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BUSINESS INCUBATORS AND THE CREATION OF TECHNOLOGY-BASED FIRMS.
2) THE DEVELOPMENT OF TECHNOLOGY-BASED SMALL AND MEDIUM-SIZED
ENTERPRISES (SMES) WITHIN INCUBATORS *

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DEVELOPMENT OF TECHNOLOGY-BASED SMALL AND MEDIUM-SIZED BUSINESS AND BUSINESS INCUBATORS

I. THE NEW TECHNICAL AND ECONOMIC PATTERN AND KNOWLEDGE PRODUCTION

1. Scientific and technological progress has resulted in great changes to humanity, especially in relation to health, food, leisure, arts and culture, as well as new ways of social relationships, just to mention a few of those changes. With the invention of personal computers, access to information has no limits. Such mobility of information, which in the past depended on different access means and resources, enabled the hegemony of few nations over the rest of the world. This situation still exists, but almost real-time knowledge tends to weaken such hegemony. At present, new information and communication technologies (ICT) allow learning about every aspect, whether economic, social, technological, political and cultural, of a city or a country, even in visual terms, without having to leave our homes. It is now possible to create social bonds with people from different cultures and social classes. This means that the volume of data and their accessibility are limitless and create different and diversified new business opportunities.
2. The referred situation greatly speeds up the obsolescence of knowledge and products, and creates the need of new spaces for knowledge production, new spaces for a consensus on ideas and strategies to enable institutional relations; new spaces for creation and innovation; and new communication systems (diffusion of the knowledge produced and management of interfaces). On the other hand, the necessary investment in training, production, knowledge/technology safeguard and diffusion are costly and constant, as a result of which universities and scientific and technological research centers look for cooperation with companies and governments, since, in addition to the costs, the innovation process also implies risks. Both the consumer market and competition are global.
3. The creation of new spaces for knowledge production. According to Gibbons et al (1994) *Apud Costa* (2002), there are two modes of knowledge production and accumulation: mode 1 is disciplinary, and mode 2 is transdisciplinary. Based on the disciplinary mode or mode 1, knowledge production implies solving issues within the governmental and academic spheres, whenever they are interested in solving communal issues. There is a homogenous hierarchy that is rather prevailing in its organizational form; knowledge is disciplinary. The scientific community defines the objects to be studied, researched, and the way to assess their quality and results. Divulcation occurs through institutional channels, although mainly among peers, knowledge is divulged through conferences, which in the opinion of the authors, hinders creativity and even the benefits that businesses and society may obtain from such knowledge.
4. In the transdisciplinary mode or mode 2, issues are solved in relation to one particular sphere of application. Groups and hierarchy are transient and heterogeneous. Knowledge is transdisciplinary and usually applied by the industry, the government, and the society in general. The market determines the concept, defines the kind of knowledge that should be studied and/or produced. There is concern about clear rules of quality control. Communications are incredibly dynamic and conveyed through formal and informal means, among peers and institutions, communication networks, journals of scientific nature or not. The described situation results in the socialization of knowledge and in a fertile production of

ideas and new solutions. It also causes knowledge accumulation and specialization. There is cooperation among several disciplines, although these remain independent and maintain their different perspectives.

5. The heterogeneous organizational hierarchy of mode 2 encourages knowledge production simultaneously in several places, such as universities, businesses, research institutions and government agencies. The transient nature of the organizational hierarchy in the transdisciplinary mode of production enables different institutional relationships and favors both production as well as application of new knowledge. It also favors an atmosphere of creativity and innovation.

6. The flexible conformation of workgroups suggests that work is occasionally done through a communication network. Due to the transient nature of the group, it is usually dispersed as soon as the problem is solved. Another significant characteristic of model No. 2 is the easy access to resources, which generally come from three or more institutions interested in the knowledge to be produced.

7. Model No. 2 also includes spaces for consensus and innovation since, in general, the research and development teams do not depend on the respective institutions, with which they maintain informal relationships both on social and personal levels. In this case, both the society and the businesses are benefited with knowledge evolution.

8. However, the new knowledge production model requires the process to be thoroughly managed based on the following adverse situations originated on its application:

- The ownership of the financial resources and the way those resources will be increased or decreased;
- The role of the institutions involved;
- The production and ownership of the results depends on the degree of involvement of the participants;
- The lack of definition as to which institution the research team of a cooperative project is related. Virtual institutions are 'organized'; and
- The lack of equanimity as to the use of and access to the results.

9. Thus, the economic use of technological innovation opportunities involves internal issues related to the discovery, development, and production processes and, therefore, to be successful it needs to be previously assessed and developed with great enthusiasm, technical skills, dexterity and passion. On the other hand, it needs mechanisms to manage possible conflicts and to integrate the mutual perspectives and interests of the researchers, research institutions, businesses and governments. It is in this context that the technology-based business incubators are created: a mechanism or process that combines technology, capital and entrepreneurial talent. This process encourages cooperation between people and institutions for the purpose of sharing financial and economic resources, and the competencies existing in the institutions for the purpose of transferring or using the available technologies, which are transformed into competitive goods and services by creating technology-based businesses or by innovating already existing products.

10. Conflicts between universities and businesses are considered differently thanks to the market globalization: the related effect on business competitiveness and on the survival of universities. For this purpose, and mainly due to the current difference between the cultural values inherent in each field, certain mechanisms have been created to bridge the gap between those two agents and also with the government itself.

