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Entrepreneurship in the University systems

**THE TECNOLÓGICO
DE MONTERREY**

Entrepreneurship in the University systems.

The Tecnológico de Monterrey

**Public Policy and Productive Transformation Series
N° 4 / 2012**

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Foreword

Productive transformation has been one of the areas that CAF, as the development bank of Latin America, has fostered as a necessary condition for reaching a high and sustainable level of development in the region.

The experience and expertise generated in each project over the last decades have made the Institution to become a Latin American point of reference in areas of competitiveness, corporate governance, local and business development and productive inclusion.

The public policies necessary to drive productive transformation are based on the development of those capacities aimed at the implementation of good practices and on specific supports for improving business management and productivity. Thus, CAF makes its knowledge and expertise available and offers efficient support to a variety of sectors while, at the same time, creates documentation and research on success stories that are relevant to the region

“Public Policy and Productive Transformation” consists of a series of policy documents aimed at disseminating those experiences and successful stories in Latin America, as an instrument for spreading the knowledge that CAF makes available to the countries in the region so that better practices with respect to business development and productive transformation can be implemented.

L. Enrique García
Executive President

Executive Summary

Ever since it was founded, the Tecnológico de Monterrey (Monterrey Technological University) has been an institution widely known for its excellent university training and instilling an entrepreneurial culture in its students and professors. It has complemented this business vision with a firm intention to encourage the creation of sources of employment and wealth for the most vulnerable classes in Mexico through social incubators, whose aim has been to promote the transition from self-employment to the founding of micro-companies within the formal economy.

The current document describes the critical processes and strategies implemented by the Tecnológico de Monterrey for the creation of an ecosystem aimed at entrepreneurship, ranging from educational processes to the physical infrastructure and programs for technological support geared to different publics: its students, the business community, the social sector and public and private bodies, revolving around the task of training entrepreneurs for the benefit of their community.

Key words: entrepreneurship, Tecnológico de Monterrey, TEC, incubators

Introduction

Since its foundation in 1943, the Tecnológico de Monterrey (Monterrey Technological University) has been an institution widely known for its excellent university training and instilling an entrepreneurial culture in its students and professors. The prestige of the institution has resulted from years of work in the field of education, which dates back to its beginnings in northeast Mexico, one of the country's most energetic industrial regions. Created by businessmen who were truly interested in turning it into a world-class university, from its birth its aim was to form high-level human resources, with a humanistic and practical vision, to meet the needs of business development in that period and provide the high-quality education which had only been imparted by the State up to then.

Diverse entities, like the Organisation for Economic Cooperation and Development (OECD), have singled out the work in Latin America of the Tecnológico de Monterrey as a university with a leading model, characterized, among other things, by instilling an entrepreneurial culture through courses and other educational strategies in its curriculum, which demonstrate an educational commitment not only to the creation of companies but also innovation and the technological and social development of the country (OECD, 2010a).

In its recent history, the Tecnológico de Monterrey has also been responsible, year after year, for the largest number of patent applications among the country's private universities, higher even than the Universidad Nacional Autónoma de México (UNAM), Instituto Politécnico Nacional (IPN) and Centro de Investigación y de Estudios Avanzados (Cinvestav): 20 patent applications in 2006 and the same number a year later, 46 in 2008, 37 in 2009, 50 in 2010 and 47 in 2011 (Ortiz, 2012). Between 2007 and 2008 its research centers created 23 technology transfer companies and its network of company incubators and accelerators created 4,700 direct jobs in Mexico. This model has been replicated in other Latin American universities with the partial or complete adoption of the Tecnológico de Monterrey's curriculum and best practices for establishing businesses and regional economic development (OECD, 2010a).

It has complemented this business vision with a firm intention to encourage the creation of sources of employment and wealth for the needier classes in Mexico through social incubators, whose aim has been to promote the transition, among those involved, from self-employment to the founding of micro-companies within the formal economy. This aspect of sustainability, which is also set forth in the Institute's Mission 2015 Declaration, has enabled it to assume, with a profound seriousness, the principles of sustainable development seen in the universities of

other countries, like Delft University, in Holland; the University of Michigan and Dartmouth University, in the United States; and the Universidad Politécnica de Cataluña, Spain (Martin & Moneva, 2011), among others.

The present document describes the critical processes and strategies implemented by the Tecnológico de Monterrey for the creation of an ecosystem aimed at entrepreneurship, ranging from educational processes to the physical infrastructure and programs for technological support geared to different publics: its students, the business community, the social sector and public and private bodies, revolving around the task of training entrepreneurs for the benefit of their community.

Taking intra-institutional circumstances into account, regional, national and international conditions for development and competitiveness have been crucial for the establishment of the ecosystem and the design of the institutional strategy for Research, Development, Innovation and Incubation, known as "R+D+i2" ("I+D+i2", in Spanish), drawn up to increase scientific and technological research, train investigators and specialists, strengthen the interaction with the scientific system, extend the activities of priority productive sectors and collaborate with key agents for the encouragement of regional systems which favor the creation and distribution of wealth (Molina, Romero & Ramírez, 2008).

In the structuring of this ecosystem, the objective of creating opportunities for businesses with a high aggregate value, like the technology-based incubators, Technology Parks or incubation cells characteristic of advanced, knowledge-based economies, has taken on a fundamental importance. In addition, considering the panorama of unemployment and inadequate economic development in diverse Latin American countries, the job of training people who, once in the professional ambit, may exert an influence on the economic and political activity of the country is extremely important. The Tecnológico de Monterrey has sought a closer collaboration with international bodies in order to share its experiences for the benefit of other institutions and a sustainable future.

