ELSEVIER

Journal of Business Venturing 17 (2002) 163–187

JOURNAL of BUSINESS VENTURING

Co-production of business assistance in business incubators An exploratory study

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Received 1 March 1998; received in revised form 1 December 1999; accepted 1 January 2000

Abstract

A business incubator — in collaboration with the community in which it operates — is a ''producer'' of business assistance programs. The entrepreneurial ventures located in an incubator, as ''consumers'' of those outputs, operate in an interdependent co-production relationship with the incubator. This study explores the types of business assistance provided through co-production, the modes of co-production, and factors that affect the variability of impact. The allocation of the time of the incubator manager, the intensity of intervention, the breadth of co-production modalities deployed, and the readiness of the entrepreneur to engage in co-production are revealed as factors affecting the output elasticities related to co-production inputs.

Keywords: Co-production; Business incubators; Business assistance

1. Executive summary

This research effort is aimed at exploring the relationship between the managers of business incubation programs and the entrepreneurs who head the companies served by these programs. The objectives of this paper are twofold:

- to provide insights for sponsors and managers of business assistance programs that will allow them to increase program effectiveness, and

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0883-9026/02/$ – see front matter
PII: S0883-9026(00)00055-0

- to provide researchers with a deeper understanding of the theory of co-production as it is applied in the environment of business incubators.

In an economic sense, the relationship between business incubation programs and their entrepreneurial firms can be characterized as interdependent co-production, as defined in the equation below by Parks et al. (1981).

$$Q = c\mathrm{RP}^{d}\mathrm{CP}^{e}$$

Q = output; RP = regular producer inputs; CP = consumer producer inputs; c = a scaling factor; and d and e are the respective output elasticities of each input. The impact of co-production is driven primarily by the nature of the relationship between the incubator manager and the entrepreneur, a relationship that can be characterized as a co-production dyad. In the incubator manager–entrepreneur dyad, the incubator manager is the regular producer; the incubator company entrepreneur is the consumer producer; and the relevant output (Q) is business assistance.

This paper utilizes the three elements of the co-production equation: outputs, inputs of regular and consumer producers, and elasticities — to provide a framework for reporting the results of this exploratory study. A brief summary of the types of business assistance (outputs) and the inputs to co-production is provided. The primary focus of the paper is on four factors uncovered in this study that affect the output elasticities: the total amount of time dedicated to co-production by the incubator manager; the intensity of engagement in co-production by the incubator manager; the breadth of co-production modalities deployed; and the readiness of the entrepreneur to engage in co-production.

The study reveals that the incubator managers with greater impact invest more hours in co-production, invest more time on average in each co-production episode and engage in a broader range of co-production modalities. With respect to co-production modalities, the majority of incubators in this study engage primarily in reactive co-production — addressing a short-term problem or crisis identified by an entrepreneur. However, those incubators recording greater impact were engaged in the full range of co-production modalities — including proactive, continual co-production with some of their companies on a pilot basis. Finally, those entrepreneurs for whom co-production activities had greater impact exhibited greater "readiness" to engage in co-production.

These findings highlight the importance for incubator sponsors and managers of carefully managing the balance between co-production and non-co-production activities of the incubator. They also provide useful implications for how incubator sponsors and managers should structure and deliver their business assistance programs. In addition, by customizing co-production to fit the readiness profiles of their entrepreneurs, incubator managers can enhance the aggregate impact of co-production on their portfolios of incubator companies.

For researchers, this exploratory study illuminates the nature of the co-production dyadic relationship between the incubator manager and the entrepreneur and defines co-production modalities. In addition, it provides insight into the factors that affect output elasticities.

2. Introduction

During the past 20 years, states, regions, and cities have initiated economic development programs aimed at: (1) maintaining existing industries and firms, (2) recruiting established firms from other areas, and (3) creating new industries and enterprises. With respect to the third objective, there has been a proliferation of business and technical assistance programs aimed at increasing the formation, survival, and success rates of small and medium enterprises. These include Small Business Development Centers, Small Business Institutes, Service Core of Retired Executives (SCORE), Enterprise Forums, university-based entrepreneurship centers, special programs offered through Chambers of Commerce, business incubators, and so forth. Most of these programs are reactive — depending on the entrepreneur to initiate the engagement — and episodic.

By comparison, business incubators offer the opportunity to deploy multiple modes of assistance, including continual (literally on a daily basis) interaction — because companies and the incubator staff are co-located in the same facility. In the past 20 years, the number of incubators operating in the US has increased from approximately a dozen to over 500. Whereas there has been extensive investigation of the roles played by Small Business Development Center counselors and by investors (e.g., venture capitalists and angel investors) in providing assistance to entrepreneurs, the research on the nature and impact of business assistance provided in business incubators is limited.

This paper extends prior research conducted on the intervention of business and technical assistance programs in new ventures. We focus on the dyadic relationship between the entrepreneur and the manager of a business incubator. With a deeper understanding of the types of assistance provided and the modes through which assistance is delivered, some of the factors affecting the success of co-production can be identified and characterized.

3. Theoretical framework and research questions

In general, co-production involves joint efforts between two parties, who jointly determine the output of their collaboration. In the typical case, the dyad involves a producer and a consumer. But the discriminating issue is the involvement of the consumer in the production process. Contrary to being passive consumers as in most situations, in a co-production situation, the efforts of the consumer are central to the production of the output. The producer alone cannot determine the quality or the quantity of the output (Parks et al., 1981). Examples of co-production arise mostly in the context of service businesses, particularly public services such as anti-crime efforts, waste collection services, educational programs, and health services. Thus, the success of the solid waste collection program is not only determined by the infrastructure provided by the collectors, but also by the active involvement of the citizens in using the program. Similarly, the output of an educational program is "learning." When the students are not also actively involved in the process, any university, however good the professors or the facilities, will be ineffective in imparting useful knowledge.

Interdependent co-production is represented by the following equation (Parks et al., 1981).

$$Q = c\mathrm{RP}^{d}\mathrm{CP}^{e}$$

where Q = output; RP = regular producer inputs; CP = consumer producer inputs; c = a scaling factor; and d and e are the respective output elasticities of each input.

In the business incubation context, the entrepreneur is the "consumer producer" in the interdependent co-production relationship. When assistance is provided through counseling, the incubator manager is the "regular producer." When assistance is provided through networking, the incubator manager acts as the intermediary — connecting the entrepreneur to other regular producers of business assistance, i.e., the participants in the incubator's know-how network. Business assistance is an intermediate output, i.e., this output leads to secondary outputs that meet the specific objectives of the co-production partners. For example, the entrepreneurs are primarily concerned with creating a sustainable business or a growing business with significant increase in valuation and promise of eventual harvest. The sponsors and management of the business incubator are generally more concerned with the aggregate socioeconomic impact as measured by factors such as job creation, neighborhood revitalization, technology transfer, improvement in the economic condition of disadvantaged minorities, and so forth (Schroeder, 1990). A similar pattern can be observed in the other examples of co-production cited previously — anti-crime, solid waste collection, health service, and education programs. The outputs of co-production can be seen as intermediates to ultimate outputs that are different for the regular and consumer producers.