11. One of the referred mechanisms consists in business incubators, which were created in California (USA) and Europe during the 60s, and which are spreading over the rest of the countries. According to the National Business Incubation Association (NBIA), at present there are nearly 800 incubators in the USA. Through July 2003, the Associação Nacional de Entidades Promotoras de Tecnologias Avançadas, or ANPROTEC (Brazilian Association of Advanced Technology Promoting Institutions) recorded 203 incubators and over 8,000 incubated businesses in Brazil.

12. Some of the goals of those incubators consist in mediating the cooperation between the universities and the businesses, especially small and medium-sized businesses, strengthening the economic and social development potential of Brazilian regions and towns, and boosting the image of the cities. The main services and support offered are as follows:

- training entrepreneurs both on technical and managerial aspects;
 - instructing and fostering entrepreneurial competencies and skills in individuals and teams;
 - looking for process and product innovations, especially for micro and small businesses;
 - identify and negotiate funds/promotions for research and development activities that add value to production;
 - develop viable alternatives to sell innovative products and services;
 - encourage advisory and consulting services adequate for the actual needs of entrepreneurs that result in the survival and enhanced competitiveness of the enterprise;
- Support to develop a Business Plan
 - Financial and accounting management
 - Organization of a team to manage the enterprise
 - Marketing consulting services
 - Authorization, regularization and standardization
 - Legal services
 - Commercialization of technologies and processes
 - Advisory services on export activities
 - Advisory services on design
 - Internet access
 - Support for cooperation with universities and R&D centers
 - Involvement in trade shows and events related to the enterprise
 - Security and cleaning services
 - Advertise the enterprise and its products

- Provide spaces where to implement the enterprise, usually within or very close to the university campus;
- Ensure shared use of office and administrative services, as well as equipment, meeting places and food;
- Showroom for incubated products and processes;
- Library;
- Contact network with investors, suppliers and consumers; and
- Follow-up to and assessment of the performance of the sponsored enterprises and, if necessary, alternative ideas.

II. CHARACTERIZATION OF INCUBATORS

Physical incubators

13. In addition to the referred services and support, furnish entrepreneurs with a prestigious location, shared physical space and equipment and furniture facilities. Within this modality, the incubators are subdivided into:

- **Segmented:** incubation modality to support enterprises related to only one segment, for example, Information Technology Incubator, Biotechnology Incubator, or Services Incubator, among others;
- **Multi-segmented:** incubation modality to support, within the same space, enterprises related to more than one segment, for example, Technology Information, Biotechnology, Automation and other segments;
- **Virtual incubators:** they furnish entrepreneurs with all of the referred services and support, but that do not usually offer a shared physical space and facilities. Their support is mainly focused on marketing, access to networks of contacts, technologies, human resources, tax and accounting advisory services, support to obtain venture capital. This modality is widely spread in the United States, and there are some in process of being implemented in Brazil. Their main advantage consists in the reduction of management and operationalization costs since they will support increasingly more businesses at the same time and with almost the same funding;
- **Cooperative incubators:** they consist in an hybrid incubation process resulting from a combination of physical and virtual modalities, by which cooperatives' directors are furnished with management and strategic training, consulting services, advisory services and the means of the incubator to place the products and services of the members in the market with higher competitiveness. In this case, the cooperatives' address is the same as the incubator, but the member enterprises have their own, unrelated to the incubator;

- Hybrid incubators: they furnish entrepreneurs with both service and facilities infrastructure as well as with services only. In this case, the enterprises are known as incubated and associated businesses, respectively; and

- Rural incubators: they support enterprises located in rural areas. Their operation is similar to that of cooperative or virtual incubators (associated). Their focus may be to furnish services, training and education, financing and diffusion of knowledge.

14. The differences between business incubators and other existing support mechanisms are:

- The acceptance of entrepreneurs in incubators is subject to a strict selection;
- Entrepreneurs are restricted to well defined terms, phases and conditions to remain within the incubators;
- There are teams and processes to follow up, advise and evaluate the technical and financial development with well-defined methods and periodicity;
- There is a physical space provided with shared facilities to shelter newly created businesses;
- Prestigious location and strong name of an institution; and
- Contact networks.

III. PROFILE OF TECHNOLOGY-BASED BUSINESSES (TBBS)

15. The concept of small technological enterprise was used for small technology-based businesses based on the contradiction of their characteristics and the extension of global competition. On average, the staff consists of 1 to 3 people, including directors/owners, who usually have proper technical skills but lack managerial competency. Therefore, such small enterprises have no organizational structure, especially the resident members of incubators. The most that can be stated is that they have an area of R&D and production. Based on such scenario, how can this tiny structure be in line with a world of globalization, innovation and competitiveness? Will it achieve it through the general training of its human resources? Will it achieve it through the development of its entrepreneurial talent or through the conditions (resources) existing in the incubator?

16. The main feature of these TBBS is the intensive use of scientific and technological knowledge and specialized workforce. At the same time they generate innovative products and services, they also come up with new knowledge, new qualified jobs and competitive advantages. Thus, both the incubator and the small technological enterprise will be able to be the agents of the economic and social development at local, regional, and in some cases, national levels, once they achieve large-scale success. The rate of survival and success of

TBBs sponsored by incubators and similar mechanisms is of 80%. It is the opposite situation of micro and small businesses created in isolation in certain countries and/or regions, where up to 80% disappear during the first year of activities. Rogers and Larsen (1984) conducted a survey on the Silicon Valley case and found out that 20 to 30% of the new TBBs in the referred environment disappear over the first years of activity, 60 or 70% are slightly successful, and 5% are highly successful, among which are Apple and HP.

