research found that receiving a large portion of revenues from client rent and service fees is positively correlated with outcome measures, though the effect is only statistically significant for three client firm outcomes. On the expenditure side, the more programs invest in staffing and program delivery – relative to building maintenance or debt servicing – the higher the probability of improved client firm outcomes.

Collecting Outcome Data

Business incubation experts often have lamented that it is difficult to judge program effectiveness because many incubation programs do not collect sufficient outcome data. Indeed, survey results for this study indicate that over 40% of respondents still do not have formal data collection policies. Furthermore, some business incubation critics have pointed to the weakness of the evidence of industry success, due to selection bias favoring stronger programs that have the capacity to collect data. This issue is of particular importance to funders, who must weigh various options for investing scarce public resources to stimulate economic growth.

Correlation analysis provides sound empirical evidence that the length of time an incubation program collects graduate firm outcome data, resident client employment data, and graduate firm sales data are all statistically significant and positively correlated with 12 measure of client firm success. This finding could mean that programs with the capacity to collect data also have the resources to implement best practices covering the array of management practices and services that lead to client firm success. It is equally plausible that collecting outcome data demonstrating a positive return on investment assures funders that business incubation is a viable part of a sound economic development strategy and that continuing to invest in the program will result in the anticipated outcomes. Of course, success breeds success, as program stability enhances the capacity of an incubator to meet its stated goals. But having a written policy requiring clients to provide outcome data is also positively correlated at a statistically significant level. This suggests that the capacity to collect data is not the only means to ensure data collection, but that including this requirement among the entry criteria can reduce the administrative burden of data collection.

Services

The correlation analysis supports prior research and incubation theory regarding the provision of entrepreneurial services. The outcomes confirm that providing an array of entrepreneurial services is critical to business incubation program success. Overall, there were 56 positive statistically significant relationships between the services offered and measures of client outcomes. There also were five cases of statistically significant relationships between incubator services and incubation program outcome measures. However, these relationships do not fit the theory or anticipated outcomes. A closer examination reveals that in two cases, the outcome is an aggregate count of firms and PTEs in 2003. This might be the result of positive impacts not present in 2003 but manifested during the study period. In two other cases, the inverse relationship is with the total number of graduate firm PTEs in 2008. The final case concerns the growth in the number of graduate firms from 2003 to 2008. In all five cases, the relationship is relatively weak and in just one case the correlation exceeds 0.400.

Some of the services with relatively high correlation to measures of success include: (1) linkages to educational resources; (2) providing networking opportunities for clients; (3) general legal services; (4) marketing assistance; and (5) assistance identifying a management team. Each of these five services is statistically significantly correlated with at least five outcome measures.

Some services that have had demonstrable positive effects on client firm performance in prior research (and are still considered by industry experts as critical to incubator performance) did not have any statistically significant relationships with outcome measures in this study. This is the result of the statistical tool used coupled with the limited variation in the independent variable. For example, almost all (96%) of incubators provide help with business basics. As such, these services are viewed as best practices, but their contribution to client firm success is measurable only when coupled with other services and management practices.

Management Practices

Correlation analysis of management practices – including entry and exit criteria, program evaluation, budget reviews, etc. – suggests that some practices matter for client firm outcomes. Overall, for 43 of the management practices studied, the relationship's direction (positive or negative) fits incubation theory and supports prior research findings. Two management practices – clients overstaying their time and programs not having formal exit policies – confirm existing theory by having inverse relationships to measures of success. For this analysis, the research team considered these in the plus category of predictive power. Thus, 45 management practices are positively correlated with client firm outcomes; the theorized direction of the relationship is reversed in only eight cases.

Regularly evaluating incubation program effectiveness (correlated with seven outcome measures), collecting graduate data for longer periods (correlated with five outcome measures), and providing opportunities to showcase client firms in the community (correlated with four outcome measures) were the management practices that correlated with improved client firm outcomes most often. The following practices were correlated with three measures of success: (1) having exit criteria that require clients to graduate within an agreed-upon time; (2) reviewing incubation program budgets monthly; and (3) evaluating service providers regularly. Not having a formal graduation policy is negatively associated with optimal outcomes.

Constructed Indexes

The research team constructed indexes to capture the more subtle interplay between various services, management practices, goals, advisory board membership, and key outcome data incubation programs should collect. The set of three outcome data collection indexes had the highest correlation to positive client firm outcomes. Overall, the indexes were moderately correlated to the outcome measures and overwhelming positively related to improved client outcomes. Also, they followed the general pattern of the individual variables they replace in the chi-square and discriminant analysis.

Summary

The correlation analysis provides statistical evidence of a relationship between business incubation best practices and enhanced client success. The key findings support prior research and business incubation theory. Though the analysis was undermined by limited variation in predictor variables at time, these findings suggest that some industry best practices are widely used.

Incubation program age had a statistically significant correlation with only one outcome measure. Far more important to program stability and performance were the quality of staffing and the management practices employed by the program. The manager's experience and resident client-to-staff ratio were the two predictor variables with the strongest correlation with metrics of success.

While the size of the incubator facility was correlated with nine measures of success, in six cases, these were measures of the aggregate size of the number of resident firms in 2003 and 2008. This outcome was expected, as the larger the facility, the more space to rent to resident firms. That said, it also may indicate some degree of economies of scale for business incubators, when coupled with the finding that the size of the incubator budget, larger staffs, and more staff hours also are correlated with many measures of success.

C. Chi-Square Analysis

To deepen our understanding of the relationship between incubator qualities that promote client success, the researchers conducted a chi-square analysis between all dichotomous

predictor variables and the recoded outcomes as ranked order variables (low, moderate, and high). The results of this analysis buttress the findings of the correlation analysis, further demonstrating the importance of employing incubation best practices to maximize the return on public investment in business incubators.

The chi-square analysis is presented in three parts. First, the research team analyzed incubator services, then advisory board membership, and finally management practices that are dichotomous.

Services

Entrepreneurship literature has documented that start-up enterprises fail most often because they lack access to capital. Thus, is it no surprise that the top three services (determined by the number of statistically significant chi-squares) are access to various sources of capital. Overall, five services related to helping client firms access capital had 22 statistically significant outcomes in the chi-square analysis (see Table 19 on the next page).

As a group, services designed to assist clients with production processes were statistically significantly related to 14 measures of improved client performance. At the top of the list are manufacturing assistance and access to specialized equipment.

Though often considered to be of lesser importance, this research found that general services such as shared administrative assistance and office equipment still prove to be fundamental to client success. Management assistance through loaned executives and other means of connecting clients with needed expertise also have strong relationships to client firm outcomes, as documented in other research. While legal services scored relatively low in this analysis, there are only three services related to this category, most likely leading to a lower aggregate score. In the case of marketing and sales assistance, the relatively low score is considered a combination of two factors. The primary reason is the lack of variability in the number of incubation programs offering marketing services, international sales assistance, and e-commerce assistance. Second, customer relations and federal procurement aid are offered at few incubators, also explaining the weaker relationship.

Table 19: Number of Significant Chi-Squares Between Incubator Services and Measures of Success

Incubator Services	#	%
Access to Funding		
In-House Venture Fund	8	25.0
Access to Commercial Loans	5	15.6
Access to Non-Commercial Loans	5	15.6
Access to *Angel Investors*	2	6.3
Access to Venture Capitalists	2	6.3
Production Assistance		
Manufacturing Processing Assistance	5	15.6
Access to Specialized Equipment	5	15.6
Prototyping and Product Development	4	12.5
Technology Commercialization	0	0.0
General Services		
Logistics	4	12.5
High-Speed Broadband Internet	3	9.4
Economic Literacy	2	6.3
Shared Administrative Services	1	3.1
Comprehensive Business Training	1	3.1
Business Basics	0	0.0
Accounting	0	0.0
Access to Educational Resources	0	0.0
Business Etiquette	0	0.0
Management and Networking		
Loaned Executive	4	12.5
Internal Networking	1	3.1
Human Resources	1	3.1
Identify Management Team	1	3.1
Links to Strategic Partners	1	3.1
Shadow Board	0	0.0
Legal Services		
General Legal Services	4	12.5
Intellectual Property Protection	2	6.3
Regulatory Compliance	1	3.1
Marketing and Sales		
International Sales	2	6.3
Marketing Services	2	6.3
Customer Relations	1	3.1
E-Commerce	0	0.0
Federal Procurement Assistance	0	0.0

Advisory Board Membership

The chi-square analyses of the importance of different expertise on incubation program advisory boards are striking. The presence of a graduate firm representative on the advisory board is statistically significantly related to half of the 31 measures of success. This is 20% more than the number of statistically significant relationships generated by having a technology transfer specialist on the board – the next highest category (see Table 20).

Table 20: Number of Significant Chi-Squares Between Board Professional and Measures of Success

Advisory Board Member	#	%
Graduate Firm	16	51.6
Technology Transfer Specialist	10	32.3
Accountant	7	22.6
Patent Attorney	6	19.4
Business Attorney	6	19.4
Federal Economic Development Official	6	19.4
State Government Official	5	16.1
Corporate Executive	5	16.1
University Official	5	16.1
Marketing Expert	5	16.1
Local Economic Development Official	4	12.9
Chamber of Commerce	4	12.9
Incubator Manager	4	12.9
Experienced Entrepreneur	4	12.9
Representative of the Finance Community	3	9.7
Real Estate/Developer	3	9.7
Local Government Official	3	9.7
State Economic Development Official	0	0.0

As incubation theory would predict, the next three most important areas of expertise are accounting, intellectual property (patent attorney), and general legal expertise. Government actors also play a key role in enhanced client performance. In the case of business incubation, the presence of government officials – be they elected officials or economic development officials – ensures a degree of community embeddedness necessary for incubation program success. Ensuring their participation assists in educating these critical funding sources about the incubation program and its successes. Government actors also can help promote the incubator to a wider community and help attract key stakeholders from the business community.

Management Practices

The chi-square analysis provides statistically significant evidence of the relationship between business incubation practices and client outcomes. Having entry and exit policies, conducting regular budget evaluations, evaluating service providers, analyzing program effectiveness, and formalizing incubator policies in writing have positive relationships with multiple client success measures (see Table 21). Of the 24 dichotomous management practice variables, five are positively related to more than 25% of the success measures; 11 of the independent predictor variables are statistically significantly related to client firm outcomes. These findings suggest strong predictive power in determining incubation program performance.

Table 21: Number of Significant Chi-Squares Between Management Policies and Measures of Success

Incubator Characteristic	#	%
Management Practices		
Budget Reviewed Monthly	10	31.3
Evaluates Service Providers	9	28.1
Evaluates Program Effectiveness	9	28.1
Has Written Strategic Plan	8	25.0
Budget Reviewed Quarterly	6	18.8
Resident Client Firm to Staff Ratio	6	18.8
Showcases Clients	5	15.6
Has Written Sustainability Plan	4	12.5
Has Written Mission Statement	3	9.4
Has Written Marketing Plan	3	9.4
Robust Payment System	1	3.1
Stakeholders and Sponsors		
Stakeholders Understand Mission	1	3.1
Stakeholders Support Mission	1	3.1
Primary Sponsor Understand Mission	1	3.1
Primary Sponsor Support Mission	1	3.1
Entry Policy		
Selects Clients on Entrepreneurial Basis	13	40.6
Written Agreement to Provide Data	6	18.8
Selects Clients on Cultural Basis	3	9.4
Milestones and Follow-Up	2	6.3
Evaluates Needs and Plan at Entry	0	0.0
Exit Policy		
Discusses Alternatives if not Meeting Milestones	6	18.8
Offers *Pre/Post Incubation Services*	6	18.8
Discusses Milestones	3	9.4
Takes Equity Stakes in Client Firms	3	9.4

However, the chi-square analysis was less effective at measuring the strength of the relationship between how well both stakeholders and sponsors understand the incubator's mission and support its stated goals. As with any statistical test, the lack of variation of the independent variable undermines the statistical test. For all four predictor variables to measure these incubator traits, more than 94.4% of respondents said their stakeholders and sponsors understood and supported the program's mission.

Summary

It is clear from the chi-square analysis that incubation program policies and practices are strongly related to improved client performance. Similarly, providing an array of entrepreneurial services and securing the right mix of expertise on advisory boards also have statistically significant relationships with client firm development, growth, and maturation.

D. Predicting Incubator Performance

The bivariate correlation analysis and chi-square analysis provide solid statistical evidence of the positive relationship between business incubation best practices and improved client firm performance. Discriminant analysis can deepen understanding of this relationship by testing the predictive power of various incubation practices to accurately categorize outcomes into low-, moderate-, or high-performing groups. Analyzing the causal nature of these relationships can encourage industry stakeholders to adopt policies that optimize public and private investments in business incubation programs.

Discriminant analysis is designed to predict which group a dependent variable (also called outcome variable) belongs to, based on values of a set of predictor variables (also called independent variables). In this analysis, all outcome variables were ranked as low=1, moderate=2, and high=3. The grouping is based on client performance in terms of survival, employment, and revenues, as well as the number of client firms and annual graduation rates. The low category is defined as less than the median; the moderate group is between the median and the average; and the high category is above the average.

The analysis empirically documents the relatively to very strong predictive power of incubation best practices. In essence, the analysis supports the theory that implementing incubation best practices can enhance client firm growth and survival. For example, the general predictive model for the number of graduate full-time employees in 2008 predicted 87.1% of the cases accurately (significance of p=.0001). In other words, researchers can be more than 99.9% certain the predictive equation will accurately forecast the range of the number of graduate firm full-time employees 87.1% of time, which is 54.1% more than would occur randomly (with three potential categories, random prediction is 33% of cases accurately predicted). The predictive model for the change in graduate firm FTEs from 2003 to 2008 has only moderately strong predictive power. The model accurately predicted 58.3% of the cases (significance of p=.001). Still, researchers can be more than 99.9% certain the model is 23.1%

more accurate than would occur by chance. The model for predicting aggregate growth of client firm performance was the weakest, yet it still has relatively strong predictive power, suggesting that incubation practices have a causal relationship to a program's performance.

The analysis is presented in five steps. The initial stage was to test each of the constructed index incubator quality variables as the sole predictor variable. Using these results, the research team selected the indexes with the greatest predictive power for steps three and five. Next, researchers tested all single incubator quality variables as sole predictors, using the same methodology for selecting which of these to use in the general predictive models in steps three and six. Step three built a general predictive model using the incubator characteristics demonstrated to have the strongest predictive power from steps one and two.

In steps four and five, the research team analyzed the regional economic conditions to control for differences across host communities. Step four followed the same analytical techniques used in steps one and two. In step five, the team built a general predictive model using only the regional capacity variables (analogous to step three).

A Brief Remark Regarding New Enterprise Development

From a public investment and economic development perspective, graduate firm outcomes are the best proxy for evaluating business incubation policy. Whether receiving business incubation services or not, start-up firms have a critical maturation period of about five years. In the first five years, the U.S. Small Business Administration estimates that roughly half (49%) of new firms cease operation, with a precipitous decline in the closure rate after that period (U.S. Small Business Administration, Office of Advocacy, Frequently Asked Questions document, based on U.S. Department of Commerce, Bureau of the Census, Business Dynamics Statistics). Also, during this period, growth tends to be relatively slow for most start-up enterprises before they hit the "take-off" period, three to five years into their existence (Lewis 2003, 2010; Shahidi 1998; Culp 1996).

Business incubation is designed to buffer start-up enterprises from stiff market forces by providing access to capital, managerial expertise, and marketing assistance. With an average incubation period of 33 months (Knopp 2007), measuring an incubator's performance – particularly for a new business incubation program – would be premature before the program has had adequate time to nurture and graduate firms. While clients are still participating in the incubation program – whether as resident or affiliate clients – incubators have not yet demonstrated that they can improve survival rates of start-up firms, anchor them in the host community, and graduate firms that can achieve take off. Indeed, during the time clients are still receiving direct assistance from the incubation program, these firms likely won't show tremendous growth. Once they reach the take-off stage, companies should graduate from the incubation program. Hence, the most critical evaluative measures (survival rates, jobs created,

and revenues generated) will be underestimated by only examining resident and affiliate firm outcomes or graduate firms that have not had two to three years in the marketplace.

For these reasons, the research team analyzed outcome variables of both graduate firms and client firms still residing within incubation programs. For each outcome measure, the team constructed a minimum of three predictive equations based on the correlation and chi-square analyses. What are presented throughout the discriminant analysis section of this report are the results of the best predictive equation for any outcome variable and/or the summary of all the results.

E. Predictive Power of the Constructed Indexes

Researchers analyzed each of the constructed indexes in three parts. First, the team looked at the outcome metrics related to graduate firm performance, then the measures of resident firm outcomes, and finally the two valid measures of affiliate firm performance. In each case, the researchers tested all indexes as the sole predictor, comparing the results to determine which index in each category had the greatest potential to predict outcomes accurately. The categories are management practices, incubator services, goals, advisory board composition, and outcome data collection (see Appendix A for a list of variables included in each index).