Founding of the Tecnológico de Monterrey

The Tecnológico de Monterrey was founded in 1943, thanks to the vision of Eugenio Garza Sada and a group of businessmen from Monterrey who were interested in providing the possibility of a high-quality education for people seeking degrees in administration and engineering. Those businessmen thus established a non-profit civil association, free from political or religious affiliations, called “Enseñanza e Investigación, A.C. (EISAC)”, (the Association for Higher Education and Research).

The foundation of the Tecnológico had a strong impact on higher education in Mexico, since of the other three private universities then existing in the country two were linked to the Catholic Church, which is why the Tecnológico decided it would orient itself, from a different perspective, to train professionals to meet the economic requirements of the country. Garza Sada had graduated from the Massachusetts Institute of Technology (MIT) and his vision was to establish a private university that would also make up for the deficiencies of the public universities with respect to the very special needs of the region (Marmolejo, 2011) at a time when Mexico was beginning its process of industrialization through import substitutions.

As a result, from the start there was a strong link between the Tecnológico and private companies. That premise of forming integral persons, not only technicians, has been a priority for the institution, as explained by Arturo Torres García, associate vice-rector of Entrepreneurship of the Tecnológico de Monterrey System:

“Everything which the Tecnológico does is linked to the business sector, thanks to which we have a group of advisers who accompany the day to day activities of the Tecnológico de Monterrey. This managerial attitude permeated the institution since its foundation, and when we analyze the Tecnológico de Monterrey we see that it is highly entrepreneurial... this has enabled us to be in the vanguard of education” (interview, January 16, 2012).

Due to the uncertainty which then governed the regulation of educational institutions, the directors of the recently created university decided to find a means to establish the validity of the courses it offered. Hence, they applied for the accreditation of the U.S. Southern Association of Colleges and Schools (SACS), and in 1950, it became the first foreign institution to obtain that recognition. However, two years later, a presidential decree granted it the status of a “free university school”, which enabled it to directly interact with Mexico’s Secretary of Public Education. That gave the Tecnológico a wide margin to modify its curriculum without the restrictions other private institutions were subject to.

After that, the educational model of the Tecnológico de Monterrey matured and in 1967, it initiated its activities on a second campus, in the city of Guaymas, Sonora. That marked the start of a gradual expansión to other regions of the country. In addition, at the end of the 1970's, the institution decided to broaden its academic range. Since many of its graduates now held executive positions in companies and organizations, it added more administrative areas. The evolution and development of the institution continued and by 2011, the System consisted of 31 campuses covering the whole of the nation's territory and it offered 58 professional degrees, 38 professional degrees of international standing, 42 Masters programs and 10 doctoral programs.

The first steps: Management Program and Entrepreneur Program

The Tecnológico decided it would be convenient if its graduates acquired not only a degree that would open the doors to a good position: it would be necessary to instill them with an entrepreneurial attitude, so that their goal would not only be to have a high-level job but they would also be equipped with a special training and provided with the tools for entrepreneurship.

In 1979, before the end of the first semester, the Monterrey campus announced a new service to be offered to commercial companies and institutions: practical schools. These consisted of a group of 300 students and 12 teachers, who, during the first year, worked together in factories or companies for eight hours a day during a period of six weeks, for the purpose of identifying, studying and gaining knowledge of the main problems in a company. They focused, above all, on finding suitable solutions in the field of engineering and even the social sciences, and this benefited both the students and the participating organizations themselves (Elizondo, 2002).

Under this program and in the same year, the first "company-school" was opened, named "Patrones para Información, S.A." ("Patterns for Information, Inc."), a legally recognized entity devoted to the production of continuous forms for computer centers. The company began with 60 employees: the aim was for it to act as a kind of practical workshop for the students who graduated in Business Administration and it was the central feature of what was known as the Entrepreneur's Program.

The electronic aspect also began to be important for the institution. Advances in informatics were achieved in the Tecnológico between 1979 and 1980, when personal computers were introduced as a tool in higher education, whose usefulness was able to guarantee a better quality of service, which had only been obtained up to then through expensive terminals.

That helped to form the bases of the Entrepreneur Program (Programa Emprendedor), established in 1985 in the whole of the Tecnológico de Monterrey System. Given the political context in that period, the directors of the institution asked themselves how they could establish a balance between the aim of promoting economic development, on the one hand, and social development, on the other. They concluded that the creation of jobs was the best strategy and that that was not an exclusive concern of the government, but a civic enterprise undertaken through companies.

Ramón de la Peña Manrique, currently dean of the Center of University Studies System, who was the dean of the main campus of the Tecnológico de Monterrey for thirteen years recalls that: "The Tecnológico has always been a good place for creative and innovative people and the time then came when we said to ourselves: we are going to create an Entrepreneur program" (interview, January 16, 2012).

The Entrepreneur Program was first offered as an optional course for the students of all faculties. It was later taught on all the campuses after a restructuring in 1990 and afterwards it was decided that it should be turned into a "signature" course (curso "sello"), that is, an emblem of the institution, obligatory for all pre-university and degree students.

The Tecnológico undertook the task of continuing to innovate at the same time that it sought to promote an entrepreneurial culture, which is why, at the end of the 20th century, it understood that to continue along that path it was necessary to produce a multiplier effect that would enable the students of all faculties to lay the foundations of their professional success.