17. The main limitations addressed by the TBBs consists in the lack of continual training and education, and of access to scientific and technological knowledge, in addition to the reluctance of universities to work in cooperation with businesses, inadequate lines of credit, economic instability, especially in Latin America, lack of scientific and technological policies, as well as of fiscal and tax policies, inexistent entrepreneurial initiative. Therefore, enterprises of this nature mainly require mechanisms that act as a bridge between them and the government, the universities or the R&D centers.

18. Some authors such as Lalkaka (1996), Mustar (1997) and Pires *et al.*(1997) have already noted effects such as the creation of small technology-based businesses (TBBs) as a result of spin-offs of universities and large companies, chances in the institutional culture of universities and companies, and increasingly easy integration of new graduates in the labor market.

19. Moreover, rather than generating employment¹, the referred TBBs, which are characterized by the use of skilled workforce and have knowledge as their main input, act as mediators in the market and in relation to the basic research carried out in the related institution and, thus, transform academic research into innovative products, strengthening the local and regional economies. They also generate new enterprises and products in the same segment as a result of the technologies they develop, creating a multiplier effect (that is, a new product developed by a business generates employment and income in the related segments). They enhance domestic competition, thus improving businesses' quality and output and reducing the tendency to polarize and concentrate power. They create advantages for academic research as they extend the possibilities of obtaining financial resources. They may represent a way of curbing the emigration of young talents. Finally, as a result of the

¹ Mustar (1997) followed up the development of 100 TBBs created in France from 1984 to 1987, and of 102 businesses created from 1988 through 1991. The referred TBBs were created by researchers jointly with local universities and public authorities. The author carried out two different surveys, one in 1988 and the other in 1992. Among other conclusions, the author found out that: (i) an average of 40 new businesses were created per year; (ii) the areas in relation to which the TBBs were mostly implemented were: biotechnology, computer science, and engineering; (iii) the origin of technology lies in the research carried out at the universities, in the participation in seminars, in the publication of scientific articles, and in the use of doctoral students; (iv) every business has signed at least 5 partnership agreements to help them develop their goods and services; and (v) the TBBs do not generate many jobs: the 200 businesses represented 3,500 jobs. 'The average number of employees is 2 to 3, but they generate more businesses and quantitative jobs in the related segments.' (*op. cit.*:42). In addition to the referred characteristics, the author also observed that the rate of disappeared TBBs is, conversely, lower than that of the businesses acting in isolation in the market. During 5 years, the bankruptcy rate for low-technology businesses exceeds 50%. Among the businesses analyzed by Mustar, 72% were still in the market carrying out the same activities. The author stated this success was the result of the supporting network developed for such enterprises, which mainly allows them to use the knowledge generated in universities as well as the public and private funds.

risks and uncertainties posed by enterprises of this nature, both formal and informal networks of supporting organizations are created, generating a new pattern of innovation different from the linear model of research, development, production, and market, based on the integration of science and markets.

IV. PROFILE OF THE BRAZILIAN INDUSTRIAL SECTOR

20. The business sector is mainly formed by SMBs: 99% distributed as follows: 18% related to industrial activities, 45% related to commercial activities, and 37% related to services, according to the Annual Report of Social Information, or RAIS (2001). Quantitatively speaking, this means 5.6 million SMBs, which generate 27.2 million jobs for an average income of R\$ 829.88, mostly taken by people with primary and secondary education. Only 12% of these employees have completed higher education courses.

21. Based on the survey carried out by the CNI (Brazilian Industrial Confederation) (2001), the situation of Brazilian incubated is different: the average monthly income per capita amounts to R\$ 10,000.00. Each TBB generates 16.5 direct jobs. Thirty-eight percent of employees have completed higher education courses and 7% of them are postgraduates. As regards businessmen, these businesses represent the first experience for 48% of them. Fifty-four percent of them have completed higher education courses, 10% are postgraduates, 17% have master degrees, and 8% have doctorates. Another significant effect of incubators lies on the fact that 81% of incubated businesses have business plans, which are regularly updated, that is, entrepreneurs are acknowledging the importance of planning and monitoring the performance of their enterprises. Lack of planning and management are considered the main reasons for the failure of SMBs.

22. Companies still react slowly to the initiatives of the Brazilian government for the purpose of strengthening the industries' technology base and do not consider universities as their main and most significant partner, either to provide services or to train the workforce. The large business segment records a few exceptions since, based on the data supplied by government agencies, they systematically make use of programs that support competitiveness, which are also implemented by state and municipal research institutions. In the segment of small and medium-sized businesses (SMBs), this situation takes place at a smaller scale and in most cases through mechanisms such as incubators, parks or technology transfer centers.

23. Underlying the conflict of interests and vision between the academic and the industrial sectors, most of Brazilian businessmen still show a behavioral pattern different from that suggested by the present competitiveness model. They still have a short-term vision, prioritizing profit rather than an appropriate organizational environment to implement further structured learning and relearning processes, and preserve the culture based on the protection provided by a government that funds R&D initiatives or maintains excessively protectionist policies in relation to the domestic market.

