

THE UNIVERSITY BUSINESS INCUBATOR: A STRATEGY FOR DEVELOPING NEW RESEARCH/TECHNOLOGY-BASED FIRMS

SARFRAZ A. MIAN
SUNY Oswego

This article describes the university business incubator (UBI) as a strategy being employed for promoting the development of new research/technology-based firms (RTBFs). The business incubator is widely believed as providing a nurturing environment for new business start-ups, however, the role played by university relationships in providing a nurturing environment for the survival and growth of small RTBFs has escaped systematic review in the U.S. due to a lack of historical data. To fill this gap, this paper presents empirical data on two established UBI programs: the Enterprise Development Inc. at Case Western Reserve University, and the Ben Craig Center at University of North Carolina at Charlotte. These cases provide insights for policy makers and aspiring entrepreneurs into the various facility design, management policy, and value-added aspects of this modern tool employed by some entrepreneurial universities as a strategy for supporting the development of new RTBFs.

INTRODUCTION

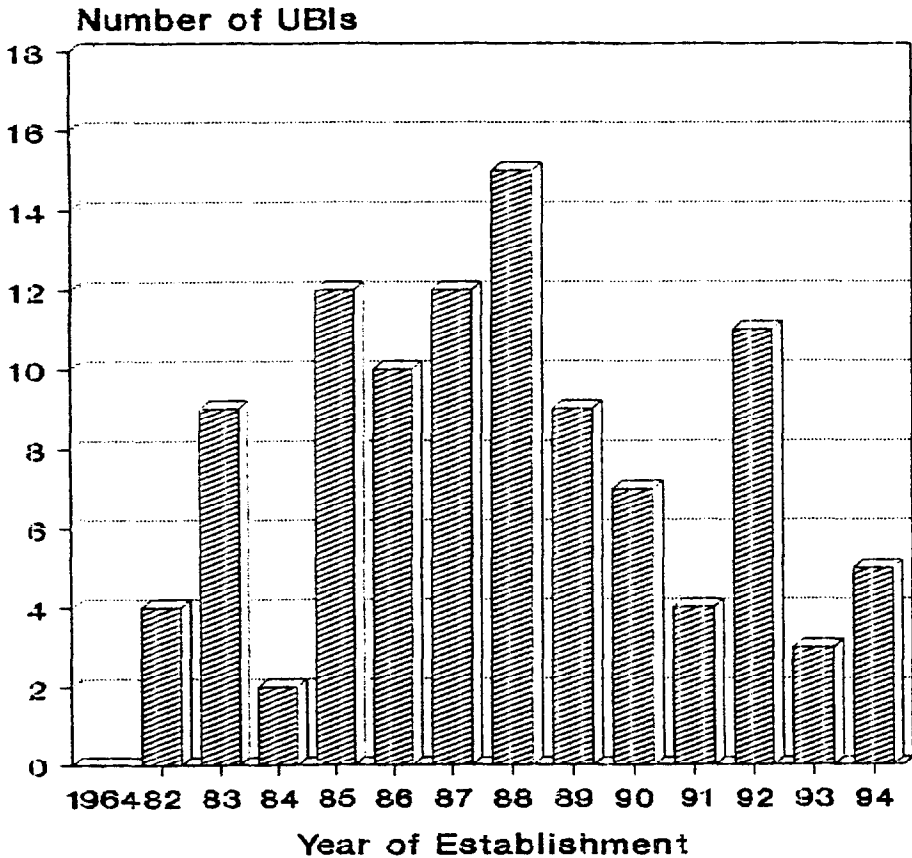
The development of new research/technology-based firms has become increasingly important in today's competitive economies. Faced with this challenge, several state governments, local business leaders, and some entrepreneurial universities are collaborating to promote the development of RTBFs in their regions (Mian, 1994a). One mechanism used for this purpose is the establishment of technology incubators in or around the university campuses. Interest in the university sponsored technology incubator stems from the significant potential of the concept. The concept holds out the possibility of linking talent, technology, capital, and know-how to leverage entrepreneurial talent, accelerate the development of new technology-based firms, and speed the commercialization of technology (Smilor & Gill, 1986). With the popularity of the business incubation concept starting

Direct all correspondence to: Sarfraz A. Mian, Associate Professor of Strategic Management and Entrepreneurship, School of Business, SUNY Oswego, Oswego, NY 13126.

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in the early 1980s, more than 50 American universities have set up new technology/business incubation facilities in and around their campuses (NBIA, 1992). This industry has been growing at a steady rate since the early 1980s (see Graph 1).¹

Despite the growth in the number of UBIs, there is a lack of understanding of the role played by the university relationships and mutual advantages arising from this linkage (Allen & Levine, 1986). This article provides a review of the two established cases of UBIs, one representing state university sponsored facilities, that is the Ben Craig Center at University of North Carolina at Charlotte, and the other representing private university sponsored facilities, that is the Enterprise Development Inc. at Case Western Reserve University. The various UBI dimensions explored include: their origins, organizational design, management and policy practices, funding, target markets, services provided and their value-added contributions to new research/technology-based start-ups. The purpose is to explore how this new enterprise development tool is being employed successfully as a strategy for developing new RTBFs.