The questions that drove the study were developed from the general concept of co-production and are listed below.

- What are the outputs of the co-production process targeted at addressing the needs of the consumer producer — the incubator company?
- What are the inputs of regular and consumer producers?
- How is co-production implemented?
- How can variability in outputs, inputs and output elasticities be characterized?

These questions are addressed in the remainder of this paper in two ways: (1) by drawing on the prior literature, and (2) by deriving insights from the detailed interview and survey case data collected during this study. Before proceeding with the exploration of these questions, the methodology implemented in the study is briefly introduced.

4. Methodology

This research project employs a multiple case study methodology. Case study research involves the examination of a phenomenon in its natural setting. The case study method is especially appropriate for research in new topic areas, with a focus on "how" or "why" questions concerning a contemporary set of events (Eisenhardt, 1989). The research design can involve single or multiple cases. Multiple cases are generally regarded as more robust,

providing the observation and analysis of a phenomenon in several settings. Case study research that employs multiple cases should follow a replication logic (Yin, 1994).

The focus of this study is on the effectiveness of co-production of business assistance, and the unit of analysis is the incubator manager/entrepreneur co-production dyad. Data was aggregated to discern patterns with respect to variability of performance of incubator managers and two groups of entrepreneurs, segmented according to the nomination and selection protocol used for this study. The sample was constructed in two steps. First, the researcher selected the incubators. Second, using guidelines provided by the researcher, the managers of the selected incubators nominated entrepreneurs for participation in the study.

4.1. Selection of incubators

Incubator managers, one-half of each co-production dyad, were selected on the basis of the characteristics of their incubator, rather than on the characteristics of the individual managers. This approach reflects the work of Manning et al. (1989), which cites three factors subject to economic policy that determine the rate of conversion of potential ventures to established new ventures: (1) determinants in the community, (2) linkages through a resource network, and (3) characteristics of the individual new ventures. The first two suggest the importance of local conditions. Thus, incubators were chosen to reflect diversity along three dimensions related to variability of local conditions: sponsorship, age, and geographical location.

For the purposes of this study, the length of this startup phase was defined according to data reported in the first National Business Incubation Association (NBIA) State of the Industry Annual Report (National Business Incubation Association, 1990; Schroeder, 1990) on capacity ratios. The capacity ratio (space occupied as a percentage of total rental space available) levels off in the third year of operation on average at approximately 70%. Therefore, for the purposes of this study, incubators 3-years-old or less were considered "new," and incubators 4-years-old or older were considered "old." Compared with their counterparts in "old" incubators, incubator managers in new incubators may be more consumed with operational issues — fundraising, establishing a board, hiring staff, recruiting companies to fill space, setting up operations, and so forth.

It was assumed that the kinds of resources available through the incubator network could vary substantially as a function of type of sponsorship. The NBIA (Schroeder, 1990) categorizes incubators according to the following sponsorship categories: economic development, local government, universities/colleges, and hybrid. For the purposes of this study, the dominant characteristic for differentiating between co-production environments within business incubators was university affiliation. The other category of sponsorship used in defining the sample was economic development.

Location selection for the first three study sites, while reflecting the desire for geographical diversity also reflected research project budgetary limitations. To minimize costs, the western incubators were included because of the opportunity to "piggyback" site visits on a trip undertaken for other purposes. Additional incubators needed to fill out the sample matrix were selected from the population of 47 incubators located in the geographical region composed of the New England states, New York State, and New Jersey using two criteria. Incubators with fewer than 10 companies and for the whom the

tenure of the incubator manager was less than 1 year were not considered. From the 12 incubators that remained after application of these criteria, five were selected to fill out the matrix based on convenience of access.

It is noted that co-production performance did not vary in any substantial way as a function of the three control variables (Rice, 1992a). The sample was constructed with two incubators in each cell of a 2×2 sample matrix based on the dimensions of age of incubator (new vs. old) and sponsorship (university vs. economic development entity). Thus, eight incubators and eight incubator managers were included in this study (Table 1).

4.2. Selection of participating entrepreneurs

The incubator managers were asked to nominate four entrepreneurs to participate in the study. The nomination guidelines indicated that all four entrepreneurs should have engaged in co-production. Two of the four should be representative of those entrepreneurs in the incubator who were successful participants (identified hereafter as Group I entrepreneurs), and the other two should be representative of unsuccessful participants (Group II entrepreneurs). The final sample of entrepreneurs was composed of 16 Group I and 16 Group II entrepreneurs, resulting in a total of 32 co-production pairs in eight incubators.

4.3. Data collection methods

Data was collected through a detailed survey instrument and in-depth interviews, both of which were implemented on site. The interviews followed a standard protocol — with a common set of open-ended questions designed to elicit a discussion of the nature of co-production, including what was effective and what was ineffective or missing. Interviews were taped for later transcription.

Two survey instruments, one for the incubator managers and another for the participating entrepreneurs, evolved out of the experience of the author (1) with the development of the State of the Industry Survey by the NBIA, and (2) with the implementation of the two surveys used in this study in two test environments, i.e., two incubators not included in the final panel of incubators. In order to test the assumption that intensity might have an impact on co-production practices and effectiveness, the first section in the survey instrument for the incubator managers requested an evaluation of time allocation, and information about

Table 1
Business incubator sample matrix

	Sponsorship	
Age	University	Economic development entity
New	Incubator #5 (NE)	Incubator #3 (W)
	Incubator #8 (NE)	Incubator #7 (NE)
Old	Incubator #2 (W)	Incubator #1 (W)
	Incubator #4 (NE)	Incubator #6 (NE)

Key: Incubator #*N* (Location; where NE = Northeast or W = West).

the nature and frequency of co-production. In the first section of the survey instrument administered to the entrepreneurs, the entrepreneurs were asked the same question regarding the nature and frequency of co-production. With the exception of variations in wording to reflect the two vantage points, the remainder of the questions in the two survey instruments are identical.

The heart of the survey instrument is a response matrix with mode of co-production (counseling, networking, training/education) as one dimension of the matrix, and types of co-production outputs (business assistance) as the second dimension. The listing of the 17 types of assistance parallels that developed for the State of the Industry Survey of the NBIA. Each respondent was asked to identify the types of assistance received/provided, through counseling or networking, and to provide a rating of the impact of the business assistance (0 = negative impact; 1 = little or no impact; 2 = some impact; 3 = significant impact; and 4 = critical impact; no response = assistance not received). Thus, for each co-production dyadic relationship, there are generally multiple response dyads. In the discussion of survey responses in this paper, complete response dyads relate to types of business assistance for which both the manager and the entrepreneur provided responses. Half dyads refer to types of business assistance for which either the incubator manager or the entrepreneur provided responses, but not both. The survey instrument also provided detailed information about the incubator managers, the entrepreneurs, and their companies.