24. At present, the structure of Brazilian companies is extremely heterogeneous and comprises foreign companies of all sizes and from different origins, with the interests and characteristics of their respective parent companies, which benefit from the potential of the domestic market with increased competition as a result of Brazil country risk and of the liberalization of the incentive policies to attract foreign investment, which has a negative impact on the domestic companies. There are several recent examples of long-standing Brazilian companies forcibly disposed of as a result of the perverted international competition.
25. Except for a few cases, the profile of the Brazilian industrial segments is little diversified, and it is characterized by industrial activities in traditional segments with low potential output and scarce diffusion of technological innovation.
26. The managerial structure still maintains a vertical, hierarchical model with conservative features, which is not adequate for the new model proposed by the synergy among marketing, production, commercialization and finance areas, and the strategic and technological alliances between the businesses within the same segment or between businesses, universities and research centers, or any other organization that fosters innovation and competitiveness.
27. Minor investments in the training of human resources, which are in need of complementing their basic education on account of the educational system in Brazil.
28. Small investments in research and development.
29. Little concern over the quality of the goods and services developed.
30. Little attention to the needs of the market.
31. The local/regional competency is underestimated, with no respect for the facilities and the local growth potential when having to determine the nature of the business to be implemented.
32. Consequently, the Brazilian industrial network is fragile, technologically underdeveloped and, therefore, in no condition to compete abroad or in the domestic market, as a result of the market deregulation in strategic segments. According to the report prepared by the United Nations Development Programme (UNDP), published in 2001, Brazil is ranked 43rd among 72 countries in relation to the Technology Achievement Index. This is one of the various indicators that show the importance of creating outstanding facilities in businesses and universities, improving the few research and development centers in the country, and increasing investments in scientific and professional training, stimulating the most advanced areas that may support human, economic and technological development.
33. There is no solid and consistent policy that supports the strengthening of micro and small businesses, which in industrialized countries are the focus of innovation and economic growth policies. In the United States, the government has implemented the U.S. Small Business Administration (SBA), an institution equivalent to the Brazilian Micro and Small Business Support Service (SEBRAE). The SBA's 2001 budget totals nearly US\$ 30 billion to provide diversified and strategic support to successful small enterprises: venture capital for innovation and access to new markets, business information, electronic commerce, mergers, legal and technical assistance, insurance against failures and disasters, technical and financial

support for minority groups to create their own businesses (natives, women, war veterans, etc.), different surveys and research on small businesses, among others. In addition to the referred resources, the government consistently provides support to over 6 thousand businesses within the United States.

34. In Brazil, the policies aimed at providing support to small businesses are still incipient and depend on a fluctuating public budget. SEBRAE's annual budget totals nearly R\$3 billion. It is only as recently as the last 5 years, that this organization has improved its strategic definition to provide support to small businesses in relation to innovation and competitiveness, by means of specific regulations for incubators and TBBs, local productive arrangements focused on the support to initiatives and governance of the municipalities in Brazil, and production chain projects.

35. It should be noted the existence of mediating mechanisms or agents in cooperation processes are vital. The success of businesses depends on the quality of the services rendered by the network, since technology-based businesses are not able to build a bridge between science and market on their own as a result of their highly specific consumer market. The process to create and develop TBBs is based on the synergy among several agents from different institutions, which establish a relationship of cooperation among them and with the local environment. The skill of such agents is the key factor that will result in assistance and processes for the diffusion of information on technology, educational resources, and consistent government policies.

36. The existence of public policies that meet the needs of SMBs is particularly vital. In the United States, for example, special policies have been implemented to protect intellectual property that encourage domestic businesses to carry out their activities in other countries as well, on account of which they become multinational businesses. Likewise, private and state-owned universities and research laboratories have signed international agreements, thereby expanding the results and the research conditions. During the 80s, the United States government created the Bayh-Dole Act, which was in charge of managing a large volume of public funds allocated to technology transfer processes and protection of intellectual rights on the knowledge base generated in universities and businesses in the referred country.

37. The public policies implemented by the United States government have decidedly contributed to create the basic conditions to generate innovation and technology-based businesses in strategic segments, particularly antitrust policies and significant military investments, which originated a critical mass of engineers, researchers and other technicians, who, after WWII, were provided with benefits and found proper environments where to create high-tech businesses. During the 70s, the National Science Foundation (NSF) implemented the Small Business Innovation Research Program, with an annual expenditure of US\$100 million allocated to financial aids for technologies and small businesses with high risks, especially in relation to the commercialization process. Later on, the Advanced Technology Program was created at the National Institute of Standards and Technology, which is in charge of providing support and technical and financial assistance to associations of large corporations and businesses that may potentially generate spillovers and high-tech start-ups.

38. It should also be noted that, since 1989, government investments have significantly increased and also extended to private industries as well. During such period, incubators played an important part in the commercialization and diffusion of technologies created in universities and state-owned laboratories through their support to the implementation of high-technology firms.

39. The role of the United States government in the process of creating a stimulating environment for the implementation and diffusion of technologies is vital and significant: from primary, secondary and technological education to the direct role in the creation of research teams that were strategic for the country, including the support provided for the implementation of technology transfer firms, incubators and innovation centers. As regards entrepreneurship education, the universities in the United States teach not only how to create a business but also how to obtain financing and grow at a fast rate. The courses at the MIT are managed by the Sloan School of Management.