BOX 1. MEXICO, THE LAND OF AMARANTH

The dream of overcoming the alimentary crisis received a dynamic push from the project created by "México Tierra de Amaranto" (Mexico, the Land of Amaranth", a civic association founded in 2005 by Mary Délano, former student of the Tecnológico de Monterrey who graduated in Biochemical Engineering. This organization is devoted to spreading knowledge of the health benefits of the consumption of that foodstuff: it also undertakes research and trains people how to grow, commercialize and consume it.

It was discovered that both the leaves and grains of amaranth can be used to feed humans and animals, because one of the outstanding properties of this plant is its high content of proteins, more than that of maize and beans. There are also evidences which suggest that when it is used as fodder, farm animals fatten more quickly and goats produce more milk (Martínez, 2002). According to the results of the experiments which gave rise to the project, this cereal aids in reducing harmful levels of cholesterol.

In marginal rural communities of the country, like the State of Querétaro, this association has worked to reduce child malnutrition, thanks to the self-sufficient plots of amaranth families grow in their back yards (Martínez, 2011). These small producers have also linked themselves to commercialize their crops, helped by the installation of the infrastructure needed to dry the grain, and they thus raise their incomes.

The woman in charge of the project explains that the idea arose when she began to understand the opportunities for economic and social development offered by amaranth, as well as its nutritional benefits. She admits that a decisive factor was the entrepreneurial outlook she

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was taught at the Tecnológico: “The Tecnológico had a strong influence on my formation. Something I liked very much about the degree course was that they always told us we had to be entrepreneurs, that we weren’t only here to repeat what had already been done. They taught us that we were expected to contribute to society” (Délano, interview, June, 2010).

As part of the strategy to commercialize the production of the small producers of the plant, the “Centro de Valor Agregado” (Aggregate Value Center) company was established, which placed products based on amaranth in the supermarkets of Querétaro, such as lasagna and other pastas, fried food for children, dips and desserts, as well as frozen amaranth leaves, and they are hoping to diversify their supply of derivative products (Buenrostro, 2011).

Knowledge of the project has been spread thanks to the creation of promotional units in different localities where the participants, who are mostly women, are taught how to grow and cook amaranth. These courses are taught by specialists from “México Tierra de Amaranto” and include gourmet recipes. In addition to the Federal Government, the association has also won support from international companies, among them Kellogg’s, Bimbo and the Walmart Foundation (Barrera, undated).

“That is how the Entrepreneur Program was born in other institutions, like the Universidad de Nuevo León, which adopted it on the basis of the Tecnológico’s model. Afterwards it fell to me to sign an agreement with the Secretary of Education at that time, Manuel Bartlett, who thought that the same program should also be implemented in the Colegio Nacional de Educación Profesional Técnica, “Conalep”, (The National College of Professional Technical Education).

Creation of a system for entrepreneurship

The national context

For the Mexican government, the transition towards a free trade model at the end of the 1980's was an opportunity for industrial and economic expansion. Public policy first focused on macro-economic stabilization and later on opening the economy to international trade through the unilateral reduction of tariffs; Mexico's adherence to the General Agreement on Tariffs and Trade (GATT); promoting the export sector; the growth of big companies and the privatization of semi-state companies and banking institutions. However, small companies were not the priority at that time. The corollary to this policy was the signing of the Free Trade Treaty with the United States and Canada, which came into force in 1994.

In 1990, in line with the world trend, the first incubator of technology-based companies in Mexico was formally founded, with the participation of the Nacional Financiera, "Nafin", (the "National Financer", a government bank); the National Council of Science and Technology (Consejo Nacional de Ciencia y Tecnología – "Conacyt"); and the Center of Scientific Research and Higher Education of Ensenada. Nevertheless, the intervention of the State was limited (Universidad Autónoma de Chihuahua, undated).

In 1992, the Conacyt developed the National Program for Technology-based Companies (PNIEBT, in its Spanish initials) but it was canceled in 1997, shortly after the 1995 foreign exchange crisis (Márquez & Pérez, 2006). In that period, the financing the banks granted to the sector of Small and Medium Companies (SMEs) was meager, because the private banks focused on credits for consumption, and the development banks suffered from imbalances which prevented them from operating on a large scale. Even though there were governmental programs for entrepreneurship, they were not coordinated, which considerably weakened their impact (Garrido, 2011).

In 2000, the Federal Government began to set its sights on micro, small and medium companies again, with the idea of reactivating productivity through the "changarrización"¹ of the economy. That coincided with the establishment of the first incubator of companies at the Tecnológico de Monterrey.

¹ A colloquial term used by the then President of Mexico, Vicente Fox (2000-2006), referring to the government's encouragement of small businesses which, as beneficiaries of public policies, would consolidate themselves as pillars of the Mexican economy. In Mexico, "changarro" is a word for a small business.

The Tecnológico de Monterrey thus went ahead with structuring the ecosystem of entrepreneurship and other programs were added to the incubators, like the accelerators of companies, capital funds, the entrepreneurship scheme, the degree in the Creation and Development of Companies, Technology Parks, the Linkage Network (“Red Enlace E+E”), the Center of Intellectual Property and Technology Transfer, and the Institute for Sustainable Social Development.

“The Tecnológico implemented operating models to make the dreams it sparked off in its students a reality. First we established operational programs and now we are even deploying the network of mentors chapters, consolidating what is known, as a whole, as the Entrepreneurship Ecosystem,” Arturo Torres points out (2012).