Graduate Firm Outcomes

In brief, the analysis of the constructed indexes provided clear guidance regarding the selection process for general predictive models. A short summary of the analysis is presented below.

1) The number of service providers (which is strongly correlated to the constructed service indexes) is the best predictor in 10 of the 12 possible outcomes, and in seven of the 10 cases, it meets the entry criteria. No service index was the best predictor more than once (see Appendix B).

2) Management Practice Indexes 1 and 4 potentially have strong predictive power, while the other two are very weak for all but one graduate firm outcome measure (change in graduate FTEs between 2003 and 2008).

3) How long an incubator collects graduate firm data is a better predictor than the three indexes on outcome data collection. Only Outcome Data Collect Index 1 is a viable predictor in more than one case. For nine of the 12 graduate firm outcomes, either the period of data collection (correlated with six outcomes measures) or one of the indexes is a strong predictive variable.

4) Only Goals Index 3 is a viable predictive variable, although in five of the 11 cases, it does not meet the entry criteria.

5) The size of the advisory board is never a strong predictor variable, while both indexes of the board composition have moderate (Advisory Board Index 1) to strong (Advisory Board Index 2) predictive power.

Resident Firm Outcomes

The discriminant analysis of the constructed indexes' relative predictive power also provided researchers with a discernable pattern to guide the selection process for the general predictive equations in steps three and six. The summary of the analysis is presented below.

1) The size of the advisory board seems to matter more for resident firm outcomes than for graduate firm outcomes. (Of course, the two advisory board indexes are strongly correlated to the size of the board.) For five resident firm outcomes, the size of the advisory board is a good predictor, while the composition of the board (as measured by the indexes) is only a good predictor for three resident client outcomes (see Appendix B).

2) For seven of the 10 resident firm outcomes, the number of service providers is a better predictor than the four service indexes. The finding is true for graduate firm outcomes. However, the service index is a strong predictor for five resident client outcomes.

3) The management practices index is a strong predictor in seven of 10 resident firm outcomes, often with more than one index meeting the entry criteria. This finding suggests a strong causal relationship between management practices and resident firm outcomes.

4) Either the length of outcome data collection or one of the three indexes for outcome data collection is a strong predictor of resident firm outcomes; for many resident client outcomes, more than one of these items meets the entry criteria. The longer incubation programs collect data, the better the outcomes. This buttresses the findings for graduate firm outcomes, suggesting a strong causal relationship between outcome data collection and client performance.

5) For just three resident firm outcomes, one of the goals indexes is a viable predictor variable.

Affiliate Firm Outcomes

The analysis of the affiliate firm outcomes is undermined due to low sample sizes, with only one affiliate firm outcome measure meeting the minimum of 30 cases. For affiliate firm revenues in 2008, the number of service providers used, the length of outcome data collection, and various management practices and goals all have good predictive power.

F. Predictive Power of Single Incubator Quality Variable

Evaluating single predictor variables begins with a comparison to the indexes. The analysis supports business incubation theory and prior research suggesting that the constructed variables that capture subtle relationships among the array of incubator qualities are better predictors than any single variable.

Some other key points of this analysis include:

1) Because the direct relationship between any single predictor variable and the outcomes are relatively weak, the researchers had to relax the entry criteria to select a variable for inclusion in the general model. The new entry criteria are: (1) Eigen values > 0.10; (2) canonical correlations > 0.3; (3) Wilkes' Lambda < 0.3; and/or (4) % predicted > 45%.

2) Of the 35 single variables, 10 emerge as the strongest predictors of successful outcomes. They include: (1) manager's hours; (2) manager's experience; (3) manager's time with current program; (4) program revenues; (5) program expenditures; (6) client-to-staff ratio (either as proportion or ranked order); (7) budget controls (quarterly, although sometimes monthly); (8) evaluating the program; and (9) evaluating service providers.

3) Incubators' years in operation and total square footage are poor predictors of growth and graduate survival. Facility size is a moderate predictor of graduate firms per year, but four other variables are stronger predictors.

4) Incubators' years in operation and total square footage are only moderate predictors of aggregate outcomes, supporting the theory that size and age are not the most important factors (although they contribute to aggregate program outcomes).

5) Collectively, a few themes emerge: (1) Variables related to program capacity to deliver services – also a proxy of program stability – (incubator revenues and expenses; manager's hours, tasks, and experience; and client-to-staff ratio) are among the best predictors of successful outcomes; (2) Having written planning documents contributes to success; (3) Regularly evaluating different aspects of the incubation program matters (reviewing budgets, service providers, and program effectiveness); and (4) Having entry and exit criteria can boost program performance.

6) Collecting outcome data matters, although this finding may be an artifact of program capacity to document its successes.

Graduate Firm Outcomes

1) Manager's hours, experience, time with the program, and client-to-staff ratio are the best predictors of graduate firm outcomes.

Resident Firm Outcomes

1) Program revenues and expenses, client-to-staff ratios, and conducting regular budget reviews are the strongest predictors of resident firm outcomes.

Affiliate Firm Outcomes

1) There is no clear pattern of predictive power regarding affiliate firm outcomes.

G. Predictive Power of a General Model Using All Incubator Quality Variables

The statistical evidence suggests a strong positive relationship between incubator quality and client firm outcomes, with moderate to strong predictive power. The general models – using a combination of constructed indexes and single predictive variables for the 24 measures of success – predicted 72.9% of the cases accurately, on average (see Appendix B). The most cases predicted accurately was 88.9% (for graduate firm FTEs in 2003). The least stable model, with relatively moderate predictive power (at 60% predicted accurately), was for the aggregate change in affiliate firm FTEs from 2003 to 2008; thus, this model was dropped from further analysis.

Using the percent predicted accurately, Eigen values, canonical correlation, and the Wilkes' Lambda significance, the researchers categorized each model by the relative strength of its predictive power. More than half of the models (13) have strong predictive power; six have relatively good predictive power; and five are moderate predictors of client firm outcomes. Overall, the discriminant analysis provides a solid understanding of business incubation practices that can positively affect client firm outcomes.

Key Incubation Practices

By examining the number of times a variable was entered into an equation and which outcome they predicted, researchers can determine the business incubation practices that contribute most to client firm success. The number of service providers – a proxy for entrepreneurial services offered – was entered into more than half of the predictive equations (14), while the resident firm-to-staff ratio was entered into half (12) of the equations, and how long an incubation program collects outcome data from graduates was entered into 11 predictor equations. These three stand out as the most entered variables, closely followed by incubation program revenues (entered into nine predictor equations) (see Table 22 on the next page).

Table 22: Best Predictive Models for All Dependent Variables*

All Predictors Variables for Entry	# of Equations Entered
Number of Service Providers	14
Client Staff Ratio (proportional, no outliers)	12
How Long Graduate Data Collected	11
Program Revenues Total	9
Advisory Board Membership Index 1	7
Manager's Experience	7
Manager's Total Hours	7
Advisory Board Membership Index 2	6
Management Practices Index 1	6
Graduate Data Collection Index 1	4
Management Practices Index 2	4

** For the complete table, see Appendix C.*

A group of five variables was clustered at six or seven entries. Entered into seven predictor equations were: (1) Advisory Board Membership Index 1; (2) manager's experience; and (3) manager's total hours. Advisory Board Membership Index 2 and Management Practices Index 1 were each entered into six equations. All other predictor variables were entered into four or fewer general models.

The analysis reveals four key findings. First, as sole predictors, single variables such as total manager's hours or experience were relatively weak predictors compared with the constructed index variables. This could indicate that no single practice, policy, or service is guaranteed to produce success. Rather, it is the synergy between multiple practices, policies, and services that produce optimal outcomes. Also, neither the age of an incubation program nor the size of its facility is a good predictor of success; it is what happens within a program that matters most.

Therefore, newer incubation programs that implement industry best practices can succeed and eventually grow their physical plant as demand increases with time. The marked contributions of the resident client-to-staff ratio, as well as the manager's experience and hours per week, illustrate the importance of staffing an incubation program with quality employees. Finally, both the number of service providers and the two advisory board indexes are strong predictors of success. These findings underscore that providing varied expertise that is embedded in the community is fundamental to improving client firm outcomes.

Graduate Firm Outcomes and the General Models

Of the 11 graduate firm outcome measures, the variables designed to capture the quality of an incubation program predicted 73.6% of the cases accurately, on average. This is more than

40% more than chance alone, suggesting that these practices have strong causal effects on graduate firm performance.

If the goal of public investment in business incubation is job creation, graduate firm survival rates, the ability to produce graduates annually and over time, graduate firm revenue, and graduate FTEs are key measures of success. From this perspective, the survival rates of graduate firms, annual graduation rates, percent increase in the number of graduate firms, growth in the number of jobs created by graduate firms, graduate revenue, and graduate full-time employment are key outcomes that policymakers should try to effect. For these six outcome measures, the predictive equations are 71.9% accurate – 38.6% better than random chance – suggesting that incubator practices can significantly improve these critical outcomes.

By understanding which incubator quality variables are the strongest predictors of success, policymakers can require incubation programs that receive public-sector funding to adhere to practices that will optimize public and private investments. The key variables for predicting graduate firm outcomes include staffing variables (manager's experience, manager's hours, and client-to-staff ratio), which were entered in five equations; outcome data collection measures, which were entered into five equations; and management practice indexes and measures of the composition of the advisory board, which were both entered in four equations. The services index and/or number of service providers was entered into three equations. Each of these practices has long been associated with improved client performance. Furthermore, management practices, incubator services, outcome data collection periods, advisory board composition, and staffing levels are within the realm of policy influence.

While the facility size was entered in two predictive equations, the age of the incubation program was not entered into any of the predictive equations for key graduate firm outcomes. This finding underscores the notion that it is the quality of the staff, services, and management practices that drives graduate firm success.

Resident Firm Outcomes and the General Models

The predictive models for 12 resident firm outcomes, collectively, are slightly less accurate than those for graduate firm outcomes, predicting 70.9% of the cases accurately (compared with 71.9% for graduate firm outcomes). The relative strength of the equations – based on Eigen values, canonical correlations, and the probability of Wilkes Lambda – indicate that incubation program attributes generally are good predictors of resident firm outcomes.

The more detailed analysis of resident firm outcomes follows the same theoretical and operational paradigm used for graduate firm outcomes. The seven resident outcomes used as proxies for job creation as the return on public investment include: (1) number of resident firms in 2008; (2) change in the number of resident firms from 2003 to 2008; (3) percent change in

the number of resident firms from 2003 to 2008; (4) change in the number of resident firm FTEs from 2003 to 2008; (5) percent change in the number of resident firm FTEs from 2003 to 2008; (6) number of resident firm FTEs in 2008; and (7) resident firm revenues in 2008. Incubator quality variables, on average, predicted 70% of the cases correctly. From this, the research team concluded that incubation program policies and practices can significantly enhance resident firm maturation and outcomes. The success of resident clients is the foundation for the success of graduate firms.

The incubator attributes that contributed most to resident firm success are very similar to those associated with causal effects on graduate firm outcomes. Staffing, collecting outcome data, and management practices variables dominate the results. Also ranking as strong predictors of resident firm outcomes are advisory board composition and services offered. Again, business incubation policies and practices are relatively strong predictors of resident firm outcomes relative to facility size, age, or budget size.

Affiliate Firm Outcomes and the General Models

Unfortunately, only one affiliate firm outcome variable provided enough data to conduct a statistically valid analysis. The predictive analysis of affiliate firm revenues in 2008 revealed a strong causal relationship between incubation program practices and affiliate client revenues. The equation predicted 88% of the cases correctly. The variety of incubator practices entered into this equation once again demonstrates that business incubator policies matter more than its physical size or age.

H. Descriptive Analysis of Host Regions

Descriptive Statistics for Regional Variables

The 113 respondents are located in 94 distinct regions. Region is defined as the Metropolitan Statistical Area or Consolidated Metropolitan Statistical Area for 88 cases; 17 of these are in a micropolitan area. There were six responding incubators not located in an MSA or CMSA. In these cases, the research team constructed regions using one of the two techniques. In three cases, the incubator was located in a county adjacent to an MSA. In those instances, the team added the additional county to the MSA definition to define the host region. When an incubator was not located in an MSA or adjacent to an MSA, researchers considered the host county the region.

Incubators are located in communities with populations ranging from 4,149 people to over 22 million people (median of 616,147). This large degree of variation extends to population age cohorts, educational attainment, regional income, and employment. The range in regional economic, demographic, and social characteristics reflects the regions' differing capacities to support entrepreneurship. To control for the possibility that the host region's capacity to support entrepreneurship is catalyzing client firm performance, the research team tested the

key regional attributes associated with innovation and entrepreneurial success in the same manner as the incubator quality variables.

The aggregate and percent growth in regional employment measures are designed to capture the impact of several regional economic trends on incubation program outcomes. An index of educational resources and the percent of the population with a bachelor's degree or higher is designed to measure the region's innovation capacity and associated workforce skills. Using the percent of regional income derived from non-earned income (interest, dividends, and rent) provides a proxy for locally controlled investment capital. Median housing value, median household income, and per capita income are used to measure regional wealth. Age cohorts also are used to categorize regions. The key variable examined is the percent of the population in the prime work years (25-54). Demographers, planners, and sociologists have documented that this cohort is more rooted than younger adults (18-24) or older individuals at or near retirement age (54-70). Above this age, people are more attached to a location, although very few are contributing to the regional productivity. The percent of a region's population living in urban areas is used to capture the opportunities for cross-sectoral interaction that fosters innovation.

Following the same analysis methods used to test the incubator quality variables, the regional descriptive analysis shows wide variation. However, only a few of the variable distributions did not resemble a normal curve. In these cases, when one or two outliers were present, the researchers moved the outlier cases to plus or minus three standard deviations from the mean. The following variables were normalized: (1) the percent population living in urban areas; (2) the percent change in regional employment from 2002 to 2007; (3) the total change in regional employment from 2002 to 2007; and (4) the index of higher education institutions per 10,000 residents.

I. Regional Capacity Analysis

The interdependent nature of the regional capacity variables results in a high degree of multicolinearity. The normalized percent urban variable is statistically significantly correlated with 16 of the 25 outcome measures. Urbanization rates are strongly and positively correlated with (1) the percent of population in the prime working years (25-54) (0.696**); (2) the percent of population over 25 years of age with a bachelor's degree (0.515**); (3) median household income (0.781**); (4) per capita income (0.773**); (5) median house value (.632**); (6) higher educational resources unweighted (0.683**); (7) total employment in 2007 (0.774**); and (8) change in total employment from 2002 to 2007 (0.658**). This degree of colinearity would obscure the results; thus, each variable needed to be tested independently to determine which is the best regional capacity variable to use in the predictive model. It can then be coupled with other less correlated regional capacity measures.

The Spearman's bivariate correlation analysis suggests that most regional capacity variables have no statistically relevant correlations to incubator client firm outcomes. However, total population and the percent of regional income from non-earned income are positively and significantly correlated with eight outcome measures. Both the raw percent of population living in urban areas variable and the normalized recode are positively and significantly correlated with four outcome metrics. No other regional capacity variable has more than two positively and statistically significant correlations with the incubator outcome variables.

As one might expect, the percentage of population over age 25 with only a high school education has an inverse relationship with some (three) incubator outcome variables. Theory and prior research has demonstrated that higher educational attainment is positively related to a region's entrepreneurship level. Somewhat more difficult to interpret is the finding that the percent of the population between the ages of 19 and 24 years has an inverse relationship with two incubator outcome measures. This runs contrary to some analysts' theory that this age group is more entrepreneurial; if that were the case, researchers would expect positively correlated outcomes.

Based on this analysis, the regional variables with the most potential to predict incubator outcomes are the total population, the percent of non-earned income, the percent of the population living in urban areas, and the percent of the population over age 25 with only a high school diploma. Since all the regional capacity variables are continuous or proportional, the researchers could not use chi-square analysis to refine the variable selection for the predictive equations or to confirm the findings of the Spearman's bivariate correlation analysis.

J. Key Characteristics of the 49 Top-Performing Programs

Following are some common characteristics of the top-performing incubation programs identified in this study.

1) Almost all (48) are not-for-profit; only one is a for-profit model.

2) While the number of service providers ranges from zero to 60, overwhelming the count falls between 10 and 30.

3) Incubator size ranges from 4,000 square feet to nearly 1 million square feet.

4) Incubation program age ranges from 7 years to over 50 years (Batavia Industrial Center in Batavia, N.Y.); excluding Batavia, ages range from 7 years to 30 years.

5) The size of incubator advisory boards range from zero to 30 members; the mode is 12, the mean 10.5, and the distribution follows a pretty normal curve.

6) The two most important goals for incubation programs are job creation (4.60) and fostering an entrepreneurial climate in the community (4.65) (out of 5).