40. Ten to forty percent of the students in each course do not come from an educational background related to business administration, and many of them have an engineering-related education. Every year, 150 projects that deal on business administration issues are entered into a contest providing a financial support of US\$50,000.00, according to Brockhaus (1999).

41. A survey conducted in 1997 at universities, educational institutions and hospitals in the United States revealed a significant growth in activities related to licensing, patents and creation of new businesses as compared with 1996. It was found that 333 starting businesses were originated from 101 institutions, compared with 248 businesses and 86 institutions over the prior year. Among the starting businesses, 86% were created within the same state of the originating institution, which shows there is an economic and social return on investments made in a certain location. Also, 69% of the licensed technologies were originated from local businesses, out of which 31% consist in incipient businesses. In 1997, a 31% increase was recorded in patent applications, and a 21% increase in new licenses. The resulting economic effect was of US\$30 billion and 250 thousand jobs created per year, according to Brockhaus (1999).

42. The referred policies are, therefore, responsible for a non-linear innovation model: Triple Helix Model (research-development-innovation) based on the implementation of cooperation networks and supra-institutional organizations, which combine interests, resources, and competencies of universities, governments and businesses (Etzkowitz, 1996).

43. The German survey conducted by Keck (1993) is a thorough analysis of the National Innovation System in Germany from the 18th century through the 1990s, focused on the social and technological changes that took place, on the basis of the educational system in that country. Since the 18th century, the German government has largely invested in higher education aimed at an education on human and technological sciences. This would be the greatest difference with other countries, including developed countries. As regards technological policies, the federal and the regional authorities provide aid and special rates for businesses that invest in R&D. Those programs offering special credit rates to foster the creation of technology-based businesses are also responsible for the development that took place in several German localities. In 1989, 53.5 million German Marks were allocated only to this segment, even as venture capital. The German government still believes in the technological competence of national R&D laboratories.

44. The German government created vocational schools, polytechnics and technology institutes. The referred structures are maintained through grants and other support means, and are focused on technology transfer and absorption, especially for SMBs. Also, there are programs that provide support to organizations that mediate between the educational system and technology on the one hand, and SMBs, on the other, so that the private sector invests in R&D&I. One of the most frequently used mechanisms is the *Fraunhofer Gesellschaft* (society) or 'FhG', as they are called. These are research centers created by the chambers of commerce and the local and state governments, and are responsible for the production and diffusion of technology. There are 46 FhG in Germany, with an annual budget of US\$750 million.

45. One of those centers, the Institute for Production and Technology (IPT), is located in the city of Aachen. Two hundred and seventy-six employees, of whom 62 are scientists, 38 are not scientists, and 176 are students, are related to this institute. The IPT's budget is absolutely formed by public funds and is compulsorily allocated as follows: 47% for industrial research, 31% for surveys under the responsibility of governments, and 22% for basic research (Shapira, 1996).

46. Interesting results were also obtained through the creation of science parks to attract new high-tech businesses or to enable the creation of spin-offs from universities and research centers. A survey conducted in 1989 in this country identified 50 innovation centers in operation and 50 centers in process of being implemented. This initiative then required an investment of nearly 5.5 million German marks.

V. EFFECTS OF INCUBATORS IN BRAZIL

47. In Brazil, incubators are currently going through a process of expansion and are highly regarded by public institutions. They have become the main supporting mechanisms for the creation and innovation of micro and small businesses. Public (federal and local authorities) and private institutions have associated with ANPROTEC to create specific lines of technical and financial support to the administration and infrastructure of incubators, as well as training courses and financial resources for resident SMBs.

48. The first SMBs incubators were created in different regions of Brazil until 1989 as a result of the initiatives of the National Research and Development Committee (CNPq), which until then only financed activities related to scientific research. The first 4 incubators were created then: 2 in the south, 1 in the southeast, and 1 in the northeast of Brazil. During the 90s, more than 100 new incubators were created. The average annual growth rate was of 30%.

49. Due to the concentration of wealth and of research-related tasks in the southern and southeastern regions of Brazil, young talents (mainly from engineering careers) migrate to the referred regions looking for job opportunities related both to research and to the industry. The decentralization of resources to other towns will enable the creation of support networks to establish TBBs beyond the southern/southeastern regions, and favor the settlement of the

referred professionals and senior researchers, who migrate to obtain improved research conditions and higher wages. The current government policies are currently focused on such purpose. Universities and private businesses have had access to resources through segment-focused programs and according to predetermined rates for institutions located in the northern, northeastern, and mid-western regions. The resources allocated to support incubators and incubated businesses are available through the same mechanisms: regional predetermined rates.

50. Physical incubators have shown certain effects that may be considered as highly successful, despite the following factors: they still do not have access to venture capital or seed money, their teams are not always as qualified as those of virtual incubators, and they lack national and international contact networks with an appropriate structure to support the fast development of enterprises. Over the last 5 years, nearly 5,000 new businesses were created, most of which are related to segments that need longer periods for these enterprises to become strengthened in the market. Fifty-seven percent of technology-based businesses, 29% of traditional segments, created by young people aged 18 to 35, which generate over 9 thousand direct jobs. Forty-seven percent of the incubators were created by private not-for-profit organizations, and 17% are federal public institutions. Seventy-two percent of the incubators are formally related to universities or research centers, and the average employment rate is of 82%. The enclosed graphs show additional indicators. The main goals of incubators consist in entrepreneurship incentives, economic diversification and technological development.