4.4. Limitations

Lacking useful objective financial data to characterize variability over time of the performance of the incubator companies, the study utilizes survey and interview data that relies on the memories and the subjective judgment of the respondents. The initial research design called for triangulation as a means to counter this limitation. Using multiple interviewees reduces the risk of a biased perspective that can arise if only a single individual is interviewed and permits a more complete picture of the phenomena being studied (Eisenhardt, 1989; Yin, 1994). In the pilot test of the research instrument, three types of respondents were solicited: incubator managers, entrepreneurs, and advisers/sponsors of the incubator who were involved in co-production. However, it was clear that the respondents in the third category were not sufficiently close to the co-production process to provide useful insights. Even so, the study benefits from the opportunity to compare responses of incubator managers and entrepreneurs — the two primary participants in co-production — to the same set of survey and interview questions.

Given the inexperience of the entrepreneurs in this study, their subjective judgments about the impact of co-production activities can be questioned. When the co-production output is a clear deliverable, e.g., an investment by an angel investor, the completion of a product prototype, or a patent, then the impact of co-production may be somewhat easier to judge. In contrast, when the output is developmental, e.g., of an enhanced marketing capacity or a long range financing plan, the judgment of the entrepreneur about impact may be more suspect. The interview responses revealed the variability in subjective judgments of impact and led to a collapsing of the impact ratings into a binary variable

for most of the analysis: no impact (0 = negative impact; 1 = little or no impact) vs. impact (2 = some impact; 3 = significant impact; and 4 = critical impact.)

The study assumes comparability of factors affecting co-production among incubator managers and the communities in which the incubators operate. It is assumed that incubator managers have a comparable skill set and knowledge base. Results may not be applicable for incubators with managers who are more skilled at facilities management or at dealing with the political aspects of economic development programs. It is also assumed that the determinants in the community are comparable among the eight incubators. The results of this study are not applicable to communities for whom this is not the case, e.g., incubators located in resource-rich regions like Silicon Valley and Route 128 and resource-poor regions, like those in which rural incubators typically operate.

Finally, because of the nature of the phenomena being studied and the data that was collected, the insights and implications presented depend on the interpretative skill and knowledge and experience of the researcher. At the same time, that knowledge and experience can create a bias in the way questions are posed and responses interpreted. The discussions with the eight incubator managers in the study, the insights provided by members of the Research Committee of the NBIA, and the comments from practitioners and academics who have attended presentations of this research have all helped shape the interpretation of the data. Even so, following the recommendations of Eisenhardt (1989) and Yin (1994), it would be useful to conduct future studies with a team of researchers who can bring different perspectives to development and implementation of the research protocol and to the analysis of the data. A mix of different perspectives can increase the likelihood of discovering novel insights. Convergence of opinions from various researchers can enhance confidence in the findings and conflicting views can keep the research from premature closure (Eisenhardt, 1989).

5. Addressing the research questions: insights from the literature and results of the study

5.1. What are the inputs of regular and consumer producers?

Both the incubator managers (the regular producers in the co-production dyad) and the entrepreneurs (the consumer producers in the co-production dyad) bring knowledge and experience to the co-production relationship. However, the raison d'etre of business incubation is to allow entrepreneurs to take advantage of the greater knowledge and experience of the incubator manager. In this sample, both the incubator managers and the entrepreneurs without exception indicated through their extensive interview responses that the superior knowledge and experience of the incubator managers created the potential for them to add value through co-production. The incubator managers in this study are well educated (two with Bachelor's degrees, five with Master's degrees and one with a PhD degree) and all had prior entrepreneurial and/or business counseling experience that prepared them for co-production of business assistance.

The entrepreneurs in this sample are also well educated, with all but one of the 32 respondents holding at least a 4-year college degree. However, only three of the entrepreneurs

reported prior startup venture experience. Typically, the entrepreneurs were sophisticated with respect to the development and production of their product or service, but relatively unsophisticated with respect to one or more aspects of business development, e.g., acquiring and managing financial resources; sales, marketing and distribution; assembling, developing and managing the entrepreneurial team and company workforce; and so forth.

5.2. What are the outputs of co-production targeted at addressing the needs of the consumer producer — the incubator company?

The business planning process defines the ultimate objective of the venture and the path it intends to follow. It also identifies the resources of the firm that can be engaged in pursuing the opportunity, as well as the gaps in resources that must be addressed if the firm is to survive in the short-term and succeed in the long-term (See for example: Sahlman, 1997; Timmons, 1999).

Manning et al. (1989) have emphasized the content aspect of assistance programs. Along these lines content can be divided into functional areas, some of which may represent knowledge gaps that need to be remedied by entrepreneurs, i.e., risk management; legal and intellectual property issues; finance; marketing; technology/product/service development; business planning; team building; and so on. Similarly, there may be other resource gaps that can be filled by the incubator, or through the incubator network. For example, technology development may require access to testing equipment, which may be available through an affiliation between the incubator and a university. The incubator company may need to try out a prototype with an early adopter, or may need to recruit a new key employee. The incubator and its network may supply important contacts to fill these needs. Most new and growing ventures need access to capital and the incubator can be a gateway to sources of capital.

The kinds of gaps that can be addressed through co-production are well understood. The outputs (Q) of the co-production process are types of business assistance. The list of types of assistance used in this study was developed for the State of the Industry Survey by the Research Committee of the NBIA. This listing includes similar elements to those identified in studies of other kinds of business assistance programs. (Chrisman, 1989; Chrisman and Leslie, 1989). These authors categorized types of assistance as strategic, administrative, or operating. The venture may lack some or all of the resources needed for (1) common business administrative processes, e.g., risk management, accounting, protecting intellectual property, negotiating legal agreements, and so forth; (2) human resource management; (3) market development, sales, and distribution; (4) accessing capital and financial management; and (5) development and production of the firm's products or services. These categories are reflected in the types of assistance listed in the survey instrument developed for this study. The frequency counts for responses from incubator company entrepreneurs regarding the types of assistance received are indicated in Table 2 below.

This part of the data collection effort did not produce any surprises with respect to types of assistance. However, the semi-structured interviews with entrepreneurs and managers that followed completion of the surveys produced a useful insight about the nature of the gap being addressed via co-production. Some outputs are directed at

Table 2
Frequency of types of assistance received via counseling and networking

Type of business assistance	Via counseling (# of cases reporting)	Via networking (# of cases reporting)
Group medical/dental insurance	0	4
Other types of insurance	4	7
Accounting/tax assistance	3	6
Legal/patent services	2	8
Business plans/strategic planning	17	6
Advice about team building	12	1
Cash flow management/general financial management	9	4
Sales/marketing/international trade	8	5
Government procurement contracts	3	3
Employment assistance[a]	0	4
Assistance with government grants and loans	9	6
Incubator revolving loan fund	0	0
Incubator seed capital fund for tenant companies	0	1
Assistance to gain outside debt financing	5	7
Assistance to gain outside equity financing (v.c., angel or investment banking	7	9
R&D/product completion	2	1
Access to labs, shops, lab equipment, computer processing, libraries, etc.	0	8
Others. Please list.	0	0

[a] Includes labor issues related to the Job Training and Procurement Act, access to students and faculty, resume flow, etc.

addressing a short-term crisis or problem, hereafter termed "crisis outputs." Alternatively, business assistance may be provided to develop over time the firm's resource base, hereafter termed "development outputs."