GRAPH 1
Growth of University Business Incubators
in U.S. and Canada

Sources: NBIA 1996, AURRP 1994

THE EXISTING BODY OF KNOWLEDGE

With the popularity of the business incubation concept during the 1980s, numerous studies have been conducted to assess the emerging incubator industry across the nation (Temali & Campbell, 1984; Allen, 1985; Smilor & Gill, 1986; Allen & Levine, 1986; Hisrich & Smilor, 1988; Campbell et al., 1988; NBIA, 1992). A review of these studies show that most of them are primarily descriptive, lacking conceptual and/or methodological grounding. Only two of these studies (Smilor & Gill, 1986; Allen & Levine, 1986) made an effort to address the performance issues and were comprehensive enough to mention the role of universities in providing business incubation support. Two recent studies (Lichtenstein, 1992; Rice, 1993) have attempted to address the merits of networking and managerial intervention respectively in providing incubation support. However, neither of these studies specifically focused on the special role played by the universities, which otherwise were generally understood to provide a resource-base necessary for supporting the development of NTBFs.

An examination of the limited research that may be considered as the body of knowledge on incubator performance show that the authors generally looked at the incubators from facility, tenant, and graduate perspectives (Allen & McCluskey, 1990). In the absence of a sound body of knowledge on business incubators, there is no consensus on what makes up the content of success or effectiveness in the area of business incubation and how to measure it (Allen, 1985; Smilor & Gill, 1986; Campbell et al., 1988). This is even more true in the case of UBIs (Mian, 1991).

During the 1980s, a number of national reports have strongly asserted that the academe, through its contribution to technological change, will be a key factor in the U.S. economic competitiveness (Business-Higher Education Forum, 1988; National Academy of Engineering, 1988; Battelle, 1995). Despite the controversy concerning the type and level of involvement, consensus exists that universities play a central role in advanced technology development, and most commentators now agree that the presence of a major university is important, though not sufficient, for the formation of a concentration of technology-oriented enterprises (NSF, 1983; Allen & Levine, 1986, Smilor et al., 1988).

This enthusiasm for partnership between university and industry exists in a range of areas, but particular emphasis is placed on: (a) research-related technology-based linkages, "the highest degree of convergence between the university and industry is in high technology research where technology transfer is rapid and requires close proximity" (National Science Board, 1982), and (b) education's potential to contribute to economic development through its more traditional training function (Allen & Levine, 1986). Additionally, substantial conceptual and theoretical work has focused on structural and organizational factors that might facilitate or hinder university-industry collaboration (Ping, 1981, Lopez-Martinez et al., 1994), but little empirical work has explored: (a) whether technology-based firms actually perceive universities to be important; (b) the aspects of university services that are of interest to technology-based firms; and (c) the characteristics of technology-based firms themselves.

In short, universities are assumed to have two major dimensions of importance to technology-based firms: (1) they are perceived as a source of research (basic theoretical inquiry and access to faculty and facilities) as well as a source of skilled employees; and (2) at the state and local levels, programs (such as UBIs) foster university-technology-

entrepreneurship linkages as a means of attracting and supporting the development of firms.

STUDY FRAMEWORK AND METHODS

The UBIs' salient policy and business-management practices in four key functional areas (management, marketing, finance, and operations) form the basis of various dimensions explored in this paper. From the incubator literature cited above, some key UBI-related assessment characteristics may be drawn. These characteristics are derived from parallel but separate incubator studies reported in the literature, which convey a sense of the UBI performance outcomes, facility management policies, and various services and their impact (Mian, 1991). These characteristics are listed under twelve different dimensions, described below (Mian, 1994b):

- *Origins of Facilities*—to understand the UBI contextual settings their origins, growth in physical facilities and other resources are assessed;
- *Objectives*—beyond the common objective of participation in the economic development, facilities articulate objectives differently depending upon their sponsors' interests;
- *Organizational Design*—most UBIs are physically located on or near their respective sponsoring-university campuses, however, their organizational relationships with the university differ. Additionally, the state and local community involvement has to be determined;
- *Governance and Policy Guidance*—generally all UBI facilities are run by various types of boards with varying degrees of university, state, local government, and private sector representations. These boards provide overall direction;
- *Tenant Performance Review*—formal periodic (annual, bi-annual, and quarterly) and informal tenant performance reviews are held at most of the UBIs which are assessed;
- *Institutional Support*—various UBI programs take advantage of their respective university technology transfer programs, research centers, and technology and business development assistance centers, such as SBDC, SBIR, and STTR projects² which vary in their levels of activities;
- *Staffing*—the facilities employ varying number of administrative/ clerical and professional staff, depending upon the size and nature of each operation;
- *Funding Sources*—the funding parameters which are explored in the respective cases include state funding and university support for the UBI, as well as funds to support the growth of tenant firms;
- *Technologies and Entrepreneurs Targeted*—the type of technology targeted for development is generally a function of the available resources at a particular facility. The type of entrepreneurs attracted, such as university-related (students, professors, alumni) or others, is a function of incentives and recruiting efforts;
- *Strategic Operational Policies*—the key elements of strategic considerations in operating a successful UBI facility include: tenant selection policy, tenant graduation policy, intellectual property safeguards for tenant firms, and graduate firm-UBI linkages;
- *Services and Their Value-Added*—there are two main categories of services: shared rental space including other typical shared incubator services; and the university related services including faculty consultants and student employees. Tenant firms' perceived value-added by these services also needs determination; and

- *Survival and Growth of Tenant Firms*—impact on the survival and growth of tenant firms are measured in terms of dropouts, annual sales, and employment growth.

Using this framework, site interviews were conducted with the selected UBI officials and involved university personnel including some faculty. The client firm data was collected through mail survey. Additionally, secondary information sources such as documents from the two sites, and the incubator professional association's newsletters and other relevant literature pertaining to the facilities were reviewed to cross-check and verify the data. The following sections employ this framework in analyzing selected cases.

CASE I: ENTERPRISE DEVELOPMENT INC.