7) Other key incubator goals are diversifying the local economy (4.20), building or accelerating new industries/businesses (4.14), and attracting or retaining businesses to the host region (4.02). All other goals are below 4.00.

8) Incubation program budgets range from revenues of $33,000 with expenses of $17,000 to $2.8 million in revenue with expenses of $2.5 million.

9) Only three programs fully support their operations through rent and service fees. The average amount of revenue incubators receive through rent and service fees is 58.7%, and it is relatively normally distributed. One program receives 100% of its funding from operating subsidies, with no revenue from rent or service fees. Another program receives 15% of its revenue from rent and fees and 53% from operating subsidies. There are four other examples of top-performing incubation programs that receive more than 60% of their revenues from operating subsidies. Only 12 of the incubation programs in the surveyed population cover all of their operational expenses through rent and service fees.

10) These high-achieving incubation programs have, on average, a higher outcome data collection rate (66.7%); this group also collects outcome data longer than other respondents. More than half collect outcome data for two or more years, with slightly over 30% collecting data for five or more years.

11) Services that all top-performing incubators provide include:

- Help with business basics
- Shared administration/equipment
- Accounting
- High-speed broadband Internet
- Networking activities among incubator clients
- Marketing assistance
- Human resource training
- E-commerce assistance
- Comprehensive business training
- Presentation skills training
- Help with business etiquette

12) Services that only one to three top-performers do not provide include:

- General legal services (3)
- Access to educational resources (2)
- Logistics support (3)

- Help identifying management team members (1)
- Shadow boards (1)
- Access to venture capital (3)
- Access to commercial loans (3)
- Access to noncommercial loans (2)
- Intellectual property protection (3)
- Technology commercialization (2)
- Customer relations training (1)
- Links to strategic partners (3)
- Help with regulatory compliance (1)
- Federal procurement assistance (3)

13) Management practices most represented among top-performing incubators:

- Has a written mission statement 92%
- Selects clients based on cultural fit 92%
- Selects clients based on potential success 92%
- Reviews client needs at entry 98%
- Stakeholders/sponsors support/understand mission/goals 98%
- Showcases clients within the community 92%
- Offers robust payment plan for rent/service fees 94%

Characteristics of Host Regions of the 49 Top-Performing Programs

1) Most variables are normally distributed, although there are outliers both above and below the mean (see Appendix D).

2) The host regions exhibit capacity characteristics that one would anticipate. For example. They typically are more urban, wealthier, have better-than-average workforce skills, are experiencing growth, and have a high concentration of higher education institutions. However, it is important to note that this is not always the case. Coupled with the prior discriminate findings, this fact suggests that high-quality business incubation programs can overcome the lack of regional capacity.

3) The top-performing incubation programs tend to be in larger, urban areas, but there is a case of a high-achieving program in a region with just over 4,000 residents and 0% urban.

4) Most host regions experienced employment growth over the study period. However, two top-performing incubation programs were located in regions that lost employment from 2002 to 2007.

5) For all host regions, educational attainment for individuals over age 25 ranged from 6% with a bachelor's degree and 3% with more than bachelor's to 28% with a bachelor's degree and 17% with more than a bachelor's. On average, all regions and the regions

that host the 49 top-performing incubation programs have approximately the same level of higher educational attainment as the national averages (15.5% with a bachelor's degree and 8.9% with more than bachelor's).

6) The age cohorts reflected the national average, although again there is significant range among the host regions.

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VII. ANNOTATED BIBLIOGRAPHY

Acs, Z., Armington, C., and Robb, A. (January 1999). *Measures of Job Flow Dynamics in the U.S.* (Publication No. CES-WP 99-01). Retrieved from U.S. Bureau of Census Center for Economic Studies Discussion Papers Online: http://webserver03.ces.census.gov/index.php/ces/cespapers

This paper uses Longitudinal Establishment and Enterprise Microdata (LEEM) to investigate gross and net job flows for the U. S. economy. The authors examine the relationships between firm size, establishment size, and establishment age, and investigate differences resulting from use of two alternative methods for classification within these categories. They find that gross job flow rates decline with age and with increasing establishment size when controlling for age differences, whether initial size or mean size classification is used. They also argue that the difference in firm size contributes little or nothing when establishment size and age are controlled for. These results shed light on previous conflicting findings in the literature on the relationship between net growth and the size of businesses.

Allen, D. (1985). *An Entrepreneurial Marriage: Business Incubators and Start-ups.* Proceedings of the Fifth Annual Babson College Entrepreneurship Research Conference, Philadelphia, PA.

Based on an analysis of 40 incubation programs and a sample of their clients, this paper presents a preliminary assessment of business incubators as a new industry. The author also discusses policy and management implications for the further development of incubators.

Allen, D. (1988). Business Incubator Life Cycles. *Economic Development Quarterly*, 2(1), 19-29.

This article examines the business incubator development process through interviews with nearly 60 stakeholders working with 12 incubators. The author poses a life-cycle model consisting of three-stages to describe the development process: the start-up stage, the business development stage, and the incubator maturation stage. He also lays out five interdependent forces, which he argues influence the incubator development process. The author concludes by discussing the policy implications focusing on realistic development expectations, management philosophy, and performance criteria.

Allen, D., & Bazan, E. (1990). *Value-added contribution of Pennsylvania's business incubators to tenant firms and local economies*. Report prepared for Pennsylvania Department of Commerce, Pennsylvania State University, University Park, PA.

By examining information about incubator clients and graduates in Pennsylvania, as well as a set of nonincubator comparison firms, the authors look at how incubator clients compare with nonincubated firms and how incubation programs contribute through their local economies. They found that incubator the failure rate for incubator graduates was lower than that of nonincubator firms. Incubator clients also had statistically better performance

in sales and employment. Incubated firms valued the services and assistance provided by incubators, with rent and shared services being the most highly valued. Three-quarters of incubator clients reported having developed connections with other clients, most frequently for information sharing and supplier/purchase arrangements. The authors found that once the incubator clients graduated, they did not outperform nonincubator firms in the same marketplace.

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

This article provides a preliminary examination of the relationship among incubator structure, policy, services, and performances. The authors use a value-added continuum model to describe incubator operations and to conduct a survey of more than 100 incubator managers to examine features of this model. They find that age and size of the incubator facility play an important role in job creation and firm graduation. The study also says the private status of incubators affects their performances.

Armington, C., & Acs, Z. (2002). The determinants of regional variation in new firm formation. *Regional Studies*, 36, 33-35.

The authors use a new database from the U.S. Bureau of the Census to analyze the effect of differences in human capital, training and education, and entrepreneurial environment on new firm formation. They find significant differences in the rate of new firm formation between industrial regions and technologically progressive regions. According to the article, this finding is best explained by measures of unemployment, population density, industrial restructuring, and availability of financing.

Battelle Laboratories. (1995). *Virginias' Center for Innovative Technology: An Economic Assessment*. Columbus, OH: Battelle Press.

Using an input-output model, this study measures the direct and indirect economic contribution of the Virginia Center for Innovative Technology on the state's economy. Researchers analyzed survey data from a random sample of firms, coupled with state expenditure data. The results suggest that the state's investment in the program leveraged a 7:1 return to the state's economy.

Bhide Amar V. (2000). *The Origin and Evolution of New Businesses*. New York, NY: Oxford University Press, USA.

The author of this book systematically identifies the differences between how individuals and large companies undertake new initiatives. The author studies previous literature, published case studies, and *Harvard Business Review* articles, and interviews several hundred entrepreneurs. He devises a comprehensive framework for understanding entrepreneurship, focusing on entrepreneurial characteristics and motivations.

Birch, David G.W. (1979). *The Job Generation Process*. MIT Program on Neighborhood and Regional Change. Available at: http://ssrn.com/abstract=1510007.

In this report, the author examines the role of small and new firms in regional job creation. He aims to develop an "economic microscope" that can reach beyond aggregate statistics to explain how the behavior of individual firms caused employment changes in the U.S. The author uses 12 million records from Dun & Bradstreet data for the U.S. for 1969, 1972, 1974, and 1976. The author suggests that it is new ventures, rather than established businesses, that are the principal force in new job creation.

Black, F., & Scholes, M. (1973, May/June). The Pricing of Options and Corporate Liabilities. *Journal of Political Economy*, 81, 637-654.

If options are correctly priced in the market, it should not be possible to make sure profits by creating portfolios of long and short positions in options and their underlying stocks. Using this principle, a theoretical variation formula for options is derived. Since almost all corporate liabilities can be viewed as combinations of options, the formula and the analysis that led to it are also applicable to corporate liabilities such as common stock, corporate bonds, and warrants. In particular, the formula can be used to derive the discount that should be applied to a corporate bond because of the possibility of default.

Bøllingtoft, A., & Ulhøi, J. P. (2005). The Networked Business Incubator: Leveraging Entrepreneurial Agency? *Journal of Business Venturing*, 20(2): 265-290.

Recent years have seen the emergence of a new incubator model, the "networked incubator," which is a hybrid form of the archetypal business incubator, based on territorial synergy, relational symbiosis, and economies of scope. This paper looks at why this new model has emerged and what distinguishes it from the more traditional incubator model. The theoretical basis of the research is social capital theory. Empirically, the paper is based on six months of ethnographic data collected in one of the first known and documented networked incubators. The closing section of the paper addresses the implications for research and practitioners.

Campbell, C., Berge, D., Janus, J., & Olsen, K. (1988). *Change Agents in the New Economy: Business Incubators and Economic Development.* Minneapolis, MN: University of Minnesota.

Are business incubators an effective job creation strategy? If so, how can they be used to create the most benefits for job creation and economic development? By studying incubators in the United States and Canada that had been in operation at least three years, the authors found that incubator firms had created, on average, 6.8 jobs, and graduates had created, on average, 20 jobs. The firms annually added 2.16 jobs while in the incubator and 3.12 jobs, on average, after graduation. Estimated cost per job at 10 U.S. incubators ranged from $3,500 to $7,000. Few firms discontinued operations after moving into the incubator (13.9 percent). In addition, 86 percent of the firms stayed within the same city after they graduated. Two of the most valued incubator services were affordable space and the camaraderie and supportive atmosphere.

Chinsomboon, O.M. (1990). *Incubators in the new economy*. (Master's Thesis). Sloan School of Management, Massachusetts Institute of Technology, Cambridge, MA.

This study examines incubator operating models and organizational forms, with a specific focus on the value-proposition, sustainability, and scalability factor. Based on existing literature and in-depth interviews with stakeholders, the author concludes that incubator success depends partly on their ability to adapt to changes in the demands of their clients.

Clarysse, B., Wright, M., Lockett, A., Van de Velde, E., & Vohora, A. (2005). Spinning out new ventures: A typology of incubation strategies from European research institutions. *Journal of Business Venturing*, 20(2), 183-216.

This paper explores different incubation strategies for spinning-out companies in European Research Institutions. The study uses a two-stage approach. In the first stage, the researchers selected seven spin-out services in five European countries for analysis. Based on an in-depth analysis of these seven cases, the authors identified three distinct incubation models of managing the spin-out process: Low Selective, Supportive, and Incubator – each with very different resource implications. In the second stage, the researchers used 43 cases to validate these incubation models in terms of resources and activities. This process identified two categories that departed from the normative models, namely, the Resource-Deficient group and the Competence-Deficient group.

Colbert, C., Adkins, D., Wolfe, C., and LaPan, K. (2010). *Best Practices in Action: Guidelines for Implementing First-Class Business Incubation Programs, Revised 2nd Edition*. Athens, OH: National Business Incubation Association.

This publication updates a 2000 NBIA publication examining best practices used by national and international incubation programs. Through descriptions developed following interviews and site visits, the authors describe best practices in eight main areas: governance, staffing, finances, facilities management, program evaluation, client entrance and exit, leveraging innovation, and client services. The study also includes ten incubator case studies (seven from the U.S., one from Israel, one from Canada, and one from New Zealand) to illustrate best practices or innovative approaches in a comprehensive incubation program.

Cooke, P. (2001). Regional innovation systems, clusters and the knowledge economy. *Industrial & Corporate Changes*, 10, 945-971.

This paper describes regional innovation systems based on discoveries made by regional scientists, economic geographers, and innovation analysts. It considers how a regional innovation system should be labeled and what factors constitute innovative activity. The paper concludes with the claim that reliance on public intervention is the cause of Europe's innovation gap with the United States.

Cooper, A.C. (1985). The role of incubator organizations in the founding of growth-oriented firms. *Journal of Business Venturing*, Winter 1985, 1(1), 75-87.

This paper uses a sample of 161 new growth-oriented firms to examine the relationship between incubation organizations (organizations where entrepreneurs work before they start their own firms) and entrepreneurial success. The author finds that most firms start geographically close to their incubator organizations. Whereas technical firms tend to be similar to their incubation organizations in terms of the nature of the business, nontechnical firms are less so. The author also finds that contrary to popular belief, with the exception software and biotechnology firms, universities have a less direct role in spinoffs than do business firms.

Copeland, T. (2001). The real-options approach to capital allocation. *Strategic Finance*, 83(4), 33.

This paper compares the traditional Net Present Value system with the newer Real-Options Analysis (ROA). The author argues that ROA takes into account the value of flexibility by allowing the option of assigning additional capital to a project that is more successful than expected. He further argues that this process allows people to make decisions based on current situations instead of distributing an initial investment based on a calculated potential value of the project. Ultimately, he argues that ROA is a more realistic approach to capital allocation.

Culp, Rhonda Phillips. (1996). *A Test of Business Growth Through an Analysis of a Technology Incubation Program*. (Doctoral dissertation). Georgia Institute of Technology.

This research establishes a profile of U.S. technology business incubators, including the frequency and nature of technology transfer; examines the impact of the Advanced Technology Development Center, a technology incubator sponsored by the state of Georgia; and looks at the performance of ATDC as a technology-based economic development program. The study found that current theory is insufficient to explain the phenomenon of technology business incubators, although innovation theory holds the most promise; there has been a low incidence of technology transfer in technology incubators due to a variety of factors, including institutional barriers; and the impact of ATDC on participating firms was not as expected. The author concludes that as a technology-based economic development approach, technology business incubators hold potential to generate net social benefits, if resources are focused on facilitating technology development and technology transfer, and clients are selected in a strategic manner.

Dabson, B., Rist, C., & Schweke, W. (1996, June). Business climate and the role of development incentives. *TheRegion*, 47-49.

State governments are under increasing pressure to create hospitable business climates that bolster their economies. However, while governments are often called upon to welcome businesses by cutting taxes, offering incentives, and decreasing regulations, these actions are not necessarily conducive to business or to residents. States need to develop policies that improve opportunities for profitability and job creation while ensuring that incentives

work effectively as part of an overall strategy for attracting and retaining business within viable communities. Five key factors must be considered: education, physical infrastructure, regulation, taxation, and modernization. While development incentives may not be good overall policy, they can be more effective if governments follow five principles in making incentive decisions: strengthen accountability and disclosure mechanisms in incentive agreements; apply incentives strategically rather than across the board; pick the right incentives for the broadest community benefit; link incentives to local employment opportunities; and look for ways to work with other government leaders and the community to agree upon policies that apply incentives responsibly and in a limited fashion.

DiGiovanna, S., & Lewis, D.A. (1998). *The Future of Technology Incubation in New Jersey: A Strategy for the New Jersey Commission on Science and Technology.* New Brunswick, NJ: Project on Regional and Industrial Economics, Rutgers University.

This policy evaluation of the New Jersey Commission on Science and Technology's investment in six nonprofit technology business incubators suggests that these investments have been good for the state. The study also found that the direct jobs created by business incubator clients cost significantly less than those created through other types of economic development capital projects.

Gatewood, E., Ogden, L. & Hoy, F. (1986). Incubator Center Evolution: The Next Five to Ten Years. *Frontiers of Entrepreneurship Research*. Wellesley, MA: Babson College Center for Entrepreneurial Studies.

The authors profile existing incubation programs and examine the results of a survey of incubator managers about future program directions. The study includes a look at incubator managers' predictions about their program's activities over the next five to ten years regarding business assistance and services, client type, seed capital, and more. The authors also examine advice from managers about successful incubator start-up and survival.

Gerber, Michael E. (1995). *The E-Myth Revisited: Why most businesses don't work and what to do about it*. New York, NY: HarperCollins.

In this book, the author dispels the myths surrounding starting a business and shows how commonplace assumptions can get in the way of running a business. He discusses the steps in the life of a business – from entrepreneurial infancy, through adolescent growing pains, to the mature entrepreneurial perspective. He then shows how to apply the lessons of franchising to any business, whether or not it is a franchise. Finally, he distinguishes between working on your business and working in your business.

Grant Thornton. (2008). *Construction Grants Program Impact Assessment Report*. Washington, DC: U.S. Department of Commerce Economic Development Administration.