Two human resource management situations in one of the incubators used to pilot test the survey instruments and interview protocol illustrate the two types of outputs. In one case, a personnel crisis triggered co-production that produced a "crisis output." A major conflict among founders threatened to result in destructive dissolution of the firm. The incubator manager was asked to intervene and provide mediation. As a result, the partners were able to resolve the dispute without legal action and with minimal impact on the precarious finances of the firm. In another case, co-production related to team building resulted in a "development output." The co-production activities were directed at planning and implementation related to staffing up the firm for growth. The incubator manager — working with human resource consultants in the incubator's know-how network — assisted the entrepreneur in identifying human resource needs, developing training procedures, designing compensation plans — including equity sharing arrangements, implementing hiring processes, and so forth.

Though the first example cited above deals with an internal crisis, external factors can also create the need for co-production of "crisis outputs." The impact of environmental jolts has been explored by Venkataraman and Van de Ven (1998). The impact of environmental jolts on expansion and contraction of the transaction set was explored through three periods in the life

of the venture: honeymoon (0–36 months); adolescence (36–72 months); and post-adolescence (72 months and beyond.) The in-depth interviews in this study revealed that jolts — or crises — can be triggered by both external and internal events.

Clearly, a firm that fails to confront and overcome jolts, crises, and short-term problems will not have the time to develop the resources to support growth. Survival is a necessary but insufficient condition for success, if success is measured in terms of growth. Growth may not be the primary objective of some incubator companies, which are focused instead on creating a small, sustainable enterprise. But for incubator managers and sponsors, growth is a critical issue. From a macroeconomic perspective, the primary objective of most incubators is economic impact — most often measured in terms of job creation. Preliminary analysis of the data from a large-scale study of the dynamics of the small and medium enterprise sector in Canada suggest that increasing the rate of formation is less important from a macroeconomic standpoint than supporting the conversion of startups to growing firms (Amit, 1997).

For all eight incubators in this study, economic impact — particularly in the form of job creation — was a goal. Yet all the firms in this sample were either in "no growth" or "slow growth" modes. At the time of the survey, all but six of the firms had fewer than 10 employees. Two firms had annual sales in excess of US$1 million but less than US$10 million; and two others had sales between US$1/2 million and US$1 million. The remainder all had sales of less than US$1/2 million. This observation leads to the question: "What is it about the co-production process that supports firm survival but does not stimulate firm growth?" This question led to an in-depth examination of the process of co-production.

5.3. How is co-production implemented?

Extensive field experience in business incubation and involvement with the Research Committee of the NBIA led the author to construct the survey instrument assuming four co-production modalities: one that is indirect, i.e., passive environmental intervention, and three that are direct, i.e., counseling, networking, and training/education (Rice, 1992a,b). The pre-test of the survey instrument at the two pilot sites indicated that this typology was useful. However, there were only five survey responses related to training/education (out of a possible 480) with impact rating >1 from the 32 entrepreneurs in the full sample. Further in the interviews only 3 of the 32 entrepreneurs recognized training/education programs as a helpful form of co-production. Hence, co-production of business assistance via training/education was not considered further. The interview and survey data confirmed that the remaining three co-production modalities were in use. Co-production of business assistance via these modalities is represented in Fig. 1 below.

5.3.1. Passive environmental intervention

Passive environmental intervention is, in a sense, an indirect form of co-production. The concept captures the various ways the incubator assists the client companies that do not involve the incubator manager directly. These include:

- Shared business services (e.g., phone answering, receptionist, security, janitorial service, and so forth);

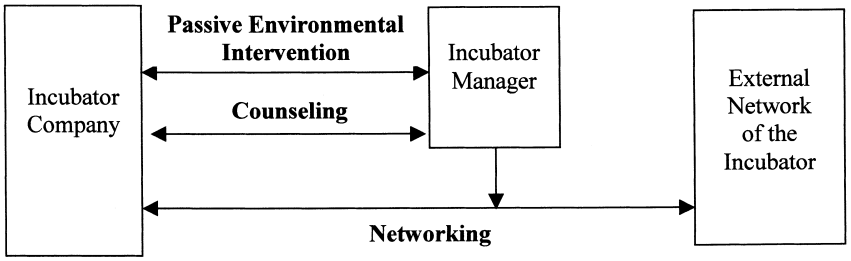

Fig. 1. Co-production modalities.

- Use of equipment (e.g., phone system, copier, fax machine, internet access);
- Shared facilities (e.g., conference room, lunch room); and
- Co-location in an incubator center, which provides the opportunity for informal networking with other entrepreneurs.

In these ways, the incubator provides a supportive environment for young companies. With respect to the value of peer networking, one entrepreneur spoke for most of his peers when he said:

> During our first year, we were operating out of the proverbial garage. Now that we are in the incubator, when we have a problem, we can talk with another entrepreneur who may have had a similar problem. I find that of great use in just keeping kind of a sane mind.

In general, these co-production outputs support firm survival but have little impact on the development of the firm.

5.3.2. Counseling

Counseling refers to the actual dissemination of knowledge and advice to entrepreneurs in the domain of business start-ups and has been emphasized by other researchers as a critical area of assistance programs (Chrisman et al., 1987; Nahavandi and Chesteen, 1988; Smeltzer et al., 1991). Counseling by the incubator manager can be substantially different from that provided by other business assistance programs, such as Small Business Development Centers, Small Business Institutes, Chambers of Commerce, and so forth. Because the incubator manager is on site with all the incubator company entrepreneurs, there is the potential for an ongoing and multi-faceted counseling relationship.

The data collected in this study indicates that one approach to counseling is "reactive and episodic." In this mode, the entrepreneur requests help dealing with a crisis or problem. This is similar to the kind of counseling that is received through other business assistance programs. The entrepreneur initiates the counseling effort. The business assistance is focused on a particular issue and is generally of limited duration.

The second type of counseling is "proactive and episodic." Because of co-location, the incubator manager can be proactive in engaging entrepreneurs in counseling on an episodic basis. For example, one incubator manager in this study stated:

> A lot of this is over the coffee pot kind of business help. My incubator is laid out so that the entrepreneurs walk by my office to use the fax machine or to get a cup of coffee. So they're in and out of my office all the time.

In another incubator, the physical layout of the incubator limited the interaction of entrepreneurs and the incubator staff; hence, the incubator manager made a point of "counseling by walking around." This informal, ad hoc counseling enhances the trust and ease of communication between the entrepreneur and the incubator manager.

The third type of counseling is "continual and proactive." The counseling efforts are focused on the ongoing developmental needs of the entrepreneur and the incubator company (Rice, 1992a,b). The potential value of this type of counseling from the perspective of entrepreneurs is reflected in the comment that follows.

> The incubator manager should provide an ongoing critique — a real, honest business critique. What am I doing? Am I floundering and, if so, why? Any company that wants to belong to an incubator should be subjected to an ongoing review, and I don't mean just superficial review.

All eight incubator managers in this study cited the need to improve their counseling efforts — particularly with respect to impact on the ongoing development of their companies. The importance of continual and proactive counseling was described by incubator manager #4, one of the three incubator managers who was piloting this kind of counseling, as follows:

> When I look at how we can provide business assistance to our incubator companies, there are some little things I can do on the margin for not a lot of resources. I think most incubators, ours included, have developed the capacity to have that little bit of impact — on sort of an ad hoc basis. But beyond that, the intervention has to be intense — aggressive. We need to do it in a real interlocking way — in which we're almost like a quasi-partner in the business.