The conviction that the university is one of the main promoters of regional socio-economic development, due to its capacity to increase an international competitiveness based on knowledge, innovation and technological development, with social and environmental responsibility, is one of the pillars of the Ecosystem and a priority concern of the I+D+i2 strategy of the Tecnológico, which includes, among its programs, the development of human capital; postgraduate courses focused on subjects that are essential for the country; sustainable campuses; the establishment of research chairs; the creation of centers of excellence in research; the strengthening of networks of research, technological development and support for industry, as well as incubators, accelerators and Technology Parks (Molina, Romero & Ramírez, 2008).

Network of Incubators

The first incubator of the network was born on the Monterrey campus in October, 2001, with the aim of providing a solution for managerial projects which, through a business idea, are trying to take off and turn themselves into strong and sustainable companies. The Tecnológico therefore decided to establish, as well, a model of virtual incubation to come closer to entrepreneurs. Given the success of those activities, the Emprendetec portal was created, which began to operate in 2003. A year later, the Network of Company Incubators of the Tecnológico de Monterrey received an official certification from the Secretary of Economy of the Mexican Government, which authorized it to transfer its incubation model to other organizations; and it accordingly began to do so in 2005 for institutions in the educational sector and government agencies, which have recognized its excellent quality (Aguirre, Giordano & Torres, 2010).

The incubation model was one of the key concepts for the development of an entrepreneurship model. The creation of the Tecnológico’s incubators helped in the design and application of other models and deepened its commitment to society, through an understanding of the need to create entrepreneurial ecosystems in each region of the country in order to strengthen all the processes of innovation. To keep up to date with the models in different parts of the world

and interchange experiences, personnel from the Incubators Network of the Tecnológico de Monterrey periodically visit their peers in Holland, the United States, Spain and France. They also maintain contacts with others in Canada, England, Ireland, Brazil and Italy (Alcaraz, 2003).

Alejandro González Hernández, president of the Organization of Tourism Entrepreneurs in Mexico and a specialist in the economy, states that “The Tecnológico has a network of incubators, a network of accelerators and a network of Technology Parks that are unique in Mexico, so that its capacity to have many organizations oriented towards the support of entrepreneurship means that the contribution of the Tecnológico is much bigger than that of other universities” (interview, January 23, 2012).

In that manner, the incubation model has provided entrepreneurs with a range of services for the development of their companies. Its objective is to stimulate the start-up and development of competitive companies in Mexico and abroad; and its strategy is to supply the entrepreneurs with the resources which enable them to transform their projects, so that they become a reality, with an impact on their community (Zapata, 2011).

BOX 2. COCOON BEACH: ELEGANCE AND SOCIAL COMMITMENT

The empowerment of women through their inclusion in productive chains has been a fundamental part of the social work of the Cocoon Beach company, incubated at the Tecnológico de Monterrey in the State of Querétaro. Since 2005, it has focused on meeting the needs of the hotel sector. The company is devoted to the innovative design of luxury goods to provide an experience of comfort and relaxation.

Its catalogue includes around 200 products, among them bath robes, turbans, slippers, cushions and pillowcases, loofahs and soap dishes, whose main characteristics are elegance and practicality. The company offers its articles in the whole of the Mexican Republic, and has entered the international market, so that it is able to supply foreign buyers with between 10,000 and 20,000 units monthly.

The idea was developed by the designer Emma García Madrid, who found a business opportunity in the mass production of elegant and high quality articles which add to the comfort of the customers of hotels and massage and relaxation centers. Basing herself on that idea, she created a deck chair cover, called the Cocoon, made of combed Egyptian cotton with a toweling finish, so designed that the fabric does not bunch up.

It was then that García decided to look for support from the company incubator of the Tecnológico de Monterrey, which advised her on how to improve and commercialize her first product: “Thanks to the training which the Tecnológico gave me, I began to understand the

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need for quality and how to explore the market. When we had got the project well organized, the 'Tec' put me in touch with the Secretary of Economy and they began to give me the first help with seed capital. With that I managed to create a trademark and a formal company, with a website, which gave the product all that was needed to commercialize it. After that they began to add other products" (García, interview, June 2010).

One of the first challenges Cocoon Beach faced was the need to make up the goods on a large scale to a standard of excellence, hence she got the women prisoners at the Centro de Readaptación Social of Querétaro ("Cereso", Center of Social Rehabilitation) involved. They were paid even more than they would have earned outside of the prison in exchange for carrying out the work in accordance with standardized processes in order to guarantee a high-quality. They later began a program to turn the workers who left the Cereso into entrepreneurs.