The U.S. Economic Development Administration asked Grant Thornton to perform an assessment of the economic impacts and federal costs of its construction program investments. The report draws on recent scholarship, the academic and program management credentials of Grant Thornton's team, and the knowledge/insights of other

federal grant- and loan-making program officials to improve on EDA's existing study, performed by a team of Rutgers University and Princeton University economists in 1997.

Greene, P. & Butler, J. (1996). The minority community as a natural business incubator. *Journal of Business Research*, 36(1), 51-58.

The article examines two methods of business implementation: the formal business incubator and a minority (or natural) business community. Through a review of business literature and a case study, the authors find major differences in the motivations behind service offerings between the two implementation models. However, they also point out some similar traits between the minority community and formal business incubators in the process of business formation.

Grimaldi, R., & Grandi, A. (2005). Business incubators and new venture creation: An assessment of incubating models. *Technovation*, 25(2), 111- 121.

The authors divide business incubators into four categories: Business Innovation Centres, university business incubators, independent private incubators, and corporate private incubators. They develop two main business incubation models based on their examination of existing models and characterizing variables. They use an empirical study of eight Italian incubators to test the hypothesis of the two proposed models. The authors find that the case studies support their hypothesis and argue that the incubation business models are driven by the evolution of company requirements and needs. They stress the importance for incubators to position themselves strategically and to diversify their client services.

Hackett, S. & Dilts, D.M. (2004). The Real Options-Driven Theory of Business Incubation. *Journal of Technology Transfer,* 29(1), 55-82.

The authors employ real options-theoretic reasoning to develop a theory of business incubation. They seek to predict and explain how business incubators and the process of business incubation increase the likelihood that new ventures will survive the early stages of development. According to the authors, their model of the incubation process and specification of the range of possible incubation outcomes reveal implications for managerial practice and policymaking vis-à-vis incubator management.

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

In this article, the authors systematically review the literature on business incubators and business incubation. They focus on primary research concerning incubator development, incubator configurations, incubator client development, incubator-incubation impacts, and theories about incubators-incubation problems. They show that interest in the incubator-incubation concept continues to grow and suggest that new research efforts focus not only on under-researched units of analysis, but also on the incubation process itself.

Hackett, S. & Dilts, D.M. (2008). Inside the black box of business incubation: Study B-scale assessment, model refinement and incubation outcomes. *Journal of Technology Transfer*, 33(5), 439-471.

This study systematically and quantitatively examines the incubation process using a sample of 53 incubators operating in the U.S. By employing the scale development methodology, the authors validate eight reliable, multidimensional scales for measuring new venture incubation, as well as an improved model of the incubation process.

Hamel, G., & Prahalad, C.K. (1994). Competing for the Future. Cambridge, MA: Harvard Business Press.

In this book, the authors use real-life examples and experiences to offer their insights on business management for the 21st century. They suggest a blueprint for what a company must do today if it is to occupy the competitive high ground of tomorrow. They argue that the key to future industry leadership is to develop an independent point of view about tomorrow's opportunities and build capabilities that exploit them.

Hansen, M.T., Chesbrough, H., Norhoa, N., & Sull, D. Networked incubators: Hothouses of the new economy. *Harvard Business Review*, September-October 2000, 74-84.

In this article, the authors argue that one type of incubator, called a networked incubator, represents a fundamentally new and enduring organizational model uniquely suited to growing businesses in the Internet economy. The findings are based on in-depth analyses of leading-edge incubators and a telephone survey of 169 incubators. The authors discuss the distinguishing feature of a networked incubator, pointing out that it can foster partnerships among start-up teams and other successful Internet-oriented firms, thus facilitating knowledge flow across companies and the forging of marketing and technology relationships between them.

Hardy, D., Holden, P., & Vassili, P. (2003). Microfinance Institutions and Public Policy. *Policy Reform*, 6(3), 147-158.

This article focuses on how to use appropriate policy tools to support microfinance institutions (MFIs). Based on a review of key MFI characteristics, the authors explore the worthiness and forms of supporting MFIs and draw conclusions about principles regarding MFI regulation and supervision.

Harrison, B. (1994). *Lean and Mean: The Changing Landscape of Corporate Power in the Age of Flexibility*. New York, NY: Basic Books.

This research examines the changing landscape of the economic structure in advanced capitalist nations focusing on the question of large corporations' current and future role. It highlights that the changes have not reduced the power (and job generating nature) of large corporate interests, but have reshaped the world of work. Essentially through shifting to a more flexible, thus contingent workforce, employers of all sizes are creating new challenges for workers and public policies makers to adapt to the new economic environment.

Harrison, B., & Kanter, S. (1978). The Political Economy of States' Job Creation Business Incentives. *Journal of the American Institute of Planners*, 44(4), 424-435.

Nearly every state government uses tax credits, subsidized loans, and other instruments to induce private investors to expand or construct new facilities within its borders. A theoretical analysis of such policies, in the context of a realistic picture of the contemporary structure of American industry, indicates no reason to expect that tax or related cost-side incentives will – by themselves – generate new investment. If any segment of the business community *is* likely to be responsive, it would be those firms paying the lowest wages and employing the fewest workers. A review of the empirical literature strongly supports the argument against such incentives. Finally, a political-economic analysis of business incentive policies leads the authors to conclude that these costly subsidies constitute a form of "welfare grant" to the business sector, especially in declining areas of the country.

Hernandez-Gantes, V. M. (1995). Fostering entrepreneurship for school-to-business transition: A challenging role for postsecondary education. (ERIC Document Reproduction Service No. ED 383 903). Paper presented at the annual meeting of the American Educational Research Association.

The author studied strategies useful in fostering entrepreneurship through business incubators and postsecondary programs supported by community and technical colleges. The study used data from a survey of entrepreneurs and incubator managers in 74 U.S. business incubators, as well as interviews with entrepreneurs and managers, teachers, and students in business incubators that offer systematic programs designed to develop entrepreneurial skills. The researcher analyzed the data based on quantitative and qualitative descriptions of entrepreneurial experiences in and out of business incubation. The author used the results to develop a profile of entrepreneurs, key factors associated with entrepreneurship, and implications for fostering entrepreneurship through business incubators and community and technical colleges. The use of real information to formulate business plans and as a method of strengthening entrepreneurial skills appears to be an effective instructional strategy for both business incubators and community and technical colleges. In general, the contextual application of educational and training opportunities appears to be critical for successful programs in postsecondary education and in partnerships with business incubators.

Hernández-Gantes, V. M., Sorensen R. P., & Nieri, A. H. (August 1996). *Fostering Entrepreneurship Through Business Incubation: The Role and Prospects of Postsecondary Vocational-Technical Education.* Report 3: Guidebook of Opportunities for Two-Year Technical Colleges. (NCRVE Publication #MDS-727).

This study uses a national survey to examine the involvement of entrepreneurs, business incubators, and postsecondary institutions in educational and training activities aimed at fostering entrepreneurship. The results indicate that incubators sponsored by two-year colleges primarily focus their services on space rental and clerical support. Their

contribution in the areas of business and technical service is disproportionately low compared with the contribution of four-year colleges and graduate schools.

Hurley, K. (2002). Incubator Building. *Economic Development Journal*, 1(2), 53-57.

In this article, the author discusses that the aim in building incubators is to establish a supportive business environment. He explains that this means the development of facilities that offer advantages to businesses and provide an environment in which start-up and growing businesses can prosper. He points out that the advantages offered by the development of incubator facilities also come from the sponsors.

Jack, S. & Anderson, A. (2002). The effects of embeddedness on the entrepreneurial process. *Journal of Business Venturing*, 17(20), 467-487.

This paper explores how entrepreneurs create and operate businesses based on local social structures. Using qualitative research methods, the authors consider the mechanism by which an entrepreneur becomes part of the local structure. Results suggest that this "embeddedness" is an important factor in the entrepreneurial process and a major factor in business sustainability.

Kirchhoff, B.A. (1994). *Entrepreneurship and Dynamic Capitalism: The Economics of Business Firm Formation and Growth*. Westport, CT: Praeger Publishers.

By re-examining the general equilibrium theory, this book explores the role of entrepreneurship in business formation and growth from a dynamic perspective. The author describes a process through which new firms enter into the market and compete with establish firms by producing innovative products and services. This process is called dynamic capitalism, which not only generates economic growth but also creates and redistributes wealth.

Knopp, L.C. (2007). *2006 State of the Business Incubation Industry*. Athens, OH: National Business Incubation Association.

This publication is the latest in a series of state of the industry reports prepared by the National Business Incubation Association to examine the latest trends in business incubation. The report covers several areas, including incubator sponsors, type, finances, goals, size, services, and impacts.

Lewis, D.A. (2001). *Does technology incubation work: A critical review of the evidence*. Washington, DC: U.S. Department of Commerce Economic Development Administration.

This publication explores the effect of technology incubators on local social and economic status. Based on a review of existing literature, the author argues that although the average lifespan of incubated companies is longer than that of businesses started independently, the average direct salary of jobs created by incubators is still relatively low. He concludes that technology incubation is still relatively new, and researchers have not been able to study the long-term effects of the industry.

Lewis, D.A. (2005). *The Incubation Edge: How incubator quality and regional capacity affect technology company performance*. Athens, OH: National Business Incubation Association.

In this book, the author argues that in order to effectively evaluate incubator performance, it is important to distinguish the technology business incubation program from regional capacities. He uses discriminant analysis to examine the influence of the incubation program and regional capacity on client firms. The findings suggest that firms receiving incubation benefits as clients can compensate for regional incapacity. Once a client graduates from an incubator, its growth will be more associated with regional attributes than the effects of the incubation program itself.

Lewis, D.A. (2010). Testimony to the U.S. House of Representatives Committee on Small Business: Business Incubators as Job Creators, Wednesday, March 17, 2010. Washington, DC: U.S. House of Representatives. (accessed on March 24, 2010, www.house.gov/smbiz/hearings/hearing-3-17-10-business-incubators/Lewis.pdf).

The U.S. House of Representatives Committee on Small Business conducted a hearing on Business Incubators as Job Creators in March 2010. Lewis' testimony before the committee provides an overview of business incubation theory, best practices, and efficacy, based on the author's 15 years of experience as a researcher in the field.

Lewis, D.A., & Frisch, M. (2008). Modeling the performance of technology business incubators at the international scale: Entrepreneurial policy development in regional context, Unpublished Manuscript.

This article examines technology business incubation as a regional development policy. The authors document the extent and spread of business incubation strategies from the United States to the rest of the world. They also develop a statistical model to test factors that affect entrepreneurial success on three scales: the incubator, the region, and the nation. The findings contribute to a better understanding of the policy instruments that support entrepreneurial activity and enhance regional development.

Lichtenstein, G. (1992). *The significance of relationships in entrepreneurial development: A case study of the ecology of enterprise in two business incubators*. (Unpublished dissertation). University of Pennsylvania.

The researcher used two business incubators – the Fulton-Carroll Center in Chicago and the Enterprise Development Center on Route 128 – as settings in which to explore the connection between relationships and entrepreneurship. He concluded that the most important contribution of business incubators to entrepreneurship lies in the opportunities they provide for entrepreneurs to interact and develop relationships with other entrepreneurs, the incubator manager, and other individuals associated with the incubator. Entrepreneurs receive three types of benefits: instrumental (such as increased sales, lower costs, enhanced capabilities, and reduced risk); psychological; and developmental. Lacking sufficient resources and skills, entrepreneurs must create or establish access to them by developing relationships of interdependence with others. Relationships are the vehicles that make the interactions as well as these benefits possible.

Lumpkin, J., & Ireland, R.D. (1988). Screening practices of new business incubators: The evaluation of critical success factors. *American Journal of Small Business*, 12(4), 59-81.

This study examines how incubator managers use critical success factors in screening new clients, and examines the relationship between these factors and incubator sponsorship, physical characteristics, and objectives. Based on data collected from the self-administered questionnaires, the authors conclude that sponsorship is the only factor associated with screening factors.

Lyons, S.T., & Hamlin, R.E. (2001). *Creating an Economic Development Action Plan.* Santa Barbara, CA: Greenwood Publishing Group.

Providing a useful guide for planners and students of planning, this revised and updated edition of Lyons and Hamlin's 1990 book offers a framework for formulating an economic development plan for a local community and explains several emerging strategies. Stating that economic development planning continues to focus too narrowly on job creation at the expense of long-term goals, the authors focus on the secondary and long-term effects of local development activities. Job creation, they claim, should be the end product of a well-considered, comprehensive, rational approach to economic development. The book looks at the objectives of economic planning, offering a broad conception of them, and considers the information needed to plan effectively. Following a discussion of public-private partnership tools in the U.S., the book shows how to translate objectives and data into a program of action, and then closes the loop of the planning cycle with a description of program evaluation.

Malizia, Emil E., and Winders, Rebecca M. (1999). Improving Creation Strategies: Tracking Gazelles in Georgia. *Economic Development Review,* 16(3), 9-11.

In this article, the authors perform an analysis of new high-growth enterprises – sometimes called "gazelles" – in Georgia. The analysis examines the employment experiences of Georgia firms between 1989 and 1994. By defining "high-growth" as adding 20 or more employees over the five-year period, the authors found that less than 4% of the young companies in the state meet this criterion.

Markley, D.M., & McNamara, K.T. (1995). Economic and fiscal impacts of a business incubator. *Economic Development Quarterly*, 9(3), 273-278.

This article evaluates the economic and fiscal impacts of an incubator on job creation and local economic development using a case study approach. The study suggests the cost-per-job created by the incubator in the study is lower than that for some programs aimed at attracting large-scale manufacturing plants. The authors argue that incubators can create linkages between firms both inside and outside the local area, resulting in long-term economic benefits and jobs.

McCabe, S. (2005). The Springfield Technical Community College Technology Park – A creative use of real estate: Converting a derelict property into an economic development engine. *Community College Journal of Research & Practice*, 29(8), 599-607.

Based on a descriptive analysis of the development of the Springfield Technical Community College Technology Park, this study explores the impact of a community college model on the local economy in creating jobs and nurturing ventures. Based on this successful example, the author suggests that community colleges are "logical sources" for business initiatives and could play an important role in regional economic development.

McGrath, Rita Gunther. (1999). Falling Forward: Real Options Reasoning and Entrepreneurial Failure. *The Academy of Management Review*, 24(1), 13-30.

In this article, the author uses real options reasoning to develop a more balanced perspective on the role of entrepreneurial failure in wealth creation. According to the author, although failure in entrepreneurship is pervasive, theory often reflects an equally pervasive anti-failure bias. The author makes suggestions as to how gains from entrepreneurship may be maximized and losses mitigated.

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

This paper presents results from a national survey of more than 30 university-sponsored technology incubators, focusing on a sample comprising three state university-sponsored and three private university-sponsored incubators. The author examines practices and performances through a set of dimensions, including organizational design, funding sources, and growth of client firms. The findings suggest no significant differences based on the type of sponsorship – state or private; university-sponsored technology incubators appear to provide a supportive environment for the development of new technology-based firms under certain conditions.

Mian, S. (1996). Assessing value-added contributions of university technology business incubators to tenant firms. *Research Policy*, 25, 325-335.

This article assesses the value-added contributions of university technology business incubators to their technology-based client firms. This author presents empirical data on university technology incubators, focusing on their value-added dimensions, which include typical incubator services and university-related inputs. The study is based on a national survey of six representative programs, providing insight into the value-added aspects as perceived by the clients. The author concludes that several services offered by university technology business incubators – specifically some of the university-related inputs such as university image, laboratories and equipment, and student employees – add major value to the client firms, making the these incubation programs a viable strategy for nurturing firms.

Molnar, L., De Pietro, R., & Gillette, L. (1996). *Sustaining economic growth: The positive impact of the Michigan incubator industry, 1985-1995*. East Lansing, MI: University of Michigan Business School & the Michigan Business Incubator Association.

This study aims to identify trends, growth status, and economic impacts of the Michigan business incubator industry. Through analysis on survey data collected from the state business incubator graduate firms, current incubator clients, and incubator managers, the authors find that Michigan-based incubator graduate firms significantly affect the economies of their local communities in areas such as revenue accumulation and job creation. The results also suggest that incubators provide reliable source and methods for economic and business development for the state.

Molnar, L., Grimes, D., Edelstein, J., De Pietro, R., Sherman, H., Adkins, D., & Tornatzky, L. (1997). *Impact of Incubator Investments.* Washington, DC: U.S. Department of Commerce Economic Development Administration.

The purpose of this study is to evaluate the economic impacts of business incubator investments. On the basis of surveys, focus groups, stakeholder panels, and regional macroeconomic analysis, the researchers find that business incubation programs perform well in job creation and nurturing entrepreneurship. Further, they argue that business incubators create new jobs for a low subsidy cost and their graduate firms exhibit high survival rates.

Nash-Hoff, M. (1998). *For-Profit Incubators: An Industry Survey Report*. Athens, OH: National Business Incubation Association.