The manager of incubator #4 engaged in the most successful business planning process recorded — with a regular and ongoing review and business planning effort for one of his four ventures. It was the only case in which both the incubator manager and the entrepreneur rated the impact on the venture as crucial or critical (i.e., a rating of 4). Rice (1992b) has reported the experience of a continual and proactive counseling program implemented at one of the pilot site incubators.

5.3.3. Networking

The central purpose of the incubator is to provide resources in those areas where entrepreneurs have gaps. If the incubator cannot provide the missing resources directly, then

it must connect the entrepreneurs through its external network to those channels or parties that can provide the missing resources. Thus, developing and managing a networking infrastructure is a critical function of the incubator. Since the entrepreneurs lack credibility and a history of operations, the incubator allows them to overcome this liability by providing a networking infrastructure. Networking as a means of overcoming credibility problems and filling resource and knowledge gaps has been emphasized by Birley (1985) and Dubini and Aldrich (1991).

The interview transcripts reveal that in most cases, networking represents a one-shot referral of the entrepreneur by the incubator manger to what Smilor and Gill (1986) termed the "know how network." The community know-how network upon which the incubator manager can draw includes technical experts, bankers, business attorneys, intellectual property attorneys, university professors, accountants, marketing and other types of consultants, and potential debt or equity investors. The referral is usually a reactive response by the incubator manager to an entrepreneur's request for assistance, which the manager is not prepared to provide or which could be provided more effectively by an outside expert. In co-production via networking, the incubator manager serves as the intermediary between the regular producer of assistance (the community) and the consumer producer (the entrepreneur).

5.4. How can variability in outputs, inputs and output elasticities be characterized?

Identifying performance measures in the incubator environment is problematic. As indicated earlier, the firms in this study are for the most part in start up mode or are still financially marginal. There was insufficient variability in financial data against which to compare variability of co-production. Hence, performance is assessed in terms of variability of co-production outputs, i.e., business assistance, reported via the response dyads. It is assumed that co-production of business assistance directed at addressing the firms' resource gaps will improve their probabilities of survival and ultimate success.

The impact of counseling is assessed by examining survey response dyads in three ways: total number of complete dyads; total number of responses by entrepreneurs with an impact rating >1; and ratio of number of complete response dyads to total number of response dyads. In counseling, both the incubator manager and the entrepreneur must be engaged. Hence, response dyads for which both the incubator manager and the entrepreneur recognize that the business assistance was delivered provide the highest confidence that there was impact on the firm. It is also useful to examine all response dyads containing entrepreneurs' responses, including those dyads without a corresponding response by the incubator manager. If the entrepreneur recognizes value in business assistance, even if the manager does not, then there is impact. Finally, the ratio of the number of complete response dyads to total number of response dyads is also an indicator of counseling impact. It utilizes the concept of triangulation of responses, as introduced earlier in Section 4 (Eisenhardt, 1989; Yin, 1994). There is inevitably concern that the data collection relies on the memories of the entrepreneurs and incubator managers about co-production activities. If only one of the co-producers recognizes or remembers a co-production episode or activity, then there is doubt about its impact. The incubator

managers with stronger co-production dyadic relationships should have proportionally fewer half dyads.

The in-depth interview responses related to networking indicated that typically the incubator manager makes the connection between the entrepreneur and the know-how network expert, and then has little or no ongoing involvement in the intervention. Hence, since the entrepreneur alone is in the best position to assess co-production via networking, the survey responses of the entrepreneurs with ratings >1 are used to assess networking impact.

The rankings are based on the combination of the factors in columns 2–5 in the Table 3 below. As will become apparent shortly, more useful than the absolute rankings is clustering of the incubators into three groups. With respect to co-production impact, incubators #7, #2, and #1 appear to be the weakest; incubators #3, #4, and #8 appear to be the strongest; and incubators #5 and #6 fall in the middle. Tables 3 and 4 are structured to indicate this clustering.

Three factors emerge from the interview and survey data that appear to contribute to the variability of impact of the incubator manager in co-production:

- Time available for co-production;
- Intensity of co-production; and
- Range of co-production modalities deployed.

5.4.1. Time available for co-production

One section of the survey asked incubator managers to allocate their time among co-production and various administrative activities. All incubator managers in this sample have additional duties beyond co-production of business assistance. These are primarily administrative functions related to the continuation of the incubator program: facilities management, business operations, marketing, fundraising, staff management, building and sustaining the know-how network affiliated with the incubator, and serving in other economic development capacities.

Table 3
Impact of incubator managers

Incubator #	Counseling: # of complete response dyads with entrepreneur responses >1	Counseling: # of entrepreneur responses >1	Counseling: ratio of complete to total response dyads	Networking: # of entrepreneur responses >1	Overall rank based on assessed impact
7	2	2	0.26	3	8
2	2	7	0.12	3	7
1	5	5	0.18	6	6
6	5	5	0.28	9	5
5	3	7	0.26	9	4
3	6	7	0.42	11	3
4	9	11	0.43	9	2
8	10	13	0.39	10	1

Table 4
Factors contributing to co-production impact of incubator managers

Inc # in order of increasing impact	Hours per week dedicated to co-production	Intensity (hours/ intervention episode	Passive environmental intervention	Reactive crisis intervention	Proactive crisis intervention	Proactive developmental intervention
7	3	0.7	Yes	Yes	No	No
2	7	1.2	Yes	Yes	No	No
1	3	0.6	Yes	Yes	No	No
6	10	1.3	Yes	Yes	No	No
5	11	2.6	Yes	Yes	Yes	No
3	22	2.1	Yes	Yes	Yes	Yes
4	12	1.9	Yes	Yes	Yes	Yes
8	10	1.7	Yes	Yes	Yes	Yes

5.4.2. Intensity of co-production

Incubator managers were also asked to estimate the frequency of their engagement in co-production activities for all the companies in their incubators. Though the amount of time dedicated to each engagement varied, the average amount of time per co-production episode for each incubator manager provides an indicator of intensity of intervention.

5.4.3. Range of co-production types deployed

All eight incubators provided a supportive environment (passive environmental intervention). All eight incubator managers also engaged in co-production activities in response to a crisis or problem situation identified by an entrepreneur. The four incubator managers with highest impact were proactive in seeking out problems or crises to which they could respond, and the three incubator managers with highest impact were piloting programs that proactively applied co-production to the development of resources that could support long-term sustainability and success of their incubator companies.

The data for each incubator related to these three factors is presented in Table 4. The incubators are listed according to the rankings derived from the analysis of impact presented in Table 3 above.