The Enterprise Development Incorporated's (EDI) Edison Technology Incubator at Case Western Reserve University (a private university) started working in March 1984. EDI is a cooperative venture between Cleveland Ohio's Center for Venture Development³ and the Case Western Reserve University's Weatherhead School of Management. With a gross 22,000 square feet space in its multistory building on the University campus the facility rents around 13,000 square feet to its tenant firms. The rental rate varies from \$4.50 to \$12.50 per foot, depending upon the type of customer and the quality of space. These rates are about 15 to 30% less than the market rate. All of EDI's current 7 tenant firms and 4 graduate firms were accessible for the client firm survey. Only 4 tenant firms of the 11 firms approached responded to the survey, which gives a response rate of 36%.

The EDI program's growth in facilities and new programs has been relatively slow to moderate during the past 6 years of its history, and therefore, only a handful of select tenants have been served.

In terms of goals and objectives, EDI seeks participation in the state's economic development activities by supporting the development of RTBFs. In pursuing the economic development objective EDI also aims at providing a laboratory for learning entrepreneurial skills by the Case Western Reserve University students and faculty. Promoting commercialization of university technology (especially in biotechnology) has been one of the primary objectives at EDI.

Organizationally, EDI is a non-profit wholly owned subsidiary of the Case Western Reserve University (see Figure 1). Over the years the state had helped the incubator by providing funds for capital expenditure. Therefore, both the state and the university influence EDI's long-term planning, but the policy guidance has been provided by an 11-member private sector dominated board of trustees (including 2 representatives from the University's Weatherhead School of Management), and a 5-member advisory board from the community. The incubator management team consists of an Executive Director and an Incubator Manager, assisted by a staff. The tenant performance reviews are held each year by the Incubator Manager. There are no formal procedures developed in this regard. The general environment in research and technology development around EDI in the form of university-related institutional support is encouraging and its manifestation in the EDI's business development support activities is apparent (see Figure 2). The quality of management support received by the tenant firms in helping to solve their problems (mainly in accessing outside financial support, inside and outside business connections) was reported as ranging from moderate to major in value-added terms.

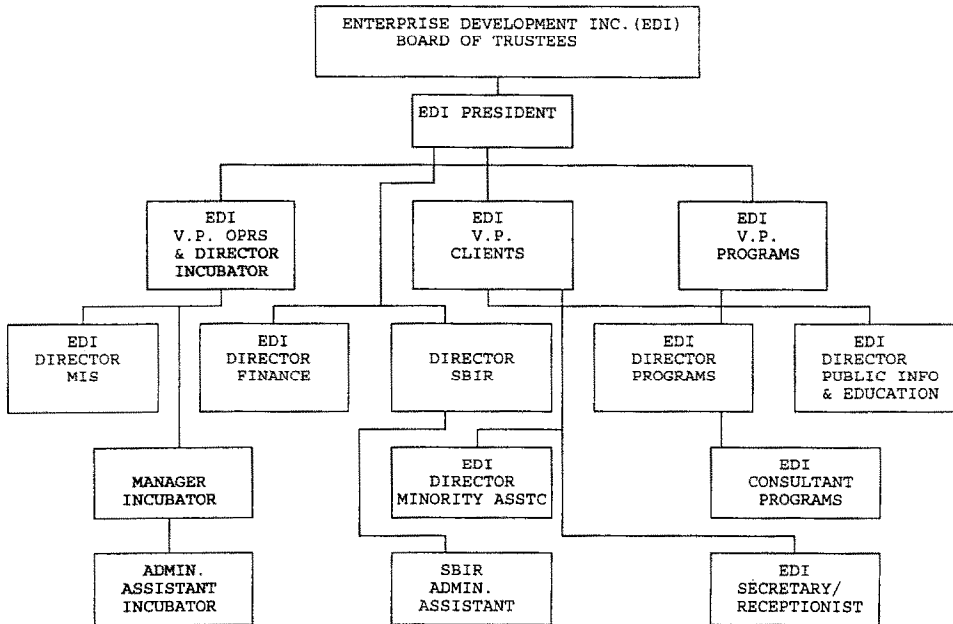


FIGURE 1
EDI - Organizational Structure

The quality of management support received by the client firms in helping to solve their problems ranged from moderate to major in value-added terms, and in accessing outside financial support ranged from no value to minor value.⁴

EDI client firms' data show (on the average) moderate growth in sales and employment during their incubation years. As shown in Figure 3, of the total 4 firms (responding to the questionnaire), 3 firms sustained a general trend in sales growth (yearly averages: 56%, 0%, 267%, and 12%) and 3 firms experienced employment growth (yearly averages: 27%, 140%, 0, and 38) during the incubation period. According to the EDI management, as of early 1992, 4 firms had graduated from EDI, all of which are still in operation. This yields an average of about 8% ($4/7 \times 100/7$) incubation rate per year.

Impact on the University itself in the form of student jobs and faculty consulting was limited, and only a small number of part-time students and faculty were involved with the program. (The exact numbers were not made available). No adverse impact on the University's teaching and/or research was reported. The very fact that the facility is providing jobs and helping to create new businesses qualified EDI for honorable mentioning by the state legislators and for obtaining funds from the state and private sources. Also, a large number of inquiries and visits by local, national, and even international parties interested in setting up such facilities were reported. Therefore, the management's claim that the presence of EDI on the Case Western Reserve University's campus has enhanced its prestige and added to its image in the state and outside seems plausible.

The state grants through the Edison Technology program along with other local financial support have been the major sources of capital funds and operational grants for EDI.