The American Enterprise Center surveyed 52 for-profit incubators to compare these programs with their nonprofit counterparts. The author finds that for-profit incubators are typically larger than nonprofit incubators, and they are not as interested in graduating firms. The study also includes an analysis of four models of for-profit incubators.

Peterson, J., et al. (1985). *Creating Jobs by Creating Businesses: The Role of Business Incubators.* Washington, DC: National Council for Urban Economic Development.

This report provides an early assessment of business incubators from the standpoint of local economic development, based on a national survey of business incubators conducted in late 1984 and early 1985. The report looks at a number of factors, including incubator goals and objectives, incubator operations, incubator services, incubator staffing, and outcomes.

Phan, P., Siegel, D., & Wright, M. (2005). Science parks and incubators: Observation, synthesis and future research. *Journal of Business Venturing*, 20, 165-182.

Based on a comprehensive literature review, this article argues that there is no systematic framework to understand science parks and incubators. The authors also contend that there is a failure to understand the dynamic nature of both incubators and their client firms. Finally, they point out a lack of clarity regarding the performance of science parks and incubators, which they associate with problems in identifying the nature of performance.

Philips, R. (2002). Technology business incubators: How effective as technology transfer mechanisms? *Technology in Society*, 24(3), 299-316.

This study examines the effectiveness of the technology transfer process for technology business incubators. Through data analysis of a previous survey on all types of incubators, the author finds that technology business incubators performed especially well in client employment and revenues. However, a more focused study of technology business incubators and data collected from 10 managers show that the general level of technology transfer in these incubators is not as high as expected.

Philips, R. (2004). Artful business: Using the arts for community economic development. *Community Development Journal*, 39(2), 112-120.

In this article, the author presents a typology of art-based community development approaches, including business incubation programs, cooperatives, tourist venues, and comprehensive approaches. She uses community-based cases to illustrate the effectiveness of each type of art-based community development program. The author suggests that flexibility and creativity play a key role in arts-based community development, along with creating strong community support.

Porter, M.E., & van der Linde, C. (1995). Toward a new conception of the environment-competitiveness relationship. *Journal of Economic Perspective*, 9(4), 97-118.

This paper examines the relationship between environmental regulations and industrial competitiveness in a new dynamic paradigm. By criticizing the previous literature regarding the cost of regulation compliance, the authors argue that properly designed environmental standards can lead to industrial innovations and competitive advantages over foreign companies under less stringent restrictions. They also suggest that the environmental policy should focus more on relaxing the environment-competitiveness tradeoff.

Price, R. (2004). The role of service providers in establishing networked regional business accelerators in Utah. *International Journal of Technology Management*, 27(5), 465-474.

This article focuses on business accelerators and their functions in supporting business to sustain growth and realize market potential. The author studies the case of Technology to Management, a business accelerator in Utah, particularly looking at how this organization engages service providers in coordinating a regional network of accelerators.

Regional Economic Studies Institute (2001). *Maryland Incubator Impact Analysis*. Baltimore, MD: Maryland Technology Development Corporation.

This study discusses the overall economic benefits generated by the technology incubators in Maryland and the state's capacity to support additional incubation projects. The authors use a combination of survey data from 125 incubator clients and the regional macroeconomic impact model IMPLAN. Results show a concentration of jobs in the biotechnology area and jobs with an average salary that's higher than the state average. Survey data suggest that the most important service provided by the state's incubators was

affordable, functional space. The authors conclude that investing in incubation has a major impact on job creation and the economy in general and that Maryland has the capacity to support additional high-technology incubators.

Reynolds, Paul D., Carter, N., Gartner, W., & Greene, P. (2004). Prevalence of Nascent Entrepreneurs in the United States: Evidence from the Panel Study of Entrepreneurial Dynamics. *Small Business Economics*, 23(4), 263-284.

In this article, the authors use the Panel Study of Entrepreneurial Dynamics (PSED) to provide systematic, reliable, and generalizable data on important features of the entrepreneurial or start-up process. PSED is a national longitudinal sample of 64,622 U.S. households that were contacted to find individuals who were actively engaged in starting new businesses. Results of analyses indicate that over 10.1 million individuals are actively engaged in starting new businesses in the United States, including all categories of individuals (by gender, age, and ethnicity).

Reynolds, P.D., & White, S.B. (1997). In: *The Entrepreneurial Process: Economic Growth, Men, Women, and Minorities*. Westport, CT: Quorum Books.

Entrepreneurship is an extremely important, but little understood, component of the U.S. economy. This book aids that understanding by exploring the challenges and outcomes of the start-up phases of new firms. This is the first detailed, large-scale, longitudinally-based analysis of the entrepreneurial process. The authors use three representative samples of new firms and two representative samples of nascent entrepreneurs (those attempting to start new firms) to consider a variety of factors that affect successful completion of the major transitions in the life of new businesses: conception, birth, and early development (survival and growth). Surprisingly, a substantial minority of start-ups become operational new firms. Among the many lessons the authors learn are that although new firm growth appears to reflect many factors, initial size is of special consequence. Not only are many general insights for entrepreneurs revealed, but the authors also pay special attention to the involvement of women and minorities in entrepreneurship and suggest effective government policy for different stages in the entrepreneurial process.

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

In this article, the author characterizes the incubation process as an interdependent co-production relationship between incubator managers and entrepreneurs. This research explores how various types of business assistance and other factors affect the co-production outputs. Based on case studies of eight business incubators, the author finds that incubator managers who are more heavily involved in both co-production episodes and modalities have greater impacts. Further, he argues that the readiness of entrepreneurs to engage in co-production affects output elasticity.

Rice, M., & Abetti, P. (1992). *Intervention mechanism utilized by business incubators to influence the critical success factors of new ventures: An exploratory study*. Fontainebleau, France: Paper presented at Babson College Entrepreneurship Conference, INSEAD.

This paper examines the practices and effectiveness of incubator intervention mechanism through a comparison of two groups of entrepreneurs: those who appear to be successful at using intervention and those who do not. Using site visits and in-depth interviews with incubator managers and entrepreneurs, the authors find that intervention effectiveness is related to a variety of factors, including entrepreneurs' responsiveness and capacity, the intensity of intervention, and the organizational structure of the incubator

Rice, M., & Mathews, J. (1995) *Growing New Ventures, Creating New Jobs*. Westport, CT: Quorum Books.

This book provides business incubator sponsors, boards, and management teams with proven strategies for enhancing the creation and development of new ventures and ensuring the success of programs that support business growth and development. Authors Matthews and Rice explain the three key principles of successful business incubation; the 10 best practices for starting, developing, and managing a business incubation program; ways to attract high-quality entrepreneurs; the litmus test to determine an incubator's feasibility; and many hands-on examples from the directors of some of the country's top business incubators.

Rice, M., Peters, L., & Sundararajan, M. (2004). The role of incubators in the entrepreneurial process. *Journal of Technology Transfer*, 29(1), 83-91.

This study intends to improve the understanding of how incubators affect the entrepreneurial process. The authors employ both interview data and quantitative outcome data to examine the impact of different incubator services – including infrastructures, coaching, and networks – on the graduation rates of the client firms. They use a quantitative model to compare impact patterns on different types of incubators. The authors conclude that their model falls short in explaining the role of the incubators in facilitating entrepreneurship. However, they warn that the graduation rate is only a very rough measure of the ability of incubators to accelerate the entrepreneurial process.

RTI International (2007). *Maryland Incubator Impact Analysis and Evaluation of Additional Incubator Capacity.* Columbia, MD: Maryland Technology Development Corporation.

RTI International assesses the economic impact of Maryland's technology incubators and analyzes the state's capacity for additional technology-based incubators for the Maryland Technology Development Corporation (TEDC). The study also examines barriers faced by incubator-graduate companies and researches effective policies to mitigate these barriers.

Ruef, M. (2002). Strong ties, weak ties and islands: Structural and cultural predictors of organizational innovation. *Industrial and Corporate Change,* 11(3), 427-449.

How does the tendency of entrepreneurs to engage in innovation relate to their structural and cultural embeddedness? Using micro-data on entrepreneurial teams and the

organizational innovations they attempt to develop, this article presents a predictive model of creative action to address this question. Capacity for creative action is seen to be a function of the ability of entrepreneurs to obtain non-redundant information from their social networks; avoid pressures for conformity; and sustain trust in developing novel – and potentially profitable – innovations. Probit analyses of over 700 organizational start-ups suggest that these mechanisms exercise effects on innovation via the network ties and enculturation of entrepreneurs.

Schulte, P. (2004). The entrepreneurial university: A strategy for institutional development. *Higher Education in Europe*, 29(2), 187-191.

In this article, the author proposes two important tasks for an entrepreneurial university: training students to be future entrepreneurs and operating the institute in an entrepreneurial way. He also suggests that such universities should develop business incubators and technology parks, and engage students in these organizations to reach self-sustainment and promote regional economic development.

Schumpeter, J. (1934). *The Theory of Economic Development*. Cambridge, MA: Harvard University Press.

The author performs economic analysis on the theory of business cycles and development. He starts with a treatise of circular flow, which, he argues, leads to a stationary state, excluding any innovations and innovative activities. According to the author, the entrepreneur disturbs this equilibrium and is the prime cause of economic development, which proceeds in cyclic fashion along several time scales.

Shahidi, H. (1998). *The Impact of Business Incubators on Entrepreneurial Networking: A Comparative Study of Small, High-Technology Firms*. (Doctoral Dissertation). George Washington University.

This publication examines the impact of business incubators on small, high-technology firms' entrepreneurial networks. A set of comparative hypotheses are posed and tested by statistical comparisons of entrepreneurial network variables between a sample of 61 high-technology incubator firms (interest group) and a sample of 80 comparable non-incubator firms (control group). The author proposes an entrepreneurial network typology, consisting of seven networking groups: board of directors, customers, suppliers, trade organizations, financial sources, consultants and advisors, and strategic partners. This study examines the effectiveness of business incubators by investigating their networking services.

Sherman, H., & Chappell, D.S. (1998). Methodological challenges in evaluating business incubation outcomes. *Economic Development Quarterly*, 12(4), 313-321.

Due to a lack of standardization of approaches for evaluating incubation's effectiveness on economic development, this paper aims to determine the best methodologies for incubators to assess their impacts. The researchers conduct a pilot test on a national sample of 50 incubation programs by employing macroeconomic analysis and surveys of clients, incubator managers, and other stakeholders. The study indicates that business incubators can be an effective economic development tool, and the researchers suggest it is important

for the incubation industry to implement a comprehensive outcome review process and establish a database of performance outcomes.

Sherman, H. (1999). Assessing the intervention effectiveness of business incubation programs on new business start-ups. *Journal of Development Entrepreneurship*, 4(2), 117-133.

This study examines the effectiveness of business incubation programs on new business ventures' survival and growth. By applying both quantitative and qualitative research methodologies (macroeconomic analysis, surveys, and telephone interviews) to a nationwide sample, the author tests two hypothesis: whether business incubation programs can raise survival rates of start-up businesses and whether the effect on sales, income, and job creation differ among different types of incubations. The findings suggest that firms in incubation programs have significantly lower failure rates than other start-ups and that firms in technology incubators have the highest gains in payroll and employment.

Sitkin, S. (1992). Learning through failure: The strategy of small losses. *Research in Organizational Behavior*, 14, 231-266. Greenwich, CT: JAI Press.

This paper covers the benefits of failing and the liabilities of success. Contrary to the traditional scholarly and managerial emphasis on failure avoidance, it argues that failure is an essential prerequisite for effective organizational learning and adaptation. The author draws on research to examine the processes by which failure can enhance learning, adaptation to changing environmental conditions, and systemic resilience when confronting unknown future changes. The article proposes a conceptual foundation for future empirical research that distinguishes the critical characteristics of failures that are hypothesized to foster organizational learning. Designs for systemic failure promotion in organizations are conceptualized and illustrated by application to three important organizational concerns: innovation, safety and security, and mergers and acquisitions.

Smilor, R. (1987). Managing the incubator system: Critical success factors to accelerate new company development. *IEEE Transactions on Engineering Management*, 34(3), 146-155.

This study explores how the incubator concept works, and more specifically, its impact on new company development and economic growth. By implementing a national survey and conducting on-site review, case study analysis, and in-depth interviews, the author identifies 10 factors that are important to the effective management of the incubator system. These factors include on-site business expertise and in-kind financial support. The evidence also suggests that factors important to effective management of the host incubator also increase the chance of incubator client success.

Timmons, J.A. (1999). *New venture creation: Entrepreneurship for the 21st century*. Boston, MA: Irwin McGraw-Hill.

In this book, the author discusses the process of getting a new venture started, growing the venture, successfully harvesting it, and starting again. According to the author, the book is based on experience, nearly two decades of research in the field, real-world application, and refinement in the classroom. The book focuses on determining the risks and rewards of

entrepreneurship, the difference between an idea and an opportunity, and how to get the odds in your favor.

Tornatzky, L., Batts, Y., McCrea, N., Lewis, M., & Quittman, L. (1996). *The art & craft of technology business incubation: Best practices, strategies and tools from 50 programs*. Athens, OH: Southern Technology Council, National Business Incubation Association, and the Ohio University Institute for Local Government Administration & Rural Development.

In an attempt to create ideal economic development strategies, the authors focus on the importance of technology commercialization. To identify industry best practices, they surveyed and interviewed over 50 technology business incubator managers. The authors stress the importance of formulating a better benchmarking system for identifying best practices and facilitating organizational improvement.

Tornatzky, L., Sherman, H., & Adkins, D. (2002). *A national benchmarking analysis of technology business incubator performance and practices.* Athens, OH: National Business Incubation Association.

A total of 17 incubators are chosen as the "best-in-class" from among 79 technology business incubators involved in this study. In addition to conducting qualitative interviews to identify best practices of these programs, the research team collects data on primary and secondary business outcomes and analyzes how these variables correlate with the technology focus of the selected programs. The findings suggest a predictive relationship between the business assistance practices and secondary business outcomes (e.g., equity investments, patents, research grant support, copyrights, and licensed intellectual property).

Ventriss, C., & Gurdon, M. (2006). Emerging Issues in Economic Development Policy and Technology Incubators: The Vermont Center for Emerging Technologies Experience. *Comparative Technology Transfer & Society*, 4(1), 22-52.

The findings of this study are based on existing literature, a survey, and interview data from the key actors associated with the Vermont Center for Emerging Technologies. Based on their findings, the authors find that social networks and capital availability are central to providing the necessary conditions for the success of a technology incubator. Other factors that are also important are a steady focus on certain basic guidelines (interdependency, investment, and integration) and synergistic policies to foster the resources that make up a technological infrastructure.

Voisey, P., Gornall, L., Jones, P., & Thomas, B. (2005). Developing a model for a "ladder of incubation" linked to higher and further education institutions in Wales. *Industry and Higher Education*, 19(6), 445-456.

This paper identifies criteria for successful operations and ongoing sustainability for business incubators. The authors use a multiple case study methodology, in which each case study represents a different combination of business incubation variables. The results show that business incubators need to have a strong relationship with the public and private sector to be successful.

Von Zedtwitz, M. (2003). Classification and management of incubators: Aligning strategic objectives and competitive scope for new business facilitation. *International Journal of Entrepreneurship & Innovation Management,* 3(1), 176-196.

Based on 41 interviews with incubation and R&D managers, this paper outlines five incubator archetypes: the university incubator, the independent commercial incubator, the regional business incubator, the company-internal incubator, and the virtual incubator. The author describes a generic incubator business model, which is refined for different value propositions to customers and other major stakeholders. The author concludes that whether an incubator is for-profit or not, the program should be run as a business. The paper also includes a summary of implications for operational and strategic management of incubators, as well as policy and strategy considerations for universities, venture capitalists, municipalities, corporations, and other parent institutions of incubators.

Wolfe, C., Adkins, D., & Sherman, H. (2000). *Best practices in business incubation*. Athens, OH: National Business Incubation Association.

This study examines best practices used by national and international incubation programs. The authors use a combination of existing publications and new data from successful incubation programs to identify 10 major domains of best practices. The study also includes eight incubator case studies (six from the U.S., one from Israel, and one from the United Kingdom) to illustrate best practices or innovative approaches in a comprehensive incubation program.