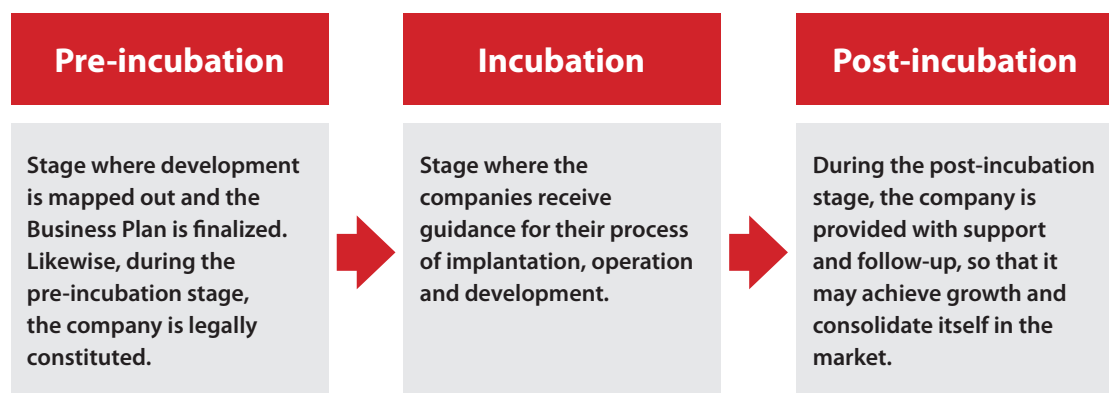
After consolidating several items of merchandise, García designed a line of products made of ixtle (agave), produced by the members of the Otomí indigenous communities of the Sierra Gorda of Querétaro. This involved the formation of production cooperatives, mostly staffed by women, as well as the establishment of quality standards. In that way, Cocoon Beach became an intermediary for the marketing of the crafts goods made by those persons. A similar project arose later on, in collaboration with 120 craftswomen from the State of Hidalgo. "As had happened with the Cereso, my idea is that these women should not be exploited in their work, but treated with dignity and paid a fair wage. One achievement was that they began to send invoices, another was that, little by little, the system of political favors that existed was eliminated," García notes (2010). Further, as part of the company's commitment to sustainability, the products and their packagings are environmentally friendly.

Within the Tecnológico's Network of Incubators there are three sub-networks, focused on handling the different characteristics and needs of the entrepreneurs (García, 2011):

- The Network of Technology-based Incubators, which promotes innovation on the basis of research, to form companies of a high aggregate value in sectors like bio-technology, pharmaceuticals, biomedical engineering and others.
- The Network of Intermediate Technology-Incubators deals with companies whose business models depend on innovation, for example: agro-businesses, software services, construction and telecommunications.
- The Network of Social Incubators focuses on micro-companies whose social and economic impact drives communities forward, and its work includes grocery stores, carpentry shops and beauty salons.

Figures compiled by the Tecnológico de Monterrey show that between 2009 and 2010 more than 800 projects and companies were attended to, and more than seven thousand direct jobs were created – an average of three jobs per company – thanks to the agility afforded by the three stages of the model: creation or pre-incubation, development (the incubation phase, strictly speaking) and the consolidation of the company or post-incubation phase (see Figure 1).

FIGURE 1. STAGES OF INCUBATION



Source: Tecnológico de Monterrey

Throughout these processes, services of mentoring and specialized consultancy are provided by more than 730 experts who belong to the Network. Furthermore, with the aim of extending the incubation services and enabling them to reach more isolated places, the virtual modality was designed, which does not require the physical presence of the incubated companies and works through the Emprendetec portal. By 2012, the Network was made up of 130 incubators of companies: 70 social ones, 25 intermediate technology ones and 8 high technology ones, located all over the country, as well as the virtual incubator. More than 1,300 companies have “graduated” from this Network since it was first created (Vice-Rectoría of Entrepreneurship, 2012).

The Entrepreneur Modality

In 2003, the Entrepreneur Modality (Modalidad Emprendedora) was established to strengthen the skills and knowledge of management and business development among the graduates of all faculties. It is an optional academic opportunity, whose learning platform is the creation and operation of a company through a real and practical focus.

This modality offers the opportunity for students from any faculty of the System who are interested in creating a company while they are undertaking their professional studies to take the course from the fourth semester onwards. Currently, the Entrepreneur Modality is taught at 13 of the System’s campuses and more than 500 students operate or work on their company project (Tecnológico de Monterrey, 2011).

Carlos Cruz Limón, vice-rector for Relations and Development of the Tecnológico de Monterrey System, reflects that: “this modality has helped, to a large extent, to form an institutional entrepreneurial culture, thanks to which to speak of entrepreneurship at the Tecnológico de Monterrey is something that is very natural” (interview, January 16, 2012).

Emergence of the Universidad Tec Milenio

In September, 2002, for the purpose of extending the education based on the Tecnológico de Monterrey’s model, the System created the Universidad Tec Milenio (Tech-Millennium University), whose model allows students to develop the skills needed to contribute to the building of a more human, efficient and competitive society and equips graduates with highly-employable talents (Universidad Tec Milenio, 2010).

This new university also looks for a link with companies, so that they may be included in the educational model centered on learning. Part of this collaborative strategy is the locating of companies in the installations of the institution itself, under the scheme of the educational technology park. That is what the Softtek company did at the Ferrería campus of Mexico City in 2004: it is devoted to the development of information technologies, occupies an area of 4,400 square meters on the campus and provides jobs for 450 people (Universidad Tec Milenio, undated).