The pattern that emerges from Table 4 is that the incubator managers with higher impact invest more hours in co-production, invest more time on average in each co-production episode, and engage in a broader range of co-production modalities. The interview data reveals that the less effective managers are distracted from co-production to a greater degree than their counterparts in the second group. The three incubator managers ranked lowest with respect to co-production impact were under more pressure from their sponsors to engage in other economic development activities and in fundraising to sustain their programs. The less effective incubator managers were also exclusively reactive, engaging in co-production only in response to an inquiry from an entrepreneur. By comparison, the more effective incubator managers frequently took the initiative in engaging the entrepreneurs in the intervention process. In fact, the most effective incubator managers had developed mechanisms for engaging in ongoing, rather than episodic, co-production with some of their client companies.

5.4.4. Readiness of entrepreneurs for co-production

As indicated in Section 4, the study was structured to enable exploration of differences in how entrepreneurs engage in the co-production process. The incubator managers nominated two kinds of entrepreneurs for inclusion in the study: those who engaged in co-production and for whom impact was relatively high (Group I entrepreneurs); and those who engaged in co-production and for whom impact was relatively low (Group II entrepreneurs). The data gathering process produced the following comparative data.

- In their survey responses, the incubator managers reported engaging Group II entrepreneurs in networking and counseling only slightly less frequently than Group I entrepreneurs (86% as often).
- In their survey responses, Group II entrepreneurs reported assistance via counseling 56% as frequently as Group I entrepreneurs, and via networking, 71% as frequently as Group I entrepreneurs. The incidence of complete dyads — in which both the incubator manager and the entrepreneur both reported the shared counseling experience — occurred 42% as frequently for Group II entrepreneurs as Group I entrepreneurs.
- In the in-depth interviews, 14 of 16 Group I entrepreneurs reported counseling as one of the most helpful benefits of being in the incubator. Only 2 of 16 Group II entrepreneurs cited counseling as helpful. (All eight incubator managers cited counseling as one of the ways the incubator is most helpful to participating entrepreneurs.)
- In the interviews, 11 of 16 Group I entrepreneurs cited networking as helpful while 7 of 16 Group II entrepreneurs found it helpful. (All eight incubator managers reported that networking was one of the ways the incubator is most helpful to the participating entrepreneurs.)

The pattern that emerges is that the Group I entrepreneurs were more oriented toward taking advantage of opportunities to engage in co-production, and more frequently recognized the value of counseling and networking.

6. Discussion of results

The model presented below indicates that co-production occurs through various modalities (and counseling occurs through three types); each party to co-production contributes resources; and the outputs are various forms of business assistance aimed at addressing gaps in resources within the firm required to deal with a crisis or problem facing the firm in the short-term, or to develop the capacity of the firm to survive and prosper over the long-term.

In the model presented in Fig. 2, the nexuses of the flows of inputs from the co-production partners are represented by ovals with the letters "C" and "N" for co-production via counseling and networking, respectively. These are meant to focus attention on the "flowing together" of the inputs. It is here that the factors affecting output elasticities come into play. In those cases where the factors are favorable, the output elasticities are relatively high and the impact of co-production may be greater. In those cases where the factors are less

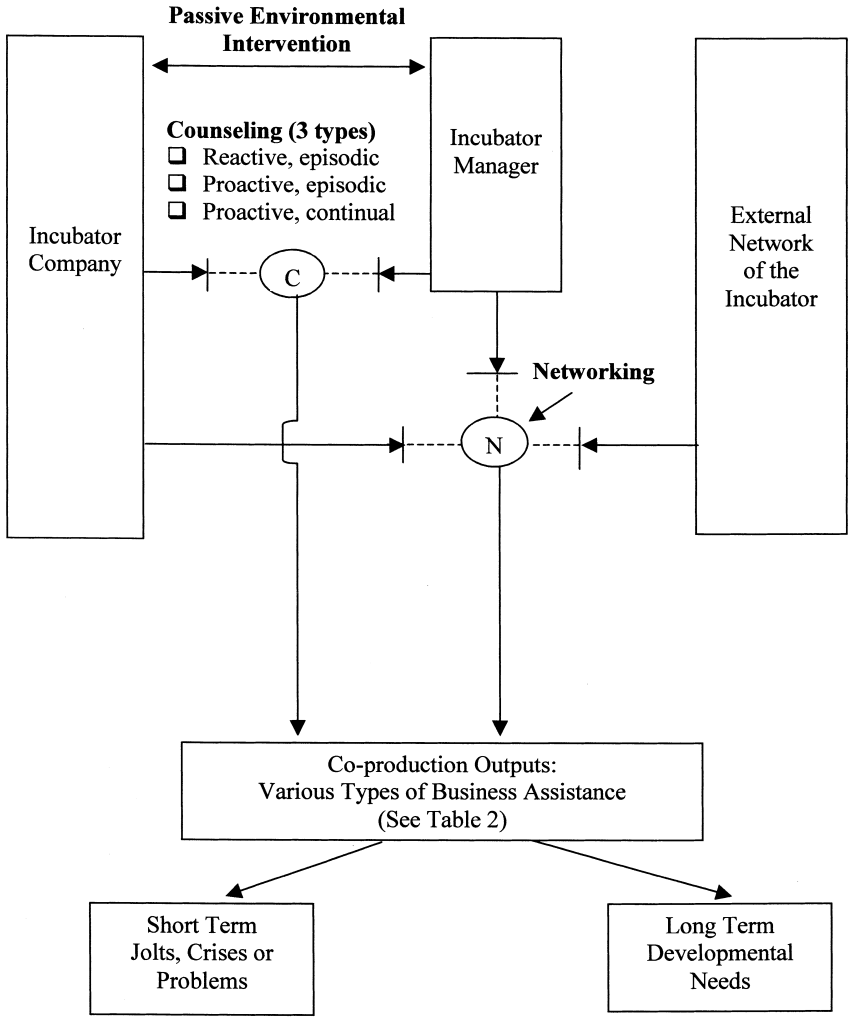

Fig. 2. A model of co-production in business incubators.

favorable, there is greater resistance to the flows of inputs into the nexuses, which can fill resource gaps of the firm.

In this study, limited attention was paid to variability of resources among the individuals within the three classes of co-production participants: incubator companies, incubator managers, and members of the incubator network. It was assumed that the variability in resources between classes was more important in driving the need for and the impact of co-production than variability in resources among the members within the three classes. The selection process for incubator managers generally requires that candidates have sufficient capacity for providing business assistance. The selection process for incubator companies generally requires that incubator companies have the potential to gain benefit from co-production. Likewise, each of the communities within which these incubators operated

offered a substantial stock of knowledge, competencies, and resources that could be accessed through the incubator network.

Thus, rather than focus on the resources of the co-producers, the study focuses on factors that affect the output elasticity of each input. As illustrated in Fig. 2, the inputs of the co-producers flow together to create the business assistance outputs that fill gaps in the resources of the entrepreneurial firms. Filling these gaps enhances the capacity of the firm to deal with crises and problems and to pursue ongoing development of the organization of the firm, its products, its markets, and its financial resources. The characteristics of co-production are different for counseling vs. networking and will be considered separately.