VIII. GLOSSARY

Term	Definition
Academics	Credentialed persons who perform research; are versed in scholarly publishing criteria, processes, and standards; and provide advice and guidance based on interpretations of findings in current research.
Administrative Offices	Space in the incubator facility dedicated to offices and other amenities for the incubation program manager or professional staff. This space is not leasable to incubator clients.
Advisory and/or Governing Board	A dedicated group of business leaders, professionals, stakeholders, and/or specialists that provides competent advice and guidance for the incubation program management team on a regular basis. This group may also advise clients. If the board is a governing board, it has additional fiduciary responsibilities for the business incubation program.
Affiliate Client	A client that is not an occupant of an incubator facility but receives many or most incubation services for a fee. See also "virtual clients," as these terms are sometimes used interchangeably.
Anchor Tenant	A business or organization that leases space from an incubator but does not receive incubation services. Space is usually provided at market rate. Resident mentors also may be included in this category.
Angel Investors	Groups of high-net-worth individuals who invest money in high-potential start-up businesses in return for an equity ownership position in the company. They often provide smaller investments and earlier-stage funding than do professional venture capitalists. Angel investors obtain a return on their investments when the companies in which they've invested experience a liquidity event; are acquired, merged, or have a successful IPO (initial public offering of stock); or are bought out by later-stage investors.
Angel Networks	Connected groups of high-net-worth individuals who are accredited angel investors. Sometimes these individuals join together to collectively invest in high-potential start-up businesses. Angel investments are generally smaller and earlier-stage than professional venture capital investments.
Business Incubation Programs	Programs designed to accelerate the successful development of entrepreneurial companies through an array of business support resources and services, developed or orchestrated by incubation program management, and offered both in the incubator and through its network of contacts. A business incubation program's main goal is to produce successful

	firms that will leave the program financially viable and freestanding. Critical to the definition of an incubation program is the provision of management guidance, technical assistance, and consulting tailored to young growing companies. Incubators usually also provide clients access to appropriate rental space and flexible leases, shared basic business services and equipment, technology support services, and assistance in obtaining the financing necessary for company growth.
Business Incubator Facility	The space or building devoted to housing the business incubation program of services, incubator management, and resident and anchor client companies. "Business incubation program" and "business incubator" often are used synonymously. However, the research team for this project defined a business incubator as a multitenant facility with on-site management that directs a business incubation program, as defined above.
Business Service Providers	Professional business assistance consultants who augment the skills of incubation program staff. These individuals – with expertise in specific subject areas such as marketing, finance, business planning, procurement, and patent law – often provide their services on a no- or low-cost basis. Along with incubator staff, these individuals provide the value-added service that is the core of effective business incubation. These individuals may also be referred to as "outside service providers," denoting that they are professionals resourced by the incubation program but they are not paid staff.
CAD	Computer-aided design involves the use of computer technology for the design of objects real or virtual.
CAE	Computer-aided engineering is the use of computer technology to support engineers in tasks such as analysis, simulation, design, manufacture, planning, diagnosis, and repair.
Client Companies	Participants in incubation programs that receive incubation services from program staff and the program's network of service providers. There are resident clients and affiliate (non-resident) clients.
CNC	Computer numerical control has revolutionized machine tools used in design and manufacture. The machines respond to abstractly coded commands rather than being manually controlled by levers or wheels.
Complementary Benefits	Any benefits that accrue to an incubator sponsor or supporter including reuse of an abandoned facility, creation of student internships, access to SBA guaranteed loan programs, joint research opportunities, etc.

Equity	The value of an incubator's client company that may be shared by owners and investors.
Experienced Entrepreneur	An individual who has experience growing his or her own company or others' companies, including a person who may be a serial entrepreneur.
Financially Sustainable	Having a diversity of dependable income sources, such that if one source of funding fails, the incubation program still will be fully functional.
Full Time	Persons who work 35 hours or more per week in the incubator or for a client company.
Graduate Firms	Clients that exit an incubation program after completing a set of benchmarks or goals. Exit criteria are often part of the client's lease or service agreement, and they apply to both resident and affiliate (non-resident) client companies. Companies that leave the incubator but do not meet the required benchmarks are not considered program graduates.
Hybrid	In terms of sponsorship, a hybrid incubator is one that has multiple sponsors that share financial and/or governance commitments, with no single controlling entity.
Incubation Program Manager	The executive who directs an incubation program's operations. Most managers report to either the chief executive officer of the program's sponsoring organization, a university president or dean, or a board of directors that governs the program. Some incubation program managers have alternative titles, such as president, CEO, or executive director.
Leasable Space	The total amount of space in the incubator facility that is dedicated for rental by both anchor tenants and resident clients (excludes administrative offices and shared common space, for example). This term is used interchangeably with "net leasable space."
Limited Participants	Company representatives or founders who attend training programs or networking meetings (or access mailboxes or other services) without having gone through the selection process required for formal admission to the incubation program.
Low-Income	Population targeted by some incubators that focus on helping poverty-level entrepreneurs. For example, such incubators may provide services to those attempting to leave welfare and provide income for themselves or their families through self-employment.
Manufacturing Incubator	An incubation program designed to assist new enterprises primarily engaged in the manufacturing sector.
Mentors	Industry experts and business service providers who offer ongoing counseling to incubator clients. A mentor provides a voice of experience on a long-term basis, perhaps through

	one or more stages of a company's development. Groups of mentors having different areas of expertise may be assigned to individual companies.
Microentrepreneurs	Entrepreneurs who run businesses that have five or fewer employees, require $35,000 or less in start-up capital, and do not have access to traditional (bank) financing.
MIS	Management information systems are technologies, processes, and protocols used to manage people, payments, receivables, documents, business or manufacturing processes, and other financial information and resources.
Mixed-Use Incubator	An incubation program that fosters the growth of many kinds of companies; the businesses in a mixed-use incubator are not required to fit into any specialized niche. Companies in mixed-use incubators may include service, manufacturing, technology, and other types of firms.
Net Leasable Space	The total amount of space in the incubator facility that is dedicated for rental by both anchor tenants and resident clients (excludes administrative offices and shared common space, for example). This term is used interchangeably with "leasable space."
Occupancy Rate	The percentage of leasable or net leasable space available for client lease that is actually being rented by incubator clients.
Part Time	Persons who work less than 35 hours per week in the incubator or for a client company.
Participating Clients	Incubation program clients who rent and/or use the incubator facilities, programs, or services on a regular basis and have not graduated from the program.
Post-Incubation	Services offered to companies that have graduated from the incubation program (i.e., access to specialized facilities as needed, consulting services, CEO roundtables, and networking functions).
Pre-Incubation	Services offered to companies or individuals who have not been formally admitted to the incubation program (i.e., FastTrac or NxLevel training and business plan reviews).
Primary Stakeholders	The organizations or entities that have or should have an interest in the incubation program's success. In addition to sponsors, these could include local government agencies, economic development organizations, industry sector networks, Small Business Development Centers, and others whose missions are such that they should have an interest or "stake" in the incubation program's success.
Primary Sponsor	Entity that provides regular financial and other support for a business incubation program. A sponsor may or may not have developed the incubation program initially, but a current sponsor maintains ongoing responsibility for managing or governing the incubator and may provide

	subsidies to fund program operations. In some cases, a sponsor may initiate the program, but if it ceases its financial, governance, or management role, the incubator likely would then operate independently with no sponsor. If two or more sponsors provide financial or management support and there is no single controlling or primary controlling entity, the incubation program likely operates with hybrid sponsorship. (See "hybrid.")
Professional Staff	Incubator staff who might include a chief operating officer, information technology professionals, client business advisors, professional facility managers, and/or other management professionals who are normally paid staff of the incubator.
Resident Client	A participant in the incubation program that rents physical space in a facility-based incubator and receives incubation program services that may be provided for additional fees.
Self-Sustainability	Having a diversity of dependable income sources, such that if one source of funding fails, the incubation program still will be fully functional.
RFID	Radio Frequency Identification; usually in the form of tags that can be mechanically scanned or read from several feet away and without being in the line of sight of the tag reader.
SBA	Small Business Administration; offers business support such as training and access to loans.
Service Incubator	An incubation program that fosters the development of entrepreneurial firms in the service industry. Firms may range from landscapers, graphic designers, and consulting firms of many types to Internet-based companies and Web development firms. An incubation program may target a segment of this sector for its services.
Social Entrepreneurs	Entrepreneurs who run companies whose business model includes achieving a social good in addition to being successful in business and generating profits. Such a company might devote a percentage of its profits to a philanthropic cause, or it might devote its services or products to ameliorating a social problem such as hunger or to lack of access to clean water or pharmaceuticals, etc.
Still in Business	Businesses that have participated in the incubation program in the past that are still successfully operating as businesses, generating revenues, developing products, and/or hiring employees.
Technology Incubator	Incubation program that fosters growth of companies based on technologies such as software, biotechnology, robotics, nanotechnology, or instrumentation. Technology incubators may focus on commercializing early-stage technology, developing new applications for existing technology, or both.

Total Annual Revenue	The sum of all incomes generated for an entire fiscal year including: 1) sales; 2) Small Business Innovation Research (SBIR)/Small Business Technology Transfer (STTR) or other grants; 3) Venture Capitalist investments; 4) Angel investments; and 5) technology licensing arrangements.
Total Cash Equity Investments	The sum of all the cash revenues received by a company for which it has offered stock, warrants, or other ownership instruments. Cash equity does not include ownership that is dependent on sweat equity (working in or for the company in return for an ownership interest).
Types of Incubators	Overall industry specialization of an incubation program indicating the program's primary focus area. In this survey, we recognize the following primary types: manufacturing, mixed-use, technology, and service.
Venture Capital Investors	Persons or groups that give cash sums to high-potential start-up businesses in exchange for shares in the company. Venture capitalists always seek an exit strategy in which the company is merged or acquired, or its stock is sold on the public stock markets, permitting the investors to recoup many times their initial investments. Professional venture capitalists generally manage and invest large sums of other peoples' money through a professionally managed entity such as a limited liability partnership.
Virtual Clients	This term may be used interchangeably with "affiliate clients" for clients that are not in residence in an incubator. However, it also may be used to denote clients located at a distance from incubation program management when the program doesn't offer multi-tenant space, or denote clients primarily served via computer and Web-based programs that bring together networks of people and other resources for the purposes of serving client companies that are not housed in any central location.
Volunteers	Persons who accomplish work for the incubation program but are not paid staff. Anyone donating time or services without receiving monetary compensation is a volunteer.
Wi-Fi	Wireless access to the Internet.
Without Graduating	Clients that stopped participating in the incubation program without completing graduation criteria or without completing required business development milestones.

IX. APPENDICES

Appendix A: Variables Included in Constructed Indexes

Management Practices

- Evaluates Service Providers
- Evaluates Program Effectiveness
- Stakeholders Understand Mission
- Stakeholders Support Mission
- Primary Sponsor Understands Mission
- Primary Sponsor Supports Mission
- Selects Clients on Entrepreneurial Basis
- Selects Clients on Cultural Basis
- Evaluates Needs and Plan at Entry
- Written Agreement to Provide Data
- Milestones and Follow-Up
- Has Written Marketing Plan
- Showcases Clients
- Discusses Milestones
- Discusses Alternatives
- Offers Pre/Post Incubation Services
- Has Written Sustainability Plan
- Takes Equity Stakes in Client Firms
- Budget Reviewed Monthly
- Budget Reviewed Quarterly
- Robust Payment System

Incubator Services

- Business Basics
- Shared Administrative Services
- General Legal Services
- Accounting
- Internal Networking
- Marketing Services
- High-Speed Broadband Internet
- Access to Specialized Equipment
- Access to Educational Resources
- Human Resources
- Logistics
- Identify Management Team
- Loaned Executive
- Access to Angel Investors
- Shadow Boards
- Access to Venture Capitalists
- In-house Venture Fund
- Access to Commercial Loans
- Access to Non-Commercial Loans
- Intellectual Property Protection
- Technology Commercialization
- E-Commerce
- Customer Relations
- Links to Strategic Partners
- Regulatory Compliance
- Federal Procurement Assistance
- International Sales
- Manufacturing Processing Assistance
- Prototyping and Product Development
- Comprehensive Business Training
- Economic Literacy
- Presentation Skills Development
- Business Etiquette Training

Incubator Goals

- Creating Jobs in the Community/Region
- Diversifying the Local/Regional Economy
- Building/Accelerating Growth of a Business/Industry
- Retaining Businesses in/Attracting Firms to the Region
- Commercializing Technologies
- Generating Complementary Benefits for the Sponsor
- Identifying Potential Spin-in or Spin-out Businesses
- Generating Net Income for Incubator or Sponsor
- Fostering the Entrepreneurial Climate
- Revitalizing Distressed Neighborhood
- Encouraging Minority or Women Entrepreneurship
- Moving People From Welfare to Work
- Other

Advisory Board

- Number on People on Board
- Patent Attorney on Board
- Local Economic Development Official on Board
- State Economic Development Official on Board
- Federal Economic Development Official on Board
- Representative of Finance Community on Board
- Chamber Member on Board
- Accountant on Board
- Local Government Official on Board
- Real Estate Manager/Developer on Board
- State Government Official on Board
- Tech-Transfer Specialist on Board
- Corporate Executive on Board

Appendix A: Variables Included in Constructed Indexes

Business Attorney on Board
University Official on Board
Incubator Manager on Board
Marketing Expert on Board
Graduate Firm Representative on Board
Experienced Entrepreneur on Board

Outcome Data Collection

Collects Client Firm Employment Data
Collects Affiliate Firm Employment Data
Collects Graduate Firm Employment Data
Collects Client Firm Revenues Data
Collects Affiliate Firm Revenues Data
Collects Graduate Firm Revenues Data
Collects Client Firm Sales Data
Collects Affiliate Firm Sales Data
Collects Graduate Firm Sales Data
Collects Client Firm Patent/Copyright Data
Collects Affiliate Firm Patent/Copyright Data
Collects Graduate Firm Patent/Copyright Data
Collects Client Firm SBIR Data
Collects Affiliate Firm SBIR Data
Collects Graduate Firm SBIR Data
Collects Client Firm Equity Data
Collects Affiliate Firm Equity Data
Collects Graduate Firm Equity Data
Collects Other Client Firm Data
Collects Other Affiliate Firm Data
Collects Other Graduate Firm Data
How Long Graduate Firm Data Is Collected
Graduates Companies Based on Time
Graduates Companies When Outgrow Space
Graduates Companies When Meet Milestones
Has No Specific Graduation Policy
Other Graduation Policies

Appendix B: Best Predictive Models for All Dependent Variables								
All Predictors Variables for Entry	**Survival Rates of Graduate Firms**	**Graduates per Year**	**Change in Graduate FTEs 2003-08**	**Change in Graduate Firms 2003-08**	**% Change in Graduate Firms 2003-08**	**Graduate FTEs 2008**	**Graduate PTEs 2008**	**Graduate Firms 2008**
Manager's Total Hours	**1**	**1**		**1**				
Manager's % Time Delivering Services							**1**	
Manager's % Time Delivering Fundraising								
Manager's Experience			**1**			**1**		**1**
Manager's Time with Current Program								
Program Expenses Total								
Program Revenues Total				**1**		**1**		**1**
% Revenues from Rent and Fees for Services								
Total Square Footage					**1**	**1**		
% Square Footage for Clients								
% Square Footage for Administration								
% Square Footage for Common Use								
Has Strategic Plan								
Has Mission Statement								
Graduated Based on Time								
Graduate Out Grew Space y/m								
Graduate Meet all Milestones								
No Specific Graduate Policy								
Client Staff Ratio (1,2,3)								
Client Staff Ratio (Proportional, No Outliers)	**1**	**1**			**1**			**1**
Year Accepting Clients (No Outliers)								
Showcases Clients								
Establishes Milestones at Entry							**1**	
Written Agreement to Collect Data								
Select Client Base on Potential Success								

Appendix B: Best Predictive Models for All Dependent Variables								
All Predictors Variables for Entry	**Survival Rates of Graduate Firms**	**Graduates per Year**	**Change in Graduate FTEs 2003-08**	**Change in Graduate Firms 2003-08**	**% Change in Graduate Firms 2003-08**	**Graduate FTEs 2008**	**Graduate PTEs 2008**	**Graduate Firms 2008**
Select Client Base on Cultural Fit							**1**	
Evaluates Service Providers								
Evaluates Service Program								
Pre and/or Post Incubation Services								
Budget Reviewed Monthly								
Budget Reviewed Quarterly								
Has Written Sustainability Plan								
Has Written Marketing Plan								
Management Practices Index 1	**1**	**1**						**1**
Management Practices Index 2						**1**		
Management Practices Index 3			**1**					
Management Practices Index 4					**1**		**1**	
Services Index 1								
Services Index 2			**1**					
Services Index 3								
Services Index 4								
Number of Service Providers	**1**			**1**				**1**
Goals Index 1								
Goals Index 2		**1**						
Goals Index 3				**1**	**1**			
Advisory Board Membership Index 1						**1**	**1**	**1**
Advisory Board Membership Index 2	**1**			**1**				
Advisory Board Membership Total								
Graduate Data Collection Index 1				**1**				
Graduate Data Collection Index 2		**1**						