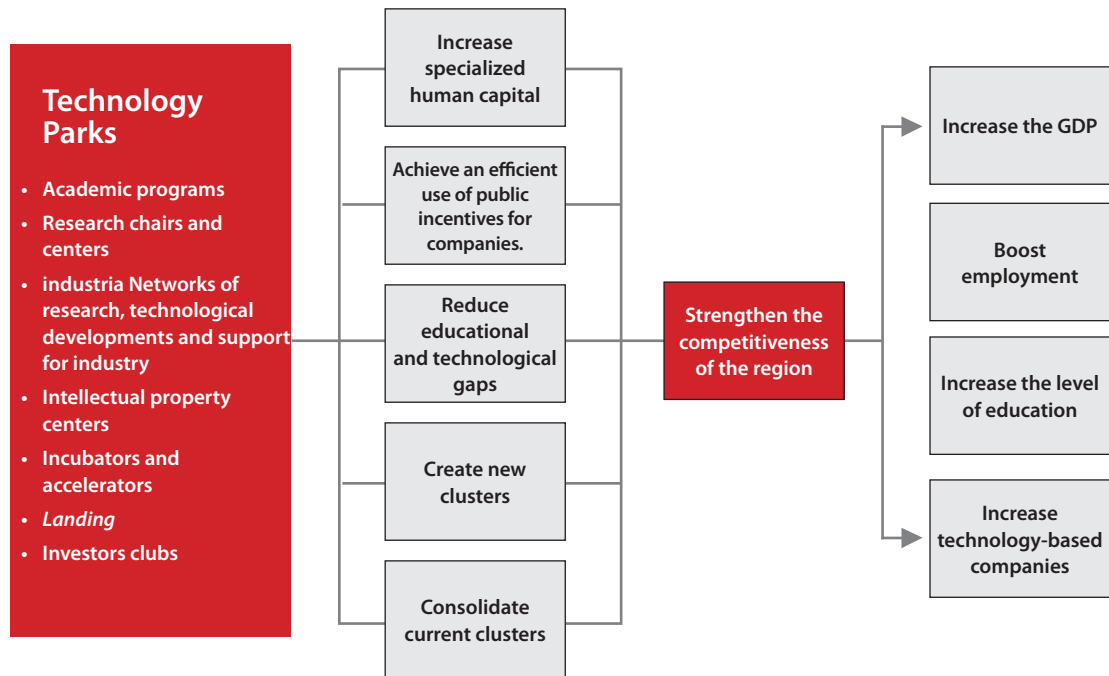
Another 19 companies located on four campuses provide 462 direct jobs, above all in the field of information technologies and those in charge of the projects in them are also professors of the Universidad Tec Milenio, so that the students have a direct contact with the working world. In addition, they are given the opportunity to undertake their professional practices in the companies, so that they will already have had working experience when they graduate.

Furthermore, the institution also offers the company incubator service under the model developed by the Tecnológico de Monterrey, which is available for the community in general but mainly focused on students and former students. The Universidad Tec Milenio has a program called “Technological Innovators”, which oversees the creation of a business plan to develop companies which are competitive and productive in the market, and students who wish to participate in the program must be academically excellent and committed to the project that is to be developed. Once they finish the program, they have the option of joining the incubators of the Universidad Tec Milenio in order to give continuity to and consolidate their idea (Universidad Tec Milenio, undated).

Technology Parks

Technology Parks are places where there are a concentration of companies, research centers and suppliers of services, among other economic agents which make an intensive use of knowledge and technology through a shared access to promote employment and productivity (see Figure 2). They are grouped in centers to capitalize on such knowledge and are world-known

FIGURE 2. IMPACTS AND BENEFITS OF TECHNOLOGY PARKS IN THE REGION



Source: Tecnológico de Monterrey

for encouraging scientific and technological research. Although they are known by different names, in accordance with the region where they operate, they are jointly known as scientific parks, innovation parks or research parks, but they are all based on the premise of capitalizing on knowledge.

The concept of Technology Parks dates back to the 1950's, when Stanford University in the United States founded the Stanford Research Park, with the participation of companies like Hewlett Packard, General Electric and Lockheed. Later, in the 1970's, the parks reached Europe and afterwards, Japan, China and India, according to the International Association of Technology Parks (IASP).

Some of the aims of the Technology Parks are to: create new business and employment opportunities; house small and medium technology-development companies; establish a flow of communication between universities and research centers, on the one hand, and SMEs, on the other; promote the creation, innovation and improvement of technologies; spur competitiveness and establish physical locations for businesses to grow and develop.

BOX 3. UNIMA: HIGH AGGREGATE VALUE

The winner of international awards for its innovations in the improvement of processes for the application of animal husbandry vaccines, the Unima Bioseguridad Integral biotechnology company, incubated on the Guadalajara campus since 2005, has helped to reduce the rates of sickness and mortality in poultry production in Mexico and the international market.

The Custovac vaccine stabilizer, the product which gave rise to the company, modifies the physicochemical conditions of the water used to prepare the vaccines on farms, protecting the virus found in them to make the injection more effective. The relevance of this technological development can be appreciated when you take into account that at the beginning of the previous decade, the average poultry mortality rate was 6% in the country and this caused enormous losses to the producer companies. For that reason, the market was estimated to have an annual value of some 2.3 million dollars when Custovac was created, at a time when existing products could not compete with the broad protection for vaccines which the company offered (Mendoza, 2007).