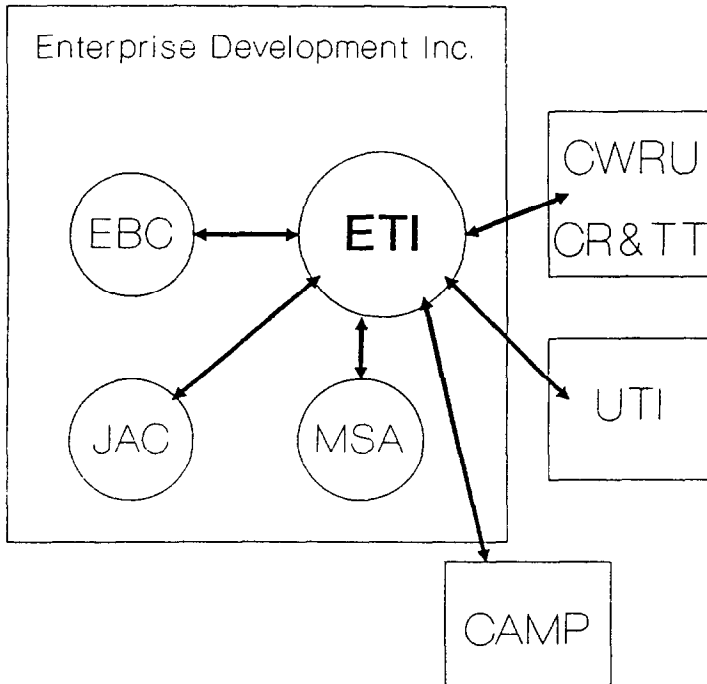


FIGURE 2

EDI - Institutional Support System; EDI - Edison Technology Incubator; EBC - Edison Biotechnology Center; JAC - JAC Business Communications; MSA - Marketing Services Associates; CR&TT - CWRU's Corporate Research and Tech. Transfer; UTI - University Technology Inc; CAMP - Cleveland Advanced Manufacturing Program.

Private sector support has also been tapped occasionally, but the University does not provide any operational funds. Various private funding arrangements and the federal SBIR awards are available for the tenant firms to seek. The EDI management provides necessary help in obtaining these funds.

In this case study the following two (UBI target markets) parameters were investigated. First, with respect to technology representation, there was a high percentage of targeted technologies among EDI's clients, which include (see Figure 4): instrumentation/mechanical, biotechnology/medical, electronics/electrical, software/information science and telecommunications. Much higher representation of instrumentation/mechanical and biotechnology/medical firms shows a growing trend in EDI's admittance policy in this area of vital interest to the state. The development of these technologies was quite in line with the University's strength in the chosen areas of technology. This also suggests that entry policies are strictly followed. Second, the percentage of university-related entrepreneurs (students, alumni, professors) among EDI's clients is hardly encouraging (no data was shared). From the EDI's past 7 years history only one major case of a professor involved

CHART A

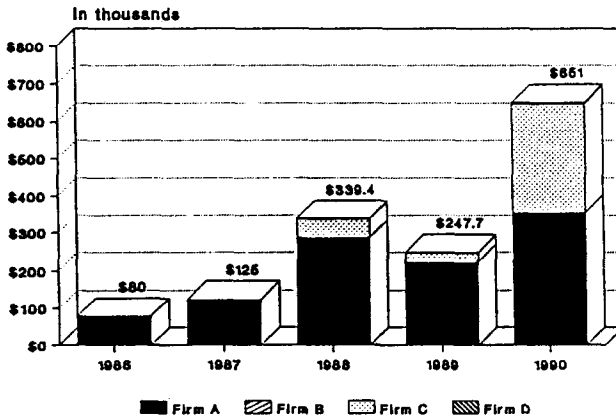


CHART B

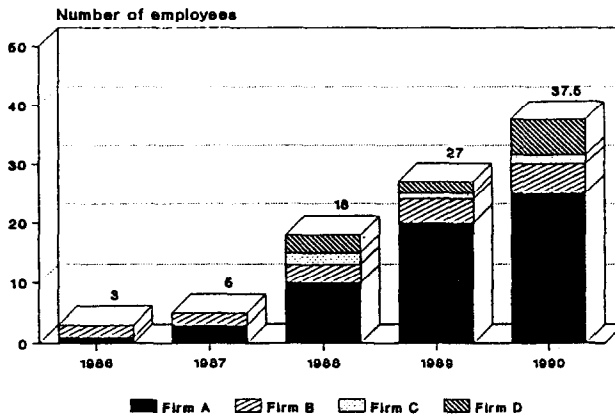
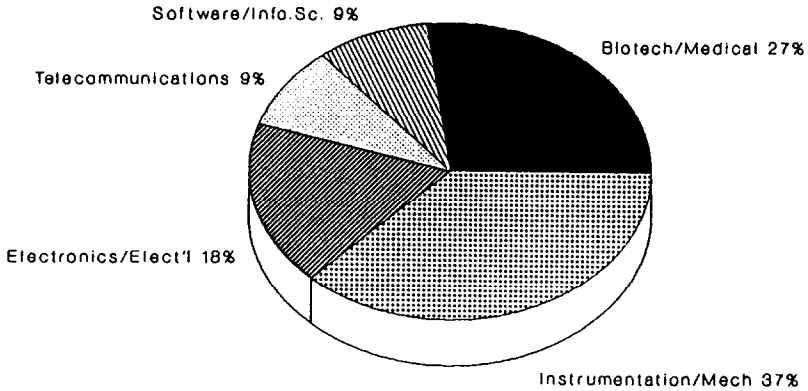


FIGURE 3
EDI - Growth of client firms (A) Sales (B) Employment

in developing a new technology was reported, which revealed some degree of ineffectiveness in developing entrepreneurs from within.