51. The incubators are provided technical and political support by ANPROTEC, SEBRAE and other government and non-government institutions, and are organized in local and regional networks, which has contributed to the accelerated and healthy growth of incubators and incubated businesses.

52. The lesson learned from the implementation of virtual incubators may be listed as follows: the focus of the support initiatives should be enhanced in relation to venture capital and marketing activities for goods and services in emerging markets. This strategy, coupled with managerial training and development of the associations already established will speed up growth and reduce time and costs of graduation (maturity) of the incubated businesses.

53. It should also be noted that the rate of success of incubated enterprises or enterprises associated with incubators in Brazil is nearly 60 to 80% of the total selected enterprises. Such success is a result of the specialized service and support structure provided through incubators, among other factors.

VI. CONCLUSION

54. Over the last decades, the relationship of universities and businesses has been frequently researched in different ways but with similar purposes: to develop new economic growth strategies, mainly regional, based on the resources existing in three environments: universities, businesses and governments. Each of these agents has a new role, in relation to which tangible actions and results are already taking place in Brazil. Cultural incompatibilities or different interests of the academic and business environments hinder the institutionalization of cooperation between universities and businesses. Thus, universities –

which have the main production input, that is, knowledge, must address their internal conflicts and come up with mechanisms that allow stimulating cooperation between universities and businesses. Whenever such interaction takes place, it may generally be noted that the level of informality is maintained, especially in the case of small and medium-sized businesses.

55. In turn, businesses must also solve their respective internal contradictions and consistently take part jointly with universities, technical schools and governments in the education, reeducation and professional training of their workforce, at the same time they increase their share in the total Science and Technology expenditure, which is still small in Brazil (1% of the GDP, out of which 90% comes from the government and 10%, from companies). This will be possible through 'capital reproduction' practices with funds obtained from their own business activities, that is, reinvesting capital in activities that will increase their competitiveness in the domestic or international markets.

56. The incubators of technology-based businesses have a significant role in relation to institutional cooperation and innovative enterprises, creating new socio-economic and political relations. They contribute to a process of cultural changes in organizations. They foster production, use and diffusion of innovations. Through strategic alliances they provide the environmental conditions advantageous for innovative production and local/regional development. In the case of regions that lack a strengthened industrial park, incubators contribute with their support to the creation of TBBs that generate qualified jobs and absorb the regional critical mass, frequently changing even local competencies and the social reality of the communities.

57. The great challenge faced by incubators is to become the agent that generates and fosters the creation of public policies aimed at innovation in SMBs, such as intellectual property, credit/promotions and funding for innovation and facilities appropriate to Research, Development and Innovation (R&D&I).

58. The new model for knowledge production and innovation in businesses comprises a new way of integration and new roles for development agents, since it is focused on multidisciplinary and multi-institutional groups, which are encouraged to take part in small-scale projects and obtaining resources from different origins, as a result of which local, regional, and national networks are formed. On the other hand, their work is based on induced and vocational demands that favor segmented and focalized development. This model is interesting for developing countries. Incubators have been proficient mediators for universities, businesses and governments.

59. Public policies that foster cooperation between universities and businesses and provide the necessary incentive and funding to generate and use scientific and technological knowledge are highly significant, since the accessibility to technology in less industrialized countries may result in local disadvantages for the TBBs compared to other businesses located in developed countries on account of the inadequate national innovation system.

60. The leaders of the Group of 8 (G-8) and the Newly Industrialized Countries (NIC), which have been frequently referred to in the scientific literature as successful experiences, confirm that contemporary states should act as catalysts for the economic activity. Also, they should foster a long-term economic and social development project consistent with their respective characteristics, that is, a project that reckons the local initiatives to promote Endogenous Development focused on small enterprises. They should as well become the distributors of wealth and income, in addition to decentralized states.

61. The above-mentioned experiences, among others, lead to the conclusion that building bridges between the academic and the business worlds is a decisive factor for local sustainable development since, except for very few cases, it will be very difficult for small entrepreneurs to have access to markets and university researchers to obtain solutions for their 'minor' problems without the support of public policies. Business incubators may be considered as a solid link for the interaction of universities, R&D institutions, technical schools, governments and small local enterprises. They constitute a local innovation system where, based on the initiatives of the incubator, a hybrid forum is created by those agents of innovation. The differences existing in each institution characterize the referred hybrid forum and makes things happen on the basis of overcoming the institutional shortcomings.

62. Gibbons et al (1994) used the term *hybrid forum* to refer to the organization of new models of knowledge production, which becomes a 'complex hybrid of social agents that encourage the supply and demand of specific knowledge, which today represent the main element of competitiveness.' This concept may be applied to incubators considering their role in fostering the interaction of economic and social development agents that direct the supply and demand of resources of any nature, and adapt the different interests and perspectives of the institutions taking part in the generation and innovation of small technological enterprises. According to Chesnais (1992), Azais (1992) and Amadeo (1992), small enterprises are vital for the economic and social development, especially at local levels.

63. Based on the data provided by SEBRAE (2003), in Latin America, the SMBs are distributed as follows: 53% carry out activities related to commerce, 34%, to services, and 13%, to industry. If we want the economic and sustainable development of Latin America, we need to encourage the further integration of public and private initiatives and policies, which promote and induce the growth of micro and small businesses consistent with their ability to absorb new technologies and capital.