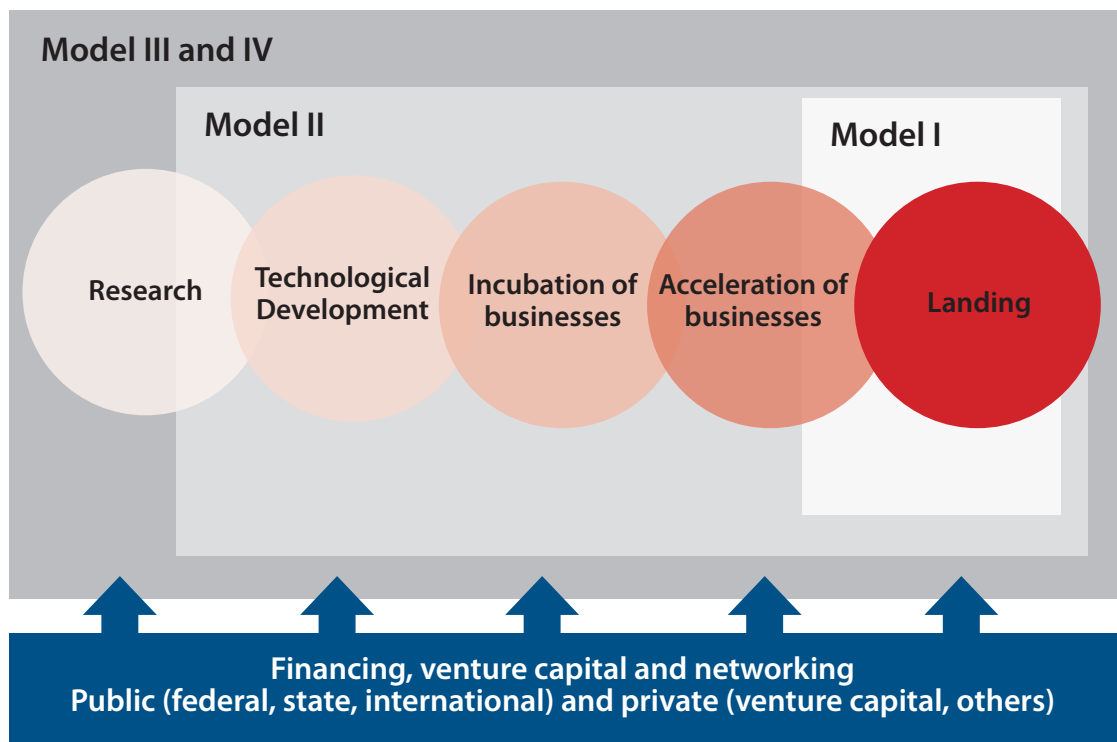
Due to that, in 2007 the Organization of American States (OAS) awarded Unima its Business Process Award for the best innovative business development, choosing it from a shortlist of 800 companies in the region. Among other awards it has obtained are the 2005 Santander Prize for Business Innovation, the 2006 Prize for the Best Investment Project from the Third National Forum of SMEs (Tercer Foro Nacional PyME), the 2006 Global Moot Corp Competition, the Northwest Venture Championship in 2007 and in the same year, the Tecnos Prize (Ornelas, 2007).

Unima's business strategy consisted of selling its product directly to pharmaceutical companies, and it reached an agreement whereby Boehringer Ingelheim Promeco would distribute Custovac in Mexico, while in the United States it became the supplier for the Letrah International Corp (Ornelas, 2007).

With the support of the Tecnológico de Monterrey, the company transformed itself, so it would not be a simple marketer of Custovac but diversify its product line. This was done after an evaluation of the existing market conditions on a national and international level, and thus its partners decided to include, among its services, the development of innovative biosecurity solutions and safe processes for the production of foodstuffs, thus widening the scope of the ambitions it had when it received funding both from the Federal Government and other investors (Mendoza, 2007).

It thus chose to continue developing other technology-based products which are applied to natural defense systems to ensure the safety of processes, as well as to deepen its concern for the environment, attain a cleaner production and offer consultancy and expert advice in the management of biosecurity (Unima, undated).

FIGURE 3. MODELS OF TECHNOLOGY PARKS AND FOCUS OF THEIR ACTIVITIES



Source: Tecnológico de Monterrey

After taking into consideration the environmental, economic, demographic, political and social impacts in different regions of the country, the Tecnológico de Monterrey decided to define the models of the Technology Parks in accordance with these regional differences and national conditions. These models are based on the best practices seen in the world, but they have been carefully adapted to the reality of the national context. The choice of the model depends both on the campus's institutional resources and the alliances which are achieved, on the one hand, and the strengths of the region, on the other. There are four models of Technology Parks (see Figure 3).

- The Technology Parks for high value employment are those devoted to housing companies focused on technology. This is the predominant model in the five Parks of the Universidad Tec Milenio and it houses 13 companies in the landing² modality. An example is the Software Development Park of the Universidad Tec Milenio, which provides jobs in high-value activities for students and graduates.

² A program to enable foreign technology-based companies to set up in a new region.

- In addition to incorporating activities of incubation and acceleration, the Technology Parks meant to attract and develop companies house foreign companies devoted to technology and interested in establishing themselves in the region (through landing programs).
- The model of Technology Parks for companies with scientific activities includes specialized laboratories to meet the more complex needs of organizations which work in highly sophisticated sectors like biotechnology or nanotechnology. Both this model and the previous one cover 265 companies in all, whether they are in landing, incubation or acceleration. An example is the Life Sciences and Biotechnology Park, on the Mexico City campus, which is positioning itself globally in research and the creation of high-tech companies in key sectors.
- The regional Technology Parks with several sponsors are the ones most widely found in the world, since science and technology are generally financed with public resources. The Tecnológico de Monterrey participates in the Research and Technological Park ("PIIT", in its Spanish initials) of Nuevo León, and its respective center houses four companies in landing, where several promoters help in the transformation of the regional economy (Aguirre, 2010).

It is worth noting that the PIIT (created in Nuevo León in 2005 through the collaboration of several institutions, among them the Tecnológico de Monterrey), is one of the largest in the country and occupies an area of 70 hectares. This center is devoted to research in the fields of biotechnology, health, mechatronics, nanotechnology, information and communications technologies, and foodstuffs (Tecnológico de Monterrey, 2012).