6.1. Counseling

The output elasticities of the inputs provided by the incubator manager and the entrepreneur are affected by the amount of inputs provided by the opposite partner in the co-production dyad. For example, let us assume an entrepreneur invests resources in addressing a crisis. If the entrepreneur's stock of resources is incomplete and inadequate to address the crisis, the entrepreneur will turn to the incubator manager to invest the missing resources. If the incubator manager contributes nothing, there is no co-production. Although the entrepreneur's investment may have some impact on resolving the crisis, the output elasticity of his inputs — given that the output is business assistance derived from co-production — is zero. Similarly, the incubator manager may be prepared to invest resources in resolving a crisis faced by an incubator company, but if the entrepreneur refuses to engage, there is no co-production of business assistance targeted at the crisis.

The data presented in Table 4 indicates that the incubator managers with greater impact invest more time in co-production. The simplest interpretation is that they contribute more input to co-production. That is certainly true. However, it is also apparent from the interview data that there is a learning curve effect. More time invested in co-production translates into greater facility of both co-production partners in the co-production process. Hence, over time the output elasticities appear to increase as the cumulative experience of each of the participants in co-production increases. This leads to an important implication for incubator sponsors and managers. To achieve greater impact, the incubator should be structured, staffed, and financed in such a way as to maximize the time of the incubator manager available for co-production activities.

This study has uncovered additional factors that contribute to the impact of the incubator manager's role in co-production. The incubator managers with more impact also generally invested more time per intervention episode, as indicated in the column in Table 4 that records intensity. The interview data indicated that the higher impact incubator managers not only contributed resources to co-production targeted at resolving a particular problem or crisis, but also provided additional follow through to enhance the ability of the entrepreneur to put those resources to work. One of the cases in incubator #3 is illustrative. The firm was facing a series of negotiations with potential alliance partners related to licensing of its proprietary technology. The incubator manager not only delivered to the entrepreneurs his knowledge related to negotiation, he also engaged in role-playing and sat in on the initial negotiating sessions. This allowed him to provide on-the-spot counsel. In addition, later on he provided

feedback to the entrepreneurs on their performance — which assisted their development as negotiators, thereby leading to improved performance in subsequent negotiations. The results of this study suggest that output elasticity of inputs by entrepreneurs is affected by the intensity of co-production by the incubator manager.

The variability in the breadth of co-production modalities deployed by the incubator manager also contributed to overall impact. The incubator managers with the lowest impact relied solely on reactive, episodic intervention for co-production. They left it to the companies to develop the capacity over time to mature beyond survival mode. In contrast, the three incubator managers with the highest impact engaged in all four co-production modalities. They engaged in reactive and proactive response to crises and problems, but also engaged in proactive and continual co-production targeted at developing the knowledge, competencies, and resources of their entrepreneurial firms.

6.2. Networking

In the interviews, 18 of the 32 entrepreneurs and all eight incubator managers reported that networking to external resources was a helpful mode of co-production. However, 25 of the 32 entrepreneurs and all eight incubator managers also cited networking to external resources in general, or more specifically to sources of funding, as a co-production shortcoming. Networking was the most frequently cited co-production shortcoming. The in-depth interviews revealed three contributing factors.

- In some cases, the know-how network experts are less than fully committed to making a productive connection, given the lack (or low level) of immediate monetary rewards. They are positioning themselves for future business with those companies that emerge from the incubator as established businesses that can afford to pay for their expertise.
- The entrepreneurs may not be ready to take advantage of the networking infrastructure. They may be unwilling to commit sufficient time to the networking process or they may not have the skills necessary to maximize the benefit of the networking connections.
- The effectiveness of the networking process is diminished when the incubator manager commits insufficient time and effort to the following tasks: (a) evaluation of the commitment and the capability of the prospective know-how network expert to address the specific needs of the entrepreneur, (b) development of the capabilities of the entrepreneurs to successfully participate in the networking co-production process, and (c) facilitation of the networking co-production relationship between the entrepreneur and the external source of expertise or resources.

The third factor can be illustrated with the following case. The incubator manager connected the entrepreneur to a state-operated small business investment fund, and then left the entrepreneur to pursue the lead. The less-than-satisfactory outcome is obvious in the post-mortem provided by the entrepreneur.

> When we finally did try to get some money from the state, the application process was so heavily burdened with paperwork and the funds available were

> so limited that I finally threw the agreement in the basket. It was such a hassle. We wasted a lot of time. Perhaps some good advice would have been the following: 'Your business is not appropriate for this type of money. Don't waste your time.'

The interview data indicate that a lack of success in networking is related primarily to lack of intensity of engagement in the process by one or more (usually all three) of the networking participants. For the incubator manager, the implication is that there is yet another call on the limited time available for co-production. Because the incubator managers' time available for co-production is a limited resource, the incubator manger is forced to make choices about how to invest that resource. There is an inevitable tradeoff between providing less time to more companies vs. targeting co-production efforts at firms for which the output elasticity is highest. This dilemma leads to a discussion of the impact of entrepreneur readiness on output elasticity of incubator manager inputs.

6.3. Entrepreneurs' readiness to engage in co-production

A starting assumption for this study was that there is significant variability in the responsiveness of entrepreneurs to the co-production opportunities presented to them as a result of their participation in a business incubator. The interview and survey data indicate that the variability is particularly striking with respect to counseling — the mode of co-production involving the greatest intensity of engagement. In the interviews, 14 of the 16 Group I entrepreneurs cited counseling as helpful, whereas only 2 of 16 Group II entrepreneurs cited counseling as helpful. In their survey responses, Group I entrepreneurs reported assistance via counseling almost twice as frequently as Group II entrepreneurs. One possible interpretation of this data is that Group II entrepreneurs have less need for counseling. The interview data paint a very different picture. Entrepreneurs do not apply for admission to an incubator nor are they accepted unless they have substantial challenges to overcome to grow out of the start up, survival mode. All of the entrepreneurs in this study had much to gain from engaging in co-production activities with their incubator managers, but varied in the extent of their engagement and their perceptions of the value of engaging in co-production. These observations led to the development of a typology of incubator companies based on the dimensions of maturity and readiness (Fig. 3).

6.3.1. Anchor tenants

Entities that have a reason to be in the incubator; pay their bills reliably and therefore support the financial needs of the incubator; and neither need nor want co-production input from the incubator manager. Examples include accounting and law firms, economic development agencies, university technology transfer offices, and so forth.

6.3.2. Long shots

Companies that have substantial need for co-production but are not ready to engage. They benefit from the supportive environment offered by an incubator and need time to mature (These companies are run by Group II entrepreneurs).

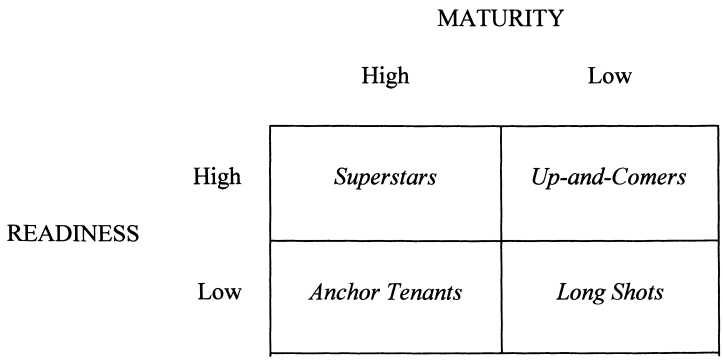

Fig. 3. A typology of incubator companies. Note: An earlier version of this typology was presented in Rice and Matthews (1995).