Chart 1 – INCUBATORS IN OPERATION

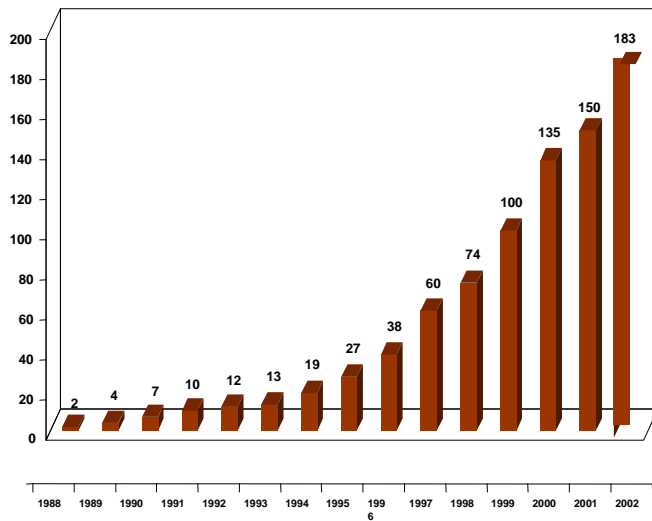
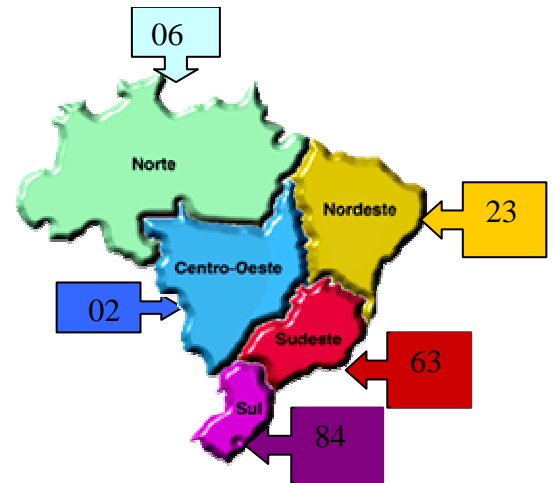


Chart 2 – REGIONAL DISTRIBUTION



North (green); Mid-west (blue); Northeast (yellow); Southeast (red); South (purple)

Chart 3 – TYPES OF INCUBATORS -

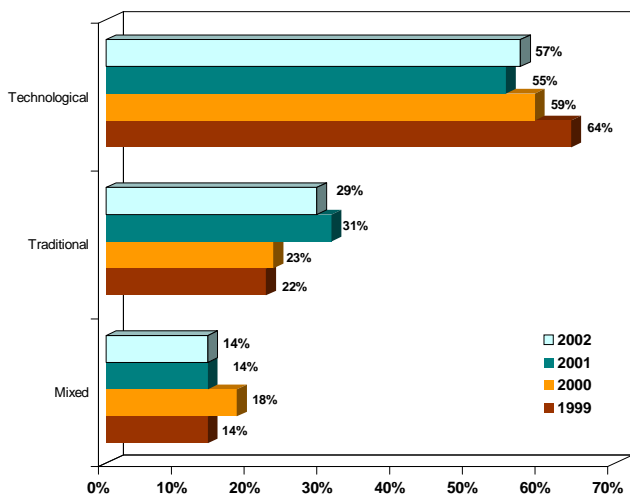
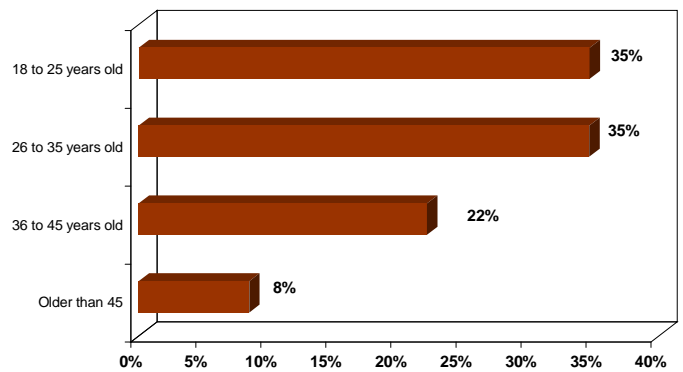
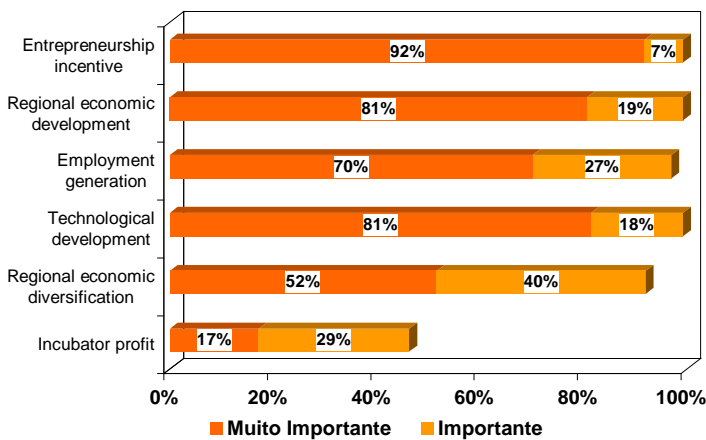