A systematic application of the strategic operational policies, including entry/selection policy and exit/graduation policy was reported. In the entry policy, technology-based start-ups were encouraged and a six-month lease was provided in the beginning. In the exit, after 2 years of tenancy, the incubation committee's approval was required for further stay. Holding equity and a success fee was reported in few cases, but was not made a practice. Intellectual property safeguards for the client's technology were available in the form of an unspoken trust between the incubator management and their client firm. No written non-disclosure policy was available, and was neither sought by the responding tenants.



Source: Survey Data

FIGURE 4
EDI - Technologies represented (client firms' percent)

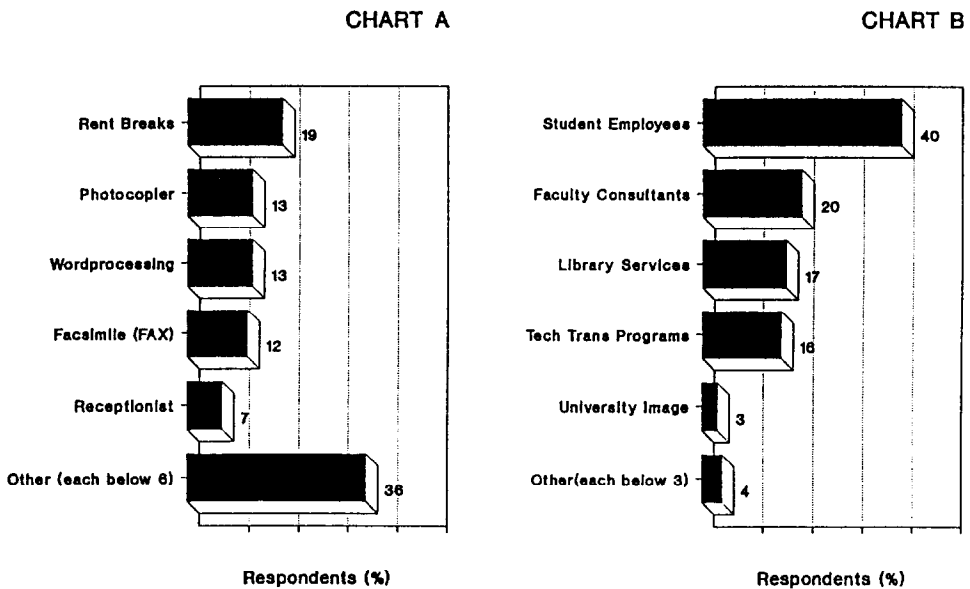


FIGURE 5
EDI - Client firms' ranking of the most important (A) Incubator services (B) University-related services

Linkages between graduate firms (who were no longer tenants) and EDI had not been given much attention, and no formal policies had been developed to keep contacts and provide some degree of access to the services after graduation.

EDI provides most of the typical incubator and university-related services to its tenant firms. The findings on value-added contributions show that among the various shared

office services, photocopiers, fax, security and receptionist services were frequently used and had major value for the clients. In the case of business assistance, the help was obtained less frequently, but reported contributing a major value. Rent breaks were also reported contributing a major value.

Among the university-related services, student employees, faculty consultants, library/information databases, labs/workshops and sophisticated equipment, and technology transfer programs were frequently used and perceived to be of value-added. Notably, employee education and training seminars were conducted regularly where client firm personnel were encouraged to participate. The respondents also reported that the university image was of major value to their firms. Figure 4 provides a ranking of the five most valued incubator services (see Chart A) as well as five most valued university-related services (see Chart B) by the responding tenants.

CASE II: THE BEN CRAIG CENTER

The Ben Craig Center (BCC) at University of North Carolina at Charlotte (a state university) was established in March 1986. BCC's technology incubator provides 50,000 square feet rentable space (out of the Gross 87,000 square feet) at the Center's newly built facility. The rental rate is \$10.50 per square foot, which is slightly cheaper (0–15%) than the market rate. Due to this recent growth in rentable space, the management has been soliciting tenants to fill the empty space while trying to keep the entry policy guidelines. All of BCC's 16 tenant firms and 3 out of 6 graduate firms were included in the client firm survey. Only 8 of the 19 firms approached responded to the survey, which gives a response rate of 42%.

During the more than five years since its inception, BCC has experienced relatively high growth in its physical facilities and services, which was mainly funded by the University foundation.

In terms of goals and objectives, BCC seeks participation in the state's economic development activities. In pursuing the economic development objective, BCC also aims at supporting the development of manufacturing oriented small firms in particular. BCC also intends to capture tenants from its graduates for the University's research park.

The Ben Craig Center is a non-profit corporation supported by the University foundation (see Figure 6). Over the years the state had helped the Center by providing funds for capital expenditures. Therefore, both the state and the University through its foundation wield some degree of indirect control on BCC's long-term objectives and strategic planning, but the policy guidance has been provided by a private sector dominated board including University representatives. The day-to-day management is provided by an Executive Director with a staff of 5 to 6 full-time individuals.