6.3.3. Up-and-comers

Companies with significant resource gaps that can be addressed through co-production. These companies are run by Group I entrepreneurs, who are aware of the gaps, recognize the potential for co-production to help them resolve the gaps, and are willing to engage.

6.3.4. Superstars

Companies that have matured beyond up-and-comer status and require minimal co-production input from the incubator manager, even though their readiness to engage remains high. For the most part, they are capable of addressing crises and sustaining their development without the involvement of the incubator manager. They are likely to graduate from the incubator in the near term, but while still in the incubator, act as role models for up-and-comers and long shots.

To achieve greater overall impact, the incubator manager should adopt a passive and reactive co-production approach to Group II entrepreneurs, and focus proactive and continual co-production on Group I entrepreneurs. One objective in adopting this approach is to move as many up-and-comer companies as quickly as possible into the superstar category. The second objective is to provide an environment in which the combination of peer networking; training/education programs; and reactive, episodic co-production gives Group II entrepreneurs the time and opportunity to mature into up-and-comer companies.

7. Future research

There is a complex set of interactive factors that affect the evolution of entrepreneurial ventures. It is unrealistic to expect that all important control variables can be held constant over the life of an extended, longitudinal study of the impact of co-production on entrepreneurial success. However, there are opportunities to improve on the methodology employed in this study and to reduce the dependence on the interpretative skill of the researcher. Most incubators continue to rely on the reactive, episodic approach to co-

production. It may be possible to develop a proactive, continual approach to co-production that is relatively standardized. A panel of incubators could be assembled, half of which adopted the full range of co-production modalities, and half of which continued to deploy the reactive, episodic approach only. For the results of the study to be useful, control variables related to the characteristics of the external environment, the incubators, and the participating companies would have to be identified. The participants in the study would have to be selected to ensure comparability at the start of the study and over its lifetime. For this reason, the length of the study should be as short as possible. Given the nature of the proactive approaches being piloted in the three highest ranked incubators in this study, it may be possible to assess performance differences within 1 to 2 years. The sample of incubators and incubator companies must be large enough to take into account exceptional circumstances.

Given the same research design limitations described above, it may be possible to explore more fully the impact of intensity of co-production by incubator managers. For example, it may be possible to recruit incubator managers who will agree to carefully track their allocation of time over an extended period of time — perhaps 6 months to 1 year. The performance of the companies could be assessed with reference to the intensity of their co-production relationships with their incubator managers.

It would be useful to develop a clearer understanding of the factors that contribute to the readiness of entrepreneurs to engage in co-production. With this understanding, it would be possible to segment the population of companies needing assistance more effectively into up-and-comer companies vs. long shots. It would also be possible to develop programs that aim to efficiently move long shot companies into the up-and-comer category.

As indicated earlier, there was no evidence of a proactive, systematic approach to training and education in the incubators in this study. Common wisdom is that entrepreneurs do not want to study entrepreneurship; they want to do it. However, incubators have the option of making participation in a training/education program a requirement for admission into and continuation in the incubator program. It might be possible to assess the impact of a standardized training/education program on the conversion of Group II entrepreneurs into Group I entrepreneurs. Instruments would have to be developed to assess the development of knowledge, skills, and attitudes of entrepreneurs.

8. Conclusion

All business assistance programs, including business incubators, are targeted at helping entrepreneurial ventures start up, survive, and succeed. To that end, the two parties engage in co-production to compensate for the firm's gaps in knowledge, competencies and resources. In the short run co-production gives firms the capacity to deal with jolts, crises and problems. In the long run, it provides time for the firm by itself — or for the firm in a co-production partnership with the incubator — to develop the knowledge, competencies, and resources necessary to achieve autonomy from the co-production partner and sustainability as an economic entity.

This study has provided insight into the nature of the co-production dyadic relationship between incubator managers (and by extension the incubator's know-how network) and

incubator company entrepreneurs. In the eight incubators in this study, the gap between the stocks of knowledge, competencies and resources of the incubator managers and the stocks of their incubator company entrepreneurs are generally substantial. Hence, there is significant ''potential'' for driving the flow from the incubator manager to the entrepreneur. However, there are also various kinds of resistance to the flow that can be captured in the concept of co-production output elasticities.

The output elasticity of the incubator manager inputs is affected by the readiness of the entrepreneur to engage in co-production. This readiness appears to be related to *awareness* by the entrepreneur of the firm's gaps in knowledge, competencies, and resources; *recognition* of the potential of the incubator manager to help fill those gaps; and *willingness* to engage in co-production. Similarly, the output elasticity of the entrepreneur inputs is affected by the readiness of the incubator manager to engage in co-production. However, readiness of the incubator manager does not appear to be related to *awareness*, *recognition*, and *willingness*. Generally, the admissions process makes incubator managers aware of the gaps in their firms' resources; they recognize that the incubator and its supporters have resources that can be brought to bear; and they are willing to engage. Instead, incubator manager readiness is related to capacity for committing sufficient time to co-production to achieve a level of intensity required for impact, as well as the breadth of co-production modes implemented. Thus, readiness of the incubator manager is related to the balance between co-production and non-co-production activities of the incubator.

Incubator managers and their advisers/sponsors can choose to create a financial and staffing structure that off-loads non-co-production activities to other members of the incubator staff. (This strategy was clearly adopted in incubators #3 and #4, two of the three most successful incubators.) Failing that, representatives of the sponsors may take on the responsibility of addressing these competing goals, thereby minimizing the distractions imposed on the incubator manager. The end result is that incubator managers will have more time available for co-production.

However, intensity involves more than total time available for intervention. Amount of time per intervention contact can be increased through a strategy of selectivity. That is, from the structure of this study it is apparent that the incubator managers are able to differentiate between those entrepreneurs who are more adept at taking advantage of co-production activities and those who are less adept. The incubator may choose to structure a multi-tiered approach to co-production, reflecting a variety of factors that affect impact, and thereby increase intensity of intervention. For example, it may also be possible to increase intensity by utilizing sponsor volunteers or community experts (e.g., Service Corps of Retired Executives volunteers) to engage in lower tier, less critical co-production activities, thereby reserving the time of the incubator manager for fewer, higher tier, more critical co-production activities. Additional strategies for optimizing the allocation of time between administrative and business assistance co-production activities, in order to enhance intensity of engagement by the incubator manager, have been discussed elsewhere (Rice, 1992a,b; Rice and Abetti, 1993; Rice and Matthews, 1995).

This study has illuminated the concept of interdependent co-production of public services, specifically business assistance programs offered through business incubators. The lessons learned may be useful in any business incubation situation in which an incubator and an

entrepreneur are engaged in co-production of business assistance, e.g., in corporate venturing, in Small Business Development Centers, in Manufacturing Technology Centers, in business assistance programs offered to members through their Chamber of Commerce, and so forth. More generally, these findings can be applied to interdependent co-production situations beyond the variety of public services discussed by Parks et al. (1981) and beyond the business assistance co-production situation examined in this paper.

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