Appendix B: Best Predictive Models for All Dependent Variables								
All Predictors Variables for Entry	**Survival Rates of Graduate Firms**	**Graduates per Year**	**Change in Graduate FTEs 2003-08**	**Change in Graduate Firms 2003-08**	**% Change in Graduate Firms 2003-08**	**Graduate FTEs 2008**	**Graduate PTEs 2008**	**Graduate Firms 2008**
Graduate Data Collection Index 3								
Graduate Data Collection Index 4								
How Long Graduate Data Collected			**1**		**1**	**1**	**1**	
Note: 1 indicates best independent variable and meets the criteria for use (p<.3; % predicted>45)								
Note: 0 indicates best predictor variable but does not meet use criteria								

Appendix B: Best Predictive Models for All Dependent Variables									
All Predictors Variables for Entry	**Graduate FTEs 2003**	**Graduate Firms 2003**	**Graduate Revenue 2008**	**Change in Resident FTEs 2003-08**	**Change in Resident PTEs 2003-08**	**Change in Resident Firms 2003-08**	**% Change in Resident FTEs 2003-08**	**% Change in Resident Firms 2003-08**	**Resident FTEs 2008**
Manager's Total Hours		**1**					**1**		
Manager's % Time Delivering Services									
Manager's % Time Delivering Fundraising									
Manager's Experience		**1**							
Manager's Time with Current Program									
Program Expenses Total		**1**		**1**					
Program Revenues Total	**1**		**1**						**1**
% Revenues from Rent and Fees for Services									
Total Square Footage						**1**			
% Square Footage for Clients					**1**				
% Square Footage for Administration	**1**								
% Square Footage for Common Use									
Has Strategic Plan									
Has Mission Statement									
Graduated Based on Time									
Graduate Out Grew Space y/m									
Graduate Meet all Milestones						**1**			
No Specific Graduate Policy									
Client Staff Ratio (1,2,3)				**1**					
Client Staff Ratio (Proportional, No Outliers)						**1**	**1**		**1**
Year Accepting Clients (No Outliers)									
Showcases Clients									
Establishes Milestones at Entry									
Written Agreement to Collect Data								**1**	
Select Client Base on Potential Success						**1**			

Appendix B: Best Predictive Models for All Dependent Variables									
All Predictors Variables for Entry	**Graduate FTEs 2003**	**Graduate Firms 2003**	**Graduate Revenue 2008**	**Change in Resident FTEs 2003-08**	**Change in Resident PTEs 2003-08**	**Change in Resident Firms 2003-08**	**% Change in Resident FTEs 2003-08**	**% Change in Resident Firms 2003-08**	**Resident FTEs 2008**
Select Client Base on Cultural Fit				**1**					
Evaluates Service Providers									
Evaluates Service Program									
Pre and/or Post Incubation Services			**1**					**1**	
Budget Reviewed Monthly				**1**					**1**
Budget Reviewed Quarterly					**1**		**1**	**1**	
Has Written Sustainability Plan									
Has Written Marketing Plan							**1**		
Management Practices Index 1									
Management Practices Index 2				**1**			**1**		
Management Practices Index 3						**1**		**1**	
Management Practices Index 4	**1**								
Services Index 1									
Services Index 2									
Services Index 3				**1**					
Services Index 4									
Number of Service Providers		**1**	**1**			**1**	**1**		**1**
Goals Index 1			**1**						
Goals Index 2									
Goals Index 3									
Advisory Board Membership Index 1	**1**				**1**				**1**
Advisory Board Membership Index 2		**1**					**1**		
Advisory Board Membership Total								**1**	
Graduate Data Collection Index 1			**1**			**1**			
Graduate Data Collection Index 2									

Appendix B: Best Predictive Models for All Dependent Variables									
All Predictors Variables for Entry	**Graduate FTEs 2003**	**Graduate Firms 2003**	**Graduate Revenue 2008**	**Change in Resident FTEs 2003-08**	**Change in Resident PTEs 2003-08**	**Change in Resident Firms 2003-08**	**% Change in Resident FTEs 2003-08**	**% Change in Resident Firms 2003-08**	**Resident FTEs 2008**
Graduate Data Collection Index 3									
Graduate Data Collection Index 4									
How Long Graduate Data Collected	**1**			**1**			**1**	**1**	**1**
Note: 1 indicates best independent variable and meets the criteria for use (p<.3; % predicted>45)									
Note: 0 indicates best predictor variable but does not meet use criteria									

Appendix B: Best Predictive Models for All Dependent Variables								
All Predictors Variables for Entry	**Resident PTEs 2008**	**Resident Firms 2008**	**Resident FTEs 2003**	**Resident PTEs 2003**	**Resident Firms 2003**	**Resident Revenue 2008**	**Change in Affiliate FTEs 2003-08**	**Affiliate Revenue 2008**
Manager's Total Hours	**1**			**1**				
Manager's % Time Delivering Services							**1**	
Manager's % Time Delivering Fundraising								
Manager's Experience		**1**	**1**		**1**			
Manager's Time with Current Program								
Program Expenses Total	**1**							
Program Revenues Total		**1**	**1**				**1**	**1**
% Revenues from Rent and Fees for Services				**1**				
Total Square Footage								
% Square Footage for Clients								
% Square Footage for Administration							**1**	
% Square Footage for Common Use								
Has Strategic Plan						**1**		
Has Mission Statement								
Graduated Based on Time								**1**
Graduate Out Grew Space y/m						**1**		**1**
Graduate Meet all Milestones						**1**		
No Specific Graduate Policy								
Client Staff Ratio (1,2,3)	**1**							
Client Staff Ratio (Proportional, No Outliers)		**1**	**1**	**1**	**1**			**1**
Year Accepting Clients (No Outliers)				**1**				
Showcases Clients						**1**		
Establishes Milestones at Entry								
Written Agreement to Collect Data								
Select Client Base on Potential Success								

Appendix B: Best Predictive Models for All Dependent Variables								
All Predictors Variables for Entry	**Resident PTEs 2008**	**Resident Firms 2008**	**Resident FTEs 2003**	**Resident PTEs 2003**	**Resident Firms 2003**	**Resident Revenue 2008**	**Change in Affiliate FTEs 2003-08**	**Affiliate Revenue 2008**
Select Client Base on Cultural Fit								
Evaluates Service Providers								
Evaluates Service Program				**1**				
Pre and/or Post Incubation Services	**1**							
Budget Reviewed Monthly								
Budget Reviewed Quarterly								
Has Written Sustainability Plan				**1**	**1**			
Has Written Marketing Plan	**1**							
Management Practices Index 1	**0**	**1**		**0**	**1**		**0**	**1**
Management Practices Index 2	**0**			**0**			**0**	
Management Practices Index 3	**0**			**0**			**0**	
Management Practices Index 4	**0**			**0**			**0**	
Services Index 1	**0**			**0**			**0**	
Services Index 2	**0**			**0**			**0**	
Services Index 3	**0**		**1**	**0**			**0**	
Services Index 4	**0**			**0**			**0**	
Number of Service Providers	**0**	**1**		**0**	**1**	**1**	**0**	**1**
Goals Index 1	**0**			**0**			**0**	
Goals Index 2	**0**			**0**			**0**	
Goals Index 3	**0**			**0**			**0**	
Advisory Board Membership Index 1	**0**			**0**			**0**	**1**
Advisory Board Membership Index 2	**0**	**1**		**0**			**0**	
Advisory Board Membership Total	**0**			**0**	**1**	**1**	**0**	
Graduate Data Collection Index 1	**0**			**0**		**1**	**0**	
Graduate Data Collection Index 2	**0**			**0**			**0**	

Appendix B: Best Predictive Models for All Dependent Variables								
All Predictors Variables for Entry	**Resident PTEs 2008**	**Resident Firms 2008**	**Resident FTEs 2003**	**Resident PTEs 2003**	**Resident Firms 2003**	**Resident Revenue 2008**	**Change in Affiliate FTEs 2003-08**	**Affiliate Revenue 2008**
Graduate Data Collection Index 3	**0**			**0**			**0**	**1**
Graduate Data Collection Index 4	**0**			**0**			**0**	
How Long Graduate Data Collected	**0**	**1**	**1**	**0**			**0**	
Note: 1 indicates best independent variable and meets the criteria for use (p<.3; % predicted>45)								
Note: 0 indicates best predictor variable but does not meet use criteria								

Appendix B: Best Predictive Models for All Dependent Variables								
All Predictors Variables for Entry	**Survival Rates of Graduate Firms**	**Graduates per Year**	**Change in Graduate FTEs 2003-08**	**Change in Graduate Firms 2003-08**	**% Change in Graduate Firms 2003-08**	**Graduate FTEs 2008**	**Graduate PTEs 2008**	**Graduate Firms 2008**
Manager's Total Hours	**1**	**1**		**1**				
Manager's % Time Delivering Services							**1**	
Manager's % Time Delivering Fundraising								
Manager's Experience			**1**			**1**		**1**
Manager's Time with Current Program								
Program Expenses Total								
Program Revenues Total				**1**		**1**		**1**
% Revenues from Rent and Fees for Services								
Total Square Footage					**1**	**1**		
% Square Footage for Clients								
% Square Footage for Administration								
% Square Footage for Common Use								
Has Strategic Plan								
Has Mission Statement								
Graduated Based on Time								
Graduate Out Grew Space y/m								
Graduate Meet all Milestones								
No Specific Graduate Policy								
Client Staff Ratio (1,2,3)								
Client Staff Ratio (Proportional, No Outliers)	**1**	**1**			**1**			**1**
Year Accepting Clients (No Outliers)								
Showcases Clients								
Establishes Milestones at Entry							**1**	
Written Agreement to Collect Data								
Select Client Base on Potential Success								

Appendix B: Best Predictive Models for All Dependent Variables								
All Predictors Variables for Entry	**Survival Rates of Graduate Firms**	**Graduates per Year**	**Change in Graduate FTEs 2003-08**	**Change in Graduate Firms 2003-08**	**% Change in Graduate Firms 2003-08**	**Graduate FTEs 2008**	**Graduate PTEs 2008**	**Graduate Firms 2008**
Select Client Base on Cultural Fit							**1**	
Evaluates Service Providers								
Evaluates Service Program								
Pre and/or Post Incubation Services								
Budget Reviewed Monthly								
Budget Reviewed Quarterly								
Has Written Sustainability Plan								
Has Written Marketing Plan								
Management Practices Index 1	**1**	**1**						**1**
Management Practices Index 2						**1**		
Management Practices Index 3			**1**					
Management Practices Index 4					**1**		**1**	
Services Index 1								
Services Index 2			**1**					
Services Index 3								
Services Index 4								
Number of Service Providers	**1**			**1**				**1**
Goals Index 1								
Goals Index 2		**1**						
Goals Index 3				**1**	**1**			
Advisory Board Membership Index 1						**1**	**1**	**1**
Advisory Board Membership Index 2	**1**			**1**				
Advisory Board Membership Total								
Graduate Data Collection Index 1				**1**				
Graduate Data Collection Index 2		**1**						

Appendix B: Best Predictive Models for All Dependent Variables								
All Predictors Variables for Entry	**Survival Rates of Graduate Firms**	**Graduates per Year**	**Change in Graduate FTEs 2003-08**	**Change in Graduate Firms 2003-08**	**% Change in Graduate Firms 2003-08**	**Graduate FTEs 2008**	**Graduate PTEs 2008**	**Graduate Firms 2008**
Graduate Data Collection Index 3								
Graduate Data Collection Index 4								
How Long Graduate Data Collected			**1**		**1**	**1**	**1**	
Note: 1 indicates best independent variable and meets the criteria for use (p<.3; % predicted>45)								
Note: 0 indicates best predictor variable but does not meet use criteria								

Appendix B: Best Predictive Models for All Dependent Variables									
All Predictors Variables for Entry	**Graduate FTEs 2003**	**Graduate Firms 2003**	**Graduate Revenue 2008**	**Change in Resident FTEs 2003-08**	**Change in Resident PTEs 2003-08**	**Change in Resident Firms 2003-08**	**% Change in Resident FTEs 2003-08**	**% Change in Resident Firms 2003-08**	**Resident FTEs 2008**
Manager's Total Hours		**1**					**1**		
Manager's % Time Delivering Services									
Manager's % Time Delivering Fundraising									
Manager's Experience		**1**							
Manager's Time with Current Program									
Program Expenses Total		**1**		**1**					
Program Revenues Total	**1**		**1**						**1**
% Revenues from Rent and Fees for Services									
Total Square Footage						**1**			
% Square Footage for Clients					**1**				
% Square Footage for Administration	**1**								
% Square Footage for Common Use									
Has Strategic Plan									
Has Mission Statement									
Graduated Based on Time									
Graduate Out Grew Space y/m									
Graduate Meet all Milestones						**1**			
No Specific Graduate Policy									
Client Staff Ratio (1,2,3)				**1**					
Client Staff Ratio (Proportional, No Outliers)						**1**	**1**		**1**
Year Accepting Clients (No Outliers)									
Showcases Clients									
Establishes Milestones at Entry									
Written Agreement to Collect Data								**1**	
Select Client Base on Potential Success						**1**			

Appendix B: Best Predictive Models for All Dependent Variables									
All Predictors Variables for Entry	**Graduate FTEs 2003**	**Graduate Firms 2003**	**Graduate Revenue 2008**	**Change in Resident FTEs 2003-08**	**Change in Resident PTEs 2003-08**	**Change in Resident Firms 2003-08**	**% Change in Resident FTEs 2003-08**	**% Change in Resident Firms 2003-08**	**Resident FTEs 2008**
Select Client Base on Cultural Fit				**1**					
Evaluates Service Providers									
Evaluates Service Program									
Pre and/or Post Incubation Services			**1**					**1**	
Budget Reviewed Monthly				**1**					**1**
Budget Reviewed Quarterly					**1**		**1**	**1**	
Has Written Sustainability Plan									
Has Written Marketing Plan							**1**		
Management Practices Index 1									
Management Practices Index 2				**1**			**1**		
Management Practices Index 3						**1**		**1**	
Management Practices Index 4	**1**								
Services Index 1									
Services Index 2									
Services Index 3				**1**					
Services Index 4									
Number of Service Providers		**1**	**1**			**1**	**1**		**1**
Goals Index 1			**1**						
Goals Index 2									
Goals Index 3									
Advisory Board Membership Index 1	**1**				**1**				**1**
Advisory Board Membership Index 2		**1**					**1**		
Advisory Board Membership Total								**1**	
Graduate Data Collection Index 1			**1**			**1**			
Graduate Data Collection Index 2									

Appendix B: Best Predictive Models for All Dependent Variables									
All Predictors Variables for Entry	**Graduate FTEs 2003**	**Graduate Firms 2003**	**Graduate Revenue 2008**	**Change in Resident FTEs 2003-08**	**Change in Resident PTEs 2003-08**	**Change in Resident Firms 2003-08**	**% Change in Resident FTEs 2003-08**	**% Change in Resident Firms 2003-08**	**Resident FTEs 2008**
Graduate Data Collection Index 3									
Graduate Data Collection Index 4									
How Long Graduate Data Collected	**1**			**1**			**1**	**1**	**1**
Note: 1 indicates best independent variable and meets the criteria for use (p<.3; % predicted>45)									
Note: 0 indicates best predictor variable but does not meet use criteria									

Appendix B: Best Predictive Models for All Dependent Variables								
All Predictors Variables for Entry	**Resident PTEs 2008**	**Resident Firms 2008**	**Resident FTEs 2003**	**Resident PTEs 2003**	**Resident Firms 2003**	**Resident Revenue 2008**	**Change in Affiliate FTEs 2003-08**	**Affiliate Revenue 2008**
Manager's Total Hours	**1**			**1**				
Manager's % Time Delivering Services							**1**	
Manager's % Time Delivering Fundraising								
Manager's Experience		**1**	**1**		**1**			
Manager's Time with Current Program								
Program Expenses Total	**1**							
Program Revenues Total		**1**	**1**				**1**	**1**
% Revenues from Rent and Fees for Services				**1**				
Total Square Footage								
% Square Footage for Clients								
% Square Footage for Administration							**1**	
% Square Footage for Common Use								
Has Strategic Plan						**1**		
Has Mission Statement								
Graduated Based on Time								**1**
Graduate Out Grew Space y/m						**1**		**1**
Graduate Meet all Milestones						**1**		
No Specific Graduate Policy								
Client Staff Ratio (1,2,3)	**1**							
Client Staff Ratio (Proportional, No Outliers)		**1**	**1**	**1**	**1**			**1**
Year Accepting Clients (No Outliers)				**1**				
Showcases Clients						**1**		
Establishes Milestones at Entry								
Written Agreement to Collect Data								
Select Client Base on Potential Success								