The general environment in research and technology development around BCC, in the form of university-related institutional support, is encouraging, and its manifestation in the Center's business development support activities is ample (see Figure 7). There are tenant advisory committees drawn from the private sector which evaluate the tenant firms' progress, providing feed back and guidance on a quarterly basis. No mandatory tenant review procedures are followed by the incubator management. However, informal evaluation meetings are held at least once a year, whereby financial and other business aspects are discussed with the clients. The quality of management support received by the client

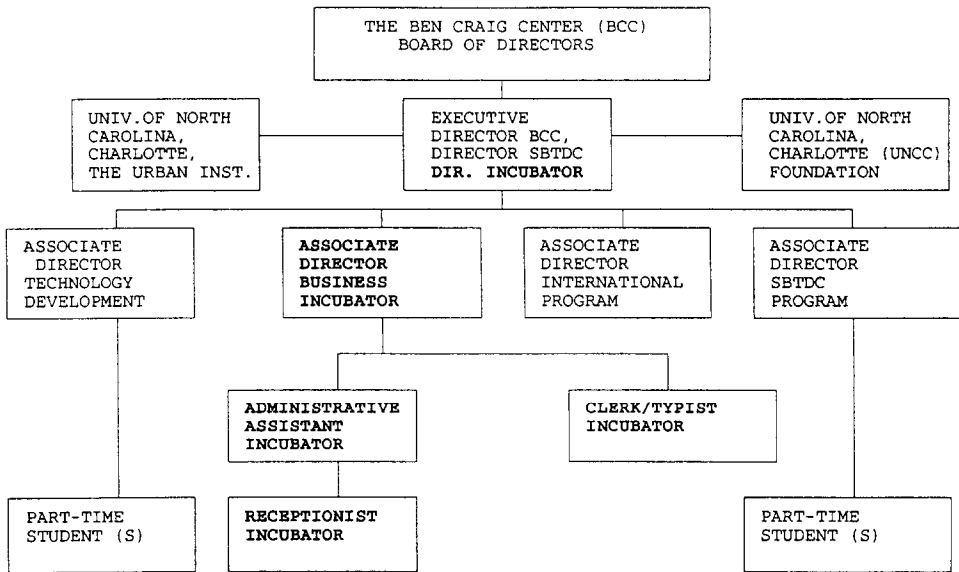


FIGURE 6
BCC - Organizational Structure

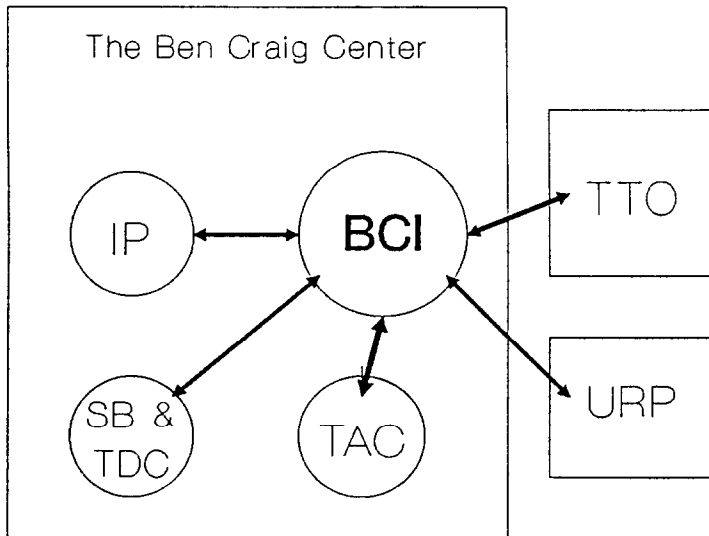


FIGURE 7
BCC - Institutional support system; BCI - Ben Craig Incubator;
IP - International Program; SB&TDC - Small Business and
Technology Development Center; TAC - Tenant Assistance Committee;
TTO - University Technology Transfer Office;
URP - University Research Park

firms in helping to solve their problems was reported as ranging from moderate to major in value-added terms.

As shown in Figure 8, the 6 responding client firms' data demonstrate a general trend in sales growth (yearly averages: 54%, 210%, 60%, 271%, 130%, and 150%) and in employment growth (yearly averages: 17%, 100%, 26%, 50%, 0% and 33%) during the incubation. According to BCC management, as of early 1992, 4 firms had graduated from BCC. This yields an average of about 7% ($4/4 \times 100/14$) incubation rate per year. All of these 4 firms are still in operation. Impact on the University itself in the form of student jobs and faculty consulting was minimal. (The exact numbers were not made available). In spite of the fact that the Center is in close proximity to the University and its research park, there is