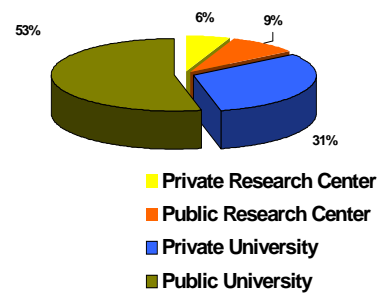
Chart 4 – AGES OF ENTREPRENEURS



Graphic 5 – INCUBATOR GOALS

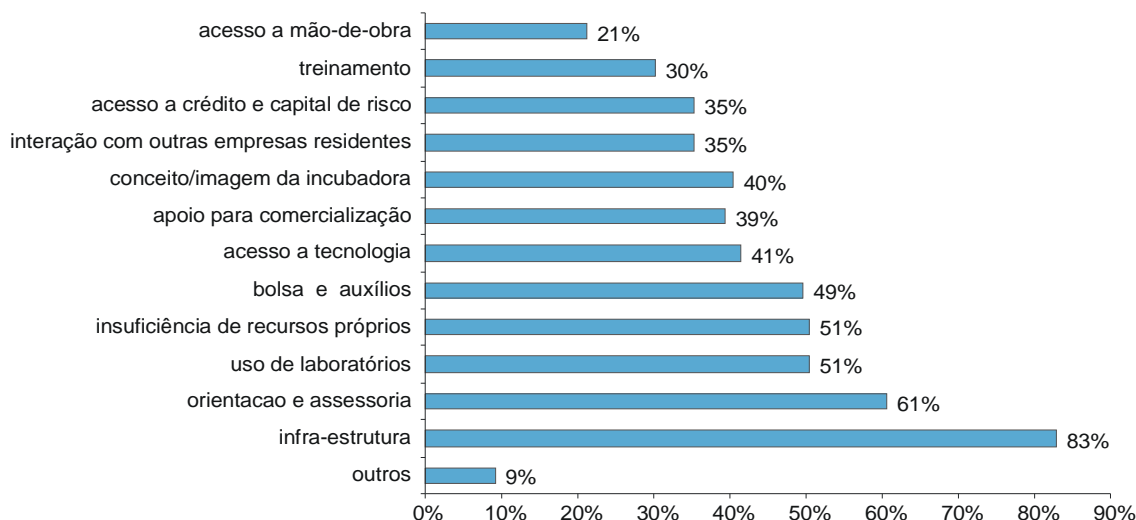


Graphic 6 – RELATIONSHIP WITH EDUCATION



Legends: (Chart 2). Highly significant (dark orange); Significant (light orange)

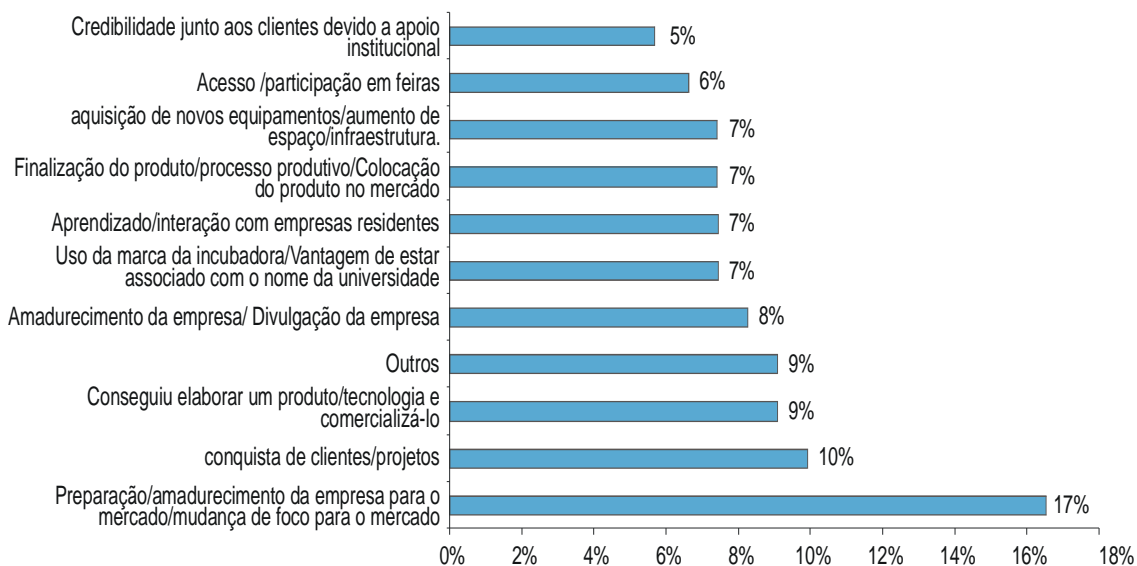
Main reasons for businesses to take part in incubation processes



Source: Survey on Graduated Businesses

Legends: Access to workforce; training; access to credit and venture capital; interaction with other resident businesses; concept/image of incubators; support for commercialization; access to technology; grants and assistance; lack of own resources; use of laboratories; guidance and advisory services; facilities; others.

Main results mentioned by incubated businesses



Legends: Credibility with clients on account of the institutional support; access/participation in trade shows; purchase of new equipment/extension of location/facilities; completion of product/production process/placement of product in the market; learning/interaction with resident businesses; use of the incubator's trademark/advantages for being associated with a university; business maturity/diffusion of business activities; others; able to manufacture a product/technology and sell it; get new clients/projects; business preparation/maturity for the market/change of focus for the market.

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