Appendix B: Best Predictive Models for All Dependent Variables								
All Predictors Variables for Entry	**Resident PTEs 2008**	**Resident Firms 2008**	**Resident FTEs 2003**	**Resident PTEs 2003**	**Resident Firms 2003**	**Resident Revenue 2008**	**Change in Affiliate FTEs 2003-08**	**Affiliate Revenue 2008**
Select Client Base on Cultural Fit								
Evaluates Service Providers								
Evaluates Service Program				**1**				
Pre and/or Post Incubation Services	**1**							
Budget Reviewed Monthly								
Budget Reviewed Quarterly								
Has Written Sustainability Plan				**1**	**1**			
Has Written Marketing Plan	**1**							
Management Practices Index 1	**0**	**1**		**0**	**1**		**0**	**1**
Management Practices Index 2	**0**			**0**			**0**	
Management Practices Index 3	**0**			**0**			**0**	
Management Practices Index 4	**0**			**0**			**0**	
Services Index 1	**0**			**0**			**0**	
Services Index 2	**0**			**0**			**0**	
Services Index 3	**0**		**1**	**0**			**0**	
Services Index 4	**0**			**0**			**0**	
Number of Service Providers	**0**	**1**		**0**	**1**	**1**	**0**	**1**
Goals Index 1	**0**			**0**			**0**	
Goals Index 2	**0**			**0**			**0**	
Goals Index 3	**0**			**0**			**0**	
Advisory Board Membership Index 1	**0**			**0**			**0**	**1**
Advisory Board Membership Index 2	**0**	**1**		**0**			**0**	
Advisory Board Membership Total	**0**			**0**	**1**	**1**	**0**	
Graduate Data Collection Index 1	**0**			**0**		**1**	**0**	
Graduate Data Collection Index 2	**0**			**0**			**0**	

Appendix B: Best Predictive Models for All Dependent Variables								
All Predictors Variables for Entry	**Resident PTEs 2008**	**Resident Firms 2008**	**Resident FTEs 2003**	**Resident PTEs 2003**	**Resident Firms 2003**	**Resident Revenue 2008**	**Change in Affiliate FTEs 2003-08**	**Affiliate Revenue 2008**
Graduate Data Collection Index 3	**0**			**0**			**0**	**1**
Graduate Data Collection Index 4	**0**			**0**			**0**	
How Long Graduate Data Collected	**0**	**1**	**1**	**0**			**0**	
Note: 1 indicates best independent variable and meets the criteria for use (p<.3; % predicted>45)								
Note: 0 indicates best predictor variable but does not meet use criteria								

Appendix B: Best Predictive Models for All Dependent Variables								
All Predictors Variables for Entry	**Survival Rates of Graduate Firms**	**Graduates per Year**	**Change in Graduate FTEs 2003-08**	**Change in Graduate Firms 2003-08**	**% Change in Graduate Firms 2003-08**	**Graduate FTEs 2008**	**Graduate PTEs 2008**	**Graduate Firms 2008**
Manager's Total Hours	**1**	**1**		**1**				
Manager's % Time Delivering Services							**1**	
Manager's % Time Delivering Fundraising								
Manager's Experience			**1**			**1**		**1**
Manager's Time with Current Program								
Program Expenses Total								
Program Revenues Total				**1**		**1**		**1**
% Revenues from Rent and Fees for Services								
Total Square Footage					**1**	**1**		
% Square Footage for Clients								
% Square Footage for Administration								
% Square Footage for Common Use								
Has Strategic Plan								
Has Mission Statement								
Graduated Based on Time								
Graduate Out Grew Space y/m								
Graduate Meet all Milestones								
No Specific Graduate Policy								
Client Staff Ratio (1,2,3)								
Client Staff Ratio (Proportional, No Outliers)	**1**	**1**			**1**			**1**
Year Accepting Clients (No Outliers)								
Showcases Clients								
Establishes Milestones at Entry							**1**	
Written Agreement to Collect Data								
Select Client Base on Potential Success								

Appendix B: Best Predictive Models for All Dependent Variables								
All Predictors Variables for Entry	**Survival Rates of Graduate Firms**	**Graduates per Year**	**Change in Graduate FTEs 2003-08**	**Change in Graduate Firms 2003-08**	**% Change in Graduate Firms 2003-08**	**Graduate FTEs 2008**	**Graduate PTEs 2008**	**Graduate Firms 2008**
Select Client Base on Cultural Fit							**1**	
Evaluates Service Providers								
Evaluates Service Program								
Pre and/or Post Incubation Services								
Budget Reviewed Monthly								
Budget Reviewed Quarterly								
Has Written Sustainability Plan								
Has Written Marketing Plan								
Management Practices Index 1	**1**	**1**						**1**
Management Practices Index 2						**1**		
Management Practices Index 3			**1**					
Management Practices Index 4					**1**		**1**	
Services Index 1								
Services Index 2			**1**					
Services Index 3								
Services Index 4								
Number of Service Providers	**1**			**1**				**1**
Goals Index 1								
Goals Index 2		**1**						
Goals Index 3				**1**	**1**			
Advisory Board Membership Index 1						**1**	**1**	**1**
Advisory Board Membership Index 2	**1**			**1**				
Advisory Board Membership Total								
Graduate Data Collection Index 1				**1**				
Graduate Data Collection Index 2		**1**						

Appendix B: Best Predictive Models for All Dependent Variables								
All Predictors Variables for Entry	**Survival Rates of Graduate Firms**	**Graduates per Year**	**Change in Graduate FTEs 2003-08**	**Change in Graduate Firms 2003-08**	**% Change in Graduate Firms 2003-08**	**Graduate FTEs 2008**	**Graduate PTEs 2008**	**Graduate Firms 2008**
Graduate Data Collection Index 3								
Graduate Data Collection Index 4								
How Long Graduate Data Collected			**1**		**1**	**1**	**1**	
Note: 1 indicates best independent variable and meets the criteria for use (p<.3; % predicted>45)								
Note: 0 indicates best predictor variable but does not meet use criteria								

Appendix B: Best Predictive Models for All Dependent Variables									
All Predictors Variables for Entry	**Graduate FTEs 2003**	**Graduate Firms 2003**	**Graduate Revenue 2008**	**Change in Resident FTEs 2003-08**	**Change in Resident PTEs 2003-08**	**Change in Resident Firms 2003-08**	**% Change in Resident FTEs 2003-08**	**% Change in Resident Firms 2003-08**	**Resident FTEs 2008**
Manager's Total Hours		**1**					**1**		
Manager's % Time Delivering Services									
Manager's % Time Delivering Fundraising									
Manager's Experience		**1**							
Manager's Time with Current Program									
Program Expenses Total		**1**		**1**					
Program Revenues Total	**1**		**1**						**1**
% Revenues from Rent and Fees for Services									
Total Square Footage						**1**			
% Square Footage for Clients					**1**				
% Square Footage for Administration	**1**								
% Square Footage for Common Use									
Has Strategic Plan									
Has Mission Statement									
Graduated Based on Time									
Graduate Out Grew Space y/m									
Graduate Meet all Milestones						**1**			
No Specific Graduate Policy									
Client Staff Ratio (1,2,3)				**1**					
Client Staff Ratio (Proportional, No Outliers)						**1**	**1**		**1**
Year Accepting Clients (No Outliers)									
Showcases Clients									
Establishes Milestones at Entry									
Written Agreement to Collect Data								**1**	
Select Client Base on Potential Success						**1**			

Appendix B: Best Predictive Models for All Dependent Variables									
All Predictors Variables for Entry	**Graduate FTEs 2003**	**Graduate Firms 2003**	**Graduate Revenue 2008**	**Change in Resident FTEs 2003-08**	**Change in Resident PTEs 2003-08**	**Change in Resident Firms 2003-08**	**% Change in Resident FTEs 2003-08**	**% Change in Resident Firms 2003-08**	**Resident FTEs 2008**
Select Client Base on Cultural Fit				**1**					
Evaluates Service Providers									
Evaluates Service Program									
Pre and/or Post Incubation Services			**1**					**1**	
Budget Reviewed Monthly				**1**					**1**
Budget Reviewed Quarterly					**1**		**1**	**1**	
Has Written Sustainability Plan									
Has Written Marketing Plan							**1**		
Management Practices Index 1									
Management Practices Index 2				**1**			**1**		
Management Practices Index 3						**1**		**1**	
Management Practices Index 4	**1**								
Services Index 1									
Services Index 2									
Services Index 3				**1**					
Services Index 4									
Number of Service Providers		**1**	**1**			**1**	**1**		**1**
Goals Index 1			**1**						
Goals Index 2									
Goals Index 3									
Advisory Board Membership Index 1	**1**				**1**				**1**
Advisory Board Membership Index 2		**1**					**1**		
Advisory Board Membership Total								**1**	
Graduate Data Collection Index 1			**1**			**1**			
Graduate Data Collection Index 2									

Appendix B: Best Predictive Models for All Dependent Variables									
All Predictors Variables for Entry	**Graduate FTEs 2003**	**Graduate Firms 2003**	**Graduate Revenue 2008**	**Change in Resident FTEs 2003-08**	**Change in Resident PTEs 2003-08**	**Change in Resident Firms 2003-08**	**% Change in Resident FTEs 2003-08**	**% Change in Resident Firms 2003-08**	**Resident FTEs 2008**
Graduate Data Collection Index 3									
Graduate Data Collection Index 4									
How Long Graduate Data Collected	**1**			**1**			**1**	**1**	**1**
Note: 1 indicates best independent variable and meets the criteria for use (p<.3; % predicted>45)									
Note: 0 indicates best predictor variable but does not meet use criteria									

Appendix B: Best Predictive Models for All Dependent Variables								
All Predictors Variables for Entry	**Resident PTEs 2008**	**Resident Firms 2008**	**Resident FTEs 2003**	**Resident PTEs 2003**	**Resident Firms 2003**	**Resident Revenue 2008**	**Change in Affiliate FTEs 2003-08**	**Affiliate Revenue 2008**
Manager's Total Hours	**1**			**1**				
Manager's % Time Delivering Services							**1**	
Manager's % Time Delivering Fundraising								
Manager's Experience		**1**	**1**		**1**			
Manager's Time with Current Program								
Program Expenses Total	**1**							
Program Revenues Total		**1**	**1**				**1**	**1**
% Revenues from Rent and Fees for Services				**1**				
Total Square Footage								
% Square Footage for Clients								
% Square Footage for Administration							**1**	
% Square Footage for Common Use								
Has Strategic Plan						**1**		
Has Mission Statement								
Graduated Based on Time								**1**
Graduate Out Grew Space y/m						**1**		**1**
Graduate Meet all Milestones						**1**		
No Specific Graduate Policy								
Client Staff Ratio (1,2,3)	**1**							
Client Staff Ratio (Proportional, No Outliers)		**1**	**1**	**1**	**1**			**1**
Year Accepting Clients (No Outliers)				**1**				
Showcases Clients						**1**		
Establishes Milestones at Entry								
Written Agreement to Collect Data								
Select Client Base on Potential Success								

Appendix B: Best Predictive Models for All Dependent Variables								
All Predictors Variables for Entry	**Resident PTEs 2008**	**Resident Firms 2008**	**Resident FTEs 2003**	**Resident PTEs 2003**	**Resident Firms 2003**	**Resident Revenue 2008**	**Change in Affiliate FTEs 2003-08**	**Affiliate Revenue 2008**
Select Client Base on Cultural Fit								
Evaluates Service Providers								
Evaluates Service Program				**1**				
Pre and/or Post Incubation Services	**1**							
Budget Reviewed Monthly								
Budget Reviewed Quarterly								
Has Written Sustainability Plan				**1**	**1**			
Has Written Marketing Plan	**1**							
Management Practices Index 1	**0**	**1**		**0**	**1**		**0**	**1**
Management Practices Index 2	**0**			**0**			**0**	
Management Practices Index 3	**0**			**0**			**0**	
Management Practices Index 4	**0**			**0**			**0**	
Services Index 1	**0**			**0**			**0**	
Services Index 2	**0**			**0**			**0**	
Services Index 3	**0**		**1**	**0**			**0**	
Services Index 4	**0**			**0**			**0**	
Number of Service Providers	**0**	**1**		**0**	**1**	**1**	**0**	**1**
Goals Index 1	**0**			**0**			**0**	
Goals Index 2	**0**			**0**			**0**	
Goals Index 3	**0**			**0**			**0**	
Advisory Board Membership Index 1	**0**			**0**			**0**	**1**
Advisory Board Membership Index 2	**0**	**1**		**0**			**0**	
Advisory Board Membership Total	**0**			**0**	**1**	**1**	**0**	
Graduate Data Collection Index 1	**0**			**0**		**1**	**0**	
Graduate Data Collection Index 2	**0**			**0**			**0**	

Appendix B: Best Predictive Models for All Dependent Variables								
All Predictors Variables for Entry	**Resident PTEs 2008**	**Resident Firms 2008**	**Resident FTEs 2003**	**Resident PTEs 2003**	**Resident Firms 2003**	**Resident Revenue 2008**	**Change in Affiliate FTEs 2003-08**	**Affiliate Revenue 2008**
Graduate Data Collection Index 3	**0**			**0**			**0**	**1**
Graduate Data Collection Index 4	**0**			**0**			**0**	
How Long Graduate Data Collected	**0**	**1**	**1**	**0**			**0**	
Note: 1 indicates best independent variable and meets the criteria for use (p<.3; % predicted>45)								
Note: 0 indicates best predictor variable but does not meet use criteria								

Appendix C: Best Predictive Models for All Dependent Variables (Summary)

All Predictors Variables for Entry	# Entered
Number of Service Providers	14
Client/Staff Ratio (Proportional, No Outliers)	12
How Long Graduate Data Collected	11
Program Revenues Total	9
Advisory Board Membership Index 1	7
Manager's Experience	7
Manager's Total Hours	7
Advisory Board Membership Index 2	6
Management Practices Index 1	6
Graduate Data Collection Index 1	4
Management Practices Index 2	4
Advisory Board Membership Total	3
Budget Reviewed Quarterly	3
Goals Index 3	3
Management Practices Index 3	3
Pre and/or Post Incubation Services	3
Program Expenses Total	3
Total Square Footage	3
Budget Reviewed Monthly	2
Client Staff Ratio (1,2,3)	2
Graduate Meet all Milestones	2
Graduate Outgrew Space	2
Has Written Marketing Plan	2
Has Written Sustainability Plan	2
Management Practices Index 4	2
Select Client Base on Cultural Fit	2

All Predictors Variables for Entry	# Entered
Services Index 3	2
% Revenues From Rent & Fees for Services	1
% Square Footage for Administration	1
% Square Footage for Clients	1
Establishes Milestones at Entry	1
Evaluates Service Program	1
Goals Index 1	1
Graduate Data Collection Index 2	1
Graduate Data Collection Index 3	1
Graduated Based on Time	1
Has Strategic Plan	1
Manager's % Time Delivering Services	1
Select Client Base on Potential Success	1
Services Index 2	1
Showcases Clients	1
Written Agreement to Collect Data	1
Year Accepting Clients (No Outliers)	1
% Square Footage for Common Use	0
Evaluates Service Providers	0
Goals Index 2	0
Graduate Data Collection Index 4	0
Has Mission Statement	0
Manager's % Time Delivering Fundraising	0
Manager's Time with Current Program	0
No Specific Graduate Policy	0
Services Index 1	0
Services Index 4	0

Appendix D: Descriptive Analysis of Regional Capacity for Top-Performing Incubators

Regional Characteristics	Mean	Median	Mode	Std. Deviation	Minimum	Maximum
Total Population	1,284,849.4	422,233	1,183,110	1,909,550.7	4149	7,039,362
Urban Population	74.2	77	77*	18.7	0	97
% 19 to 24 Years	9.6	8	8	3.9	6	23
% 25 to 54 Years	42.8	43	42*	3.0	35	48
% 55 to 64 Years	8.6	9	9	1.2	7	12
% Over 65 Years	12.7	13	13	2.5	8	19
% Less Than High School	17.8	16	16	7.0	7	45
% High School	29.2	29	29	6.0	18	45
% Bachelor's	16.1	16	16	5.1	6	28
% Greater Than Bachelor's	8.8	8	6*	3.4	3	16
Median Household Income	40,280.4	38,548	52,188	8,785.2	24,946	62,024
Per Capita Income	20,511.3	20,118	25,874	4,019.8	10,960	30,769
Percent Nonearned Income	8.0	8	8	1.7	3	15
Median House Value	109,058.6	96,200	143,800	49,829.1	48,000	340,800
Ed Institution Aggregate	107.5	9	3	258.2	1	1161
Total Employment 2002	76,331.8	46,665	29,726	81,189.9	698	291,262
Total Employment 2007	471,940.5	116,966	564,353	828,793.0	9,614	4,136,397
Change Employment 2002-07	367,702.8	31,498	0	785,339.2	-97,359	4,089,073
% Change Employment 2002-07	60.1	90.35	100	54.4	-173	100
Higher Educational Resources Index (per 1,000)	0.666	0.364	0.887	0.800	0.002	4.617
% Urban Normalized	74.8	77	77*	16.54093	30	97

* *Multiple modes exist. The smallest value is shown.*