CHART A

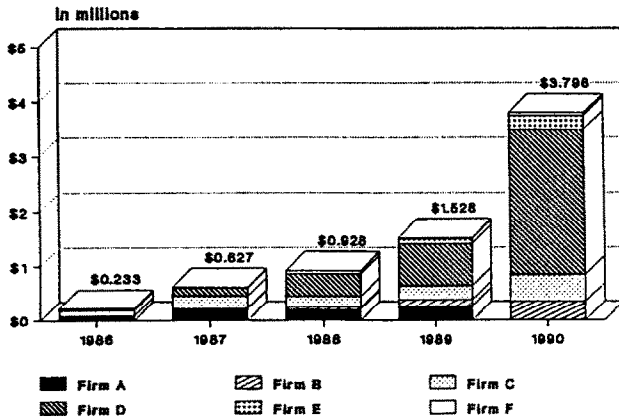


CHART B

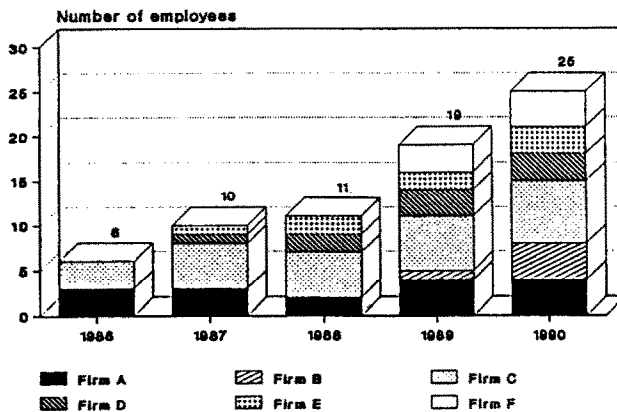


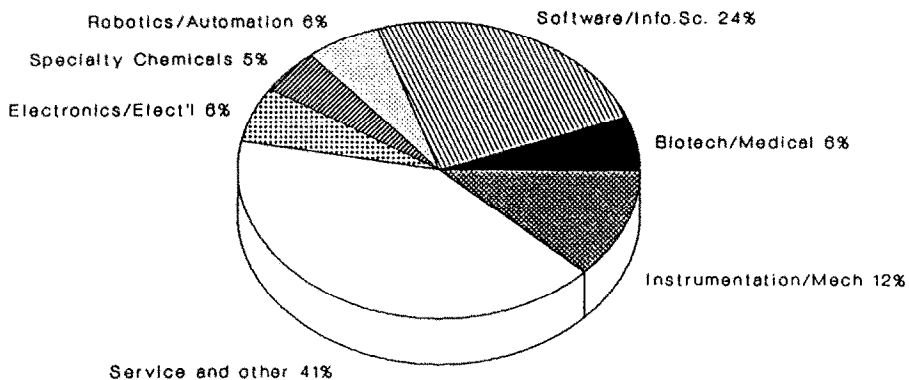
FIGURE 8
BCC - Growth of client firms (A) Sales (B) Employment

only a small number of part-time students (2 to 3) and a couple of faculty members actually involved with the program. There is no evidence of an adverse impact on the University's teaching and/or research. According to the management, BCC has drawn considerable interest and has been perceived as a model of economic development efforts in the state, and its presence was described to have enhanced University's prestige in the state and elsewhere.

The University foundation and private funds are the main sources of capital expenditure and about one third of the operational funds for BCC. In terms of operating revenue, BCC claims to receive around two thirds of its operating budget from rental and service fees. The Center currently lacks programs in financial support/funding for its client firms. This was attributed to the fact that North Carolina was not known for its venture capital industry.

Like the previous case, the same two (UBI target markets) parameters were researched with respect to BCC. First, there was a high percentage of targeted technologies among BCC's clients, which included (see Figure 9): software/information sciences, instrumentation/mechanical, electronics/electrical, robotics/automation, and biotechnology/medical firms. The much higher representation of service and software firms as opposed to technology-based manufacturing businesses showed a drift from the entry policy. This also suggested that the entry policy may not have been strictly followed for the sake of obtaining tenants. Second, the percentage of university-related entrepreneur's (students, alumni, professors) among its clients was found negligible. Currently, only one university-related entrepreneur (a professor) was involved as a client. This showed the need for improvement in the implementation of the policy of developing entrepreneurs from within.

Among the strategic operational policies, application of an entry/selection policy and an exit/graduation policy was reported. Only technology-based start-ups with high growth potential and existing cash flow were encouraged. The exit/graduation policy is generally kept flexible (with an optimal period of 3 years). However, the incubation period was negotiated at the time of entry. After the expiry of this period the rent was raised at the rate



Source: Survey Data

FIGURE 9
BCC - Technologies represented (client firms' percent)

of \$2 per square foot. Presently, there is no written intellectual rights protection policy or BCC-graduate firm linkage policy available.

BCC provides most of the incubator services. On the university-related services side, access to most of the services is made available. Of the incubator services, photocopier, fax, receptionist, conference room use, and shipping and receiving services were used and valued highly. Business assistance in accounting, marketing, business plan preparation were used and assigned moderate to high values. Of the university-related services, student employees, faculty consultants, library and lab services were valued most. Like in the previous case, the respondents reported that the university image was of major value to their firms. Figure 10 provides a ranking of the five most valued incubator services (see Chart A) as well as five most valued university-related services (see Chart B) by the responding tenants.

RESULTS AND DISCUSSION

The above case studies provide an exploratory analysis and comparison of two UBI programs in the U.S. It is interesting to note that there appear to be no significant differences based on the type of university sponsorship—University of North Carolina at Charlotte (public) or Case Western Reserve University (private). This suggests that in the U.S., UBIs hold similar objectives and provide comparable services irrespective whether they originate in public or private universities. In both cases, state or local government funds along with the university resources are being used to leverage private funds and involve-

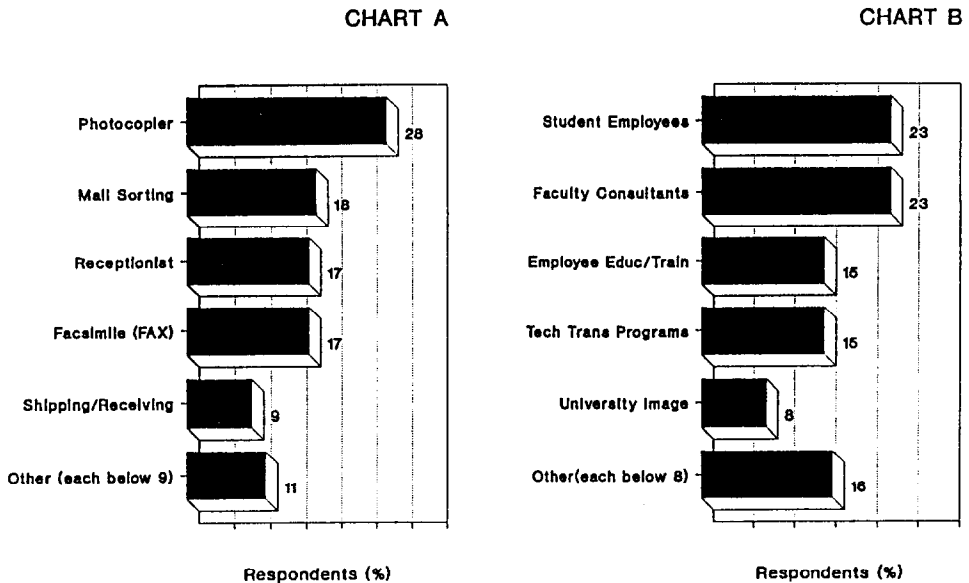


FIGURE 10
BCC - Client firms' ranking of the most important
(A) Incubator services (B) University-related services

ment, creating a sense of partnership among these sectors.

It is also interesting to note that BCC and, to a lesser extent, EDI, (both of which are subsidized by their states) do not seem motivated to strive for a break-even operation. A plausible explanation may be that the UBI management does not want to lower the quality of its services (and hence value-added), even if it has to continue receiving subsidies. It may contend that by charging market level rents and allowing entry to new tenants on the basis of their ability to pay rents, its mission of allowing only the desired technology-based firms will be violated. This conclusion is supported by the stringent entry policies followed by these facilities, especially EDI.

The finding that client firms generally trusted the UBI management in providing intellectual property safeguards seems contrary to commonly held beliefs. It appears that the clients either trusted the incubator management to protect their technologies or did not consider such protection necessary at this early unproven stage.

As expected, new and emerging technologies such as software and information sciences, instrumentation/mechanical, electronics, and biotechnology dominated these facilities. The participation of university-related entrepreneurs and faculty consultants seemed marginal. During the past decade, the two universities involved have been in the process of developing policies to address a number of the issues relating to faculty, such as, intellectual property rights and conflicts of interest. But most of the problems occur at a more mundane level, such as, maintenance of teaching loads, possible impact on tenure, and balancing work-loads. No serious attempt has been undertaken to address these latter issues. In practice, the relations between UBIs and the sponsoring-university's faculty and students have been reported as evolving at the facilities studied (Mian, 1994b).

Findings on tenant firms' performance suggest that the UBIs appear to have a positive impact on their client firms' survival and growth, as measured in terms of jobs and sales, but there is a note of caution here. In spite of the fact that every effort was made to solicit responses from the entire population of client firms in both cases studied, there is some degree of probability that the responses were primarily from the 'successful' firms. The UBIs' degree of financial self reliance is yet to be realized, which was often seen defended on the basis of 'non-quantifiable, long-term intangible benefits' such as building technology-base, encouraging technology transfer, improving start-up firms' chances of success etc.

While this research provided several new insights about UBIs, various questions remain. The study is based on comparisons between two selected UBI programs, using mostly self-report data that were directly or indirectly collected by the investigator. In spite of the methodological limitations, these findings present an intriguing, and to a large extent, favorable picture of the UBI concept. Similar results were reported in an earlier paper by the author using different case studies (Mian, 1994c). These results reinforce prior fragmented beliefs, suggesting that (a) incubators play an important role in the founding of growth oriented firms (Coopers, 1985); and (b) the university may provide both an environment for spin-off firms (Allen & Levine, 1986) and a resource-base for developing advanced-technology firms (Peters & Fusfield, 1983).

CONCLUSION AND RECOMMENDATIONS

The above two case analyses and their comparison show that UBIs are proving to be a viable strategy for providing the necessary resource-base and environment conducive to

the development of RTBFs. It concludes that despite their unique origins and types of sponsorships, successful university-sponsored business incubator programs in the U.S. have certain elements in common. These elements range from the origins and objectives, various policies and management practices, and services and their value-added, thus providing a milieu for technology-based entrepreneurship. Taken together, such elements represent a checklist of issues that should be addressed by those seeking to establish a new UBI program or to evaluate an existing one.

From the new RTBF entrepreneur's viewpoint, the implications of these findings are obvious. The UBI's university linkage plays an important role in providing the infrastructure support and the necessary value-added contributions critical for nurturing such businesses.

For the researcher of RTBF development, several challenges remain. To make this model more attractive to the entrepreneurial university, the components of benefit-cost equation have to be explored further to address the key questions of UBI sustainability and means of enhancing effectiveness in value-added terms. Similarly, from the entrepreneur's viewpoint the relative merits of this model compared to the classic intrapreneurial model for new venture creation, or the usual independent RTBF development mode, need to be probed. Additionally, the development of a joint university-sponsored business incubator and research park project seems to offer several potential benefits, including financial sustainability and greater synergy. These areas need further research.

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NOTES

1. Only 10% of these UBIs are located in Canada, the rest are in the U.S.
2. The Small Business Development Centers (SBDC) are set up by the U.S. Small Business Administration. The SBDCs provide technical and management assistance to small businesses. The Small Business Innovation Research (SBIR) program is another U.S. federal government initiative which is intended to address the Government's scientific R&D needs. The Small Business Technology Transfer (STTR) pilot program is a new federal government initiative through which funds are awarded to qualified small businesses for cooperative research and development with a non-profit research institution or a federally funded R&D center.
3. The Center for Venture Development, Cleveland, Ohio was created in 1983 by the Greater Cleveland Growth Association and Cleveland Tomorrow. The Center in cooperation with the state's Thomas Edison Program (created in 1985) had established and promoted the Edison Technology Incubator at Case Western Reserve University.
4. The value-added contributions of the services provided were assessed through tenants' perceptions recorded on a 4 level scale, with 0 as no value-added, 1 as minor value-added, 2 as moderate value-added, and 3 as major value-added. Similarly, the extent of usage was recorded on a 3 level scale with no, occasional, and high usage patterns reported by the tenant firms.

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