The time which a company that is housed in a Technology Park needs to operate in an independent way varies in accordance with its objectives and its size when it joins the center, but generally those with foreign investment which seek regional adaptation remain for between two and six years, while Mexican ones stay indefinitely, although they usually leave the Park when their roster surpasses 250 employees.

It is estimated that more than 30 Technology Parks currently operate in Mexico, of which 15 belong to the Tecnológico de Monterrey (10 to the Tecnológico de Monterrey and five to the Universidad Tec Milenio), where there are more than 200 high-tech companies, 25 of them foreign. Between 2004 and 2010, they created or maintained more than 2,300 high-value jobs, that is, posts for professionals and post-graduates (Aguirre, 2010).

The Tecnológico's project has also led to a collaboration with universities in other countries, for example: "With the Universidad Autónoma of Madrid, which has its science park and runs it together with the Universidad Complutense [also of Madrid], we have exchanged entrepreneurs from incubated or accelerated Mexican companies, or some who are with us in our Technology Parks and are now seeing an opportunity to open a market in Europe," reports Arturo Torres (2012).

Capital Funds

In 2005 it was decided to create a directorate for the financing and growth of the companies linked to the community of the Tecnológico de Monterrey. With the help of the governmental sector and/or private capital, the entrepreneurs were boosted through the financing of their companies. According to the Directorate of Capital Funds (Tecnológico de Monterrey, 2012), this support for the entrepreneurs is done through different programs which advance their operations:

- The SME Fund: Supports modest-sized companies.
- Seed Capital: Aimed at companies which develop products based on traditional, intermediate and high technology, and wish to scale their company up to a higher level through advanced venture rounds with investors.
- Investment clubs: These are made up of outstanding businessmen from different regions of the country who invest their capital in promising projects.

This work of financing is very important in a country where the culture of supplying capital to new projects is not deeply rooted, according to Carlos Cruz Limón (2012), who believes that Mexico and Latin America need to further develop this strategy: "Mexicans distrust risk capital a lot and we have to get used to the idea, on the one hand, that there is someone to put up the money, and, on the other, that people feel tranquil and confident that they can use it, because no one is going to take the company away from them".

In the line with this outlook, a pilot financing program began at the end of 2011, with the participation of four nationwide banks, as well as Nafin (the government development bank) and the Secretary of Economy, together with the Instituto Politécnico Nacional (National Polytechnical Institute) and the Tecnológico de Monterrey. After designing the project and negotiating with both universities, the Secretary of Economy committed itself to guaranteeing the seed capital funds so that the banks would authorize the credits. The purpose is to benefit nearly 200 entrepreneurs who have emerged from the two educational institutions by supporting them with consultancy, training and accompaniment, as well as the granting of loans of 400,000 pesos on average, at a 12% interest rate, which is advantageous compared to what the banks charge the SMEs (Becerra, 2011).

The Vice-Rector of Entrepreneurship reports that 108 companies have benefitted from direct financing of seed capital, at an average amount of 504, 629 pesos (see Table 1).

TABLE 1. CAPITAL FUNDS AND BENEFITED COMPANIES

Support program	Number of companies	Amount in millions of pesos
SME Fund	9036	842,0
Seed capital	108	54,5
Investors Clubs	2	1,5
Awards and Competitions	35	8,7
TOTAL	9.181	906,7

Source: Vice-Rectorcy of Entrepreneurship Tecnológico de Monterrey

Degree in the Creation and Development of Companies

In 2005, the Tecnológico de Monterrey established a Degree in the Creation and Development of Companies (LCDE, in its Spanish initials), to professionalize the creation of businesses in Mexico. It was the first degree course in the country exclusively devoted to forming innovative businessmen (Moreno, 2008). Its aim is that the graduates of this course are able to recognize business challenges and opportunities, and also undertake risks in an intelligent way in order to begin operations. This program furnishes the students with “the tools needed to create, start and ensure the growth of their own companies during a course of studies which combines academic training and real-life experiences” (Tecnológico de Monterrey, undated).

The syllabus consists of two stages: in the first six semesters, the students are taught a technical knowledge of accounting, processes and quantitative bases. In the second phase they work in the incubator, where they must bring a company into being, look for investors and obtain 15% of the capital they need to start operations (Moreno, 2008).

Up to December, 2011, 1,607 students had enrolled in this course. According to the Vice-Rectorcy of Entrepreneurship, 62% of the students have founded services companies, 15% manufacturing ones, 8% trading ones and 15% ones related to technological development.

Network of accelerators

Another step towards the forming of the Entrepreneur Ecosystem was the creation of the Network of Company Accelerators (Red de Aceleradoras de Empresas) of the Tecnológico de Monterrey, whose objective is to position businesses which already have a market presence but wish to increase their growth levels in sales and jobs. The first of these accelerators was born in

2006 at the Graduate School for the Administration and Leadership of Companies (Escuela de Graduados en Administración y Dirección de Empresas – “EGADE”) of the Monterrey campus, for the purpose of strengthening the special technical knowledge, infrastructure, human capital and contacts of companies.

In this model of acceleration, a specialized team of consultants works in close collaboration with each businessman for the development of three fundamental aspects: a vision of the market, innovation and financial strategy. The idea is to maintain and increase the rhythm of growth of these companies by developing these pillars, so that they can more adequately compete both in national and international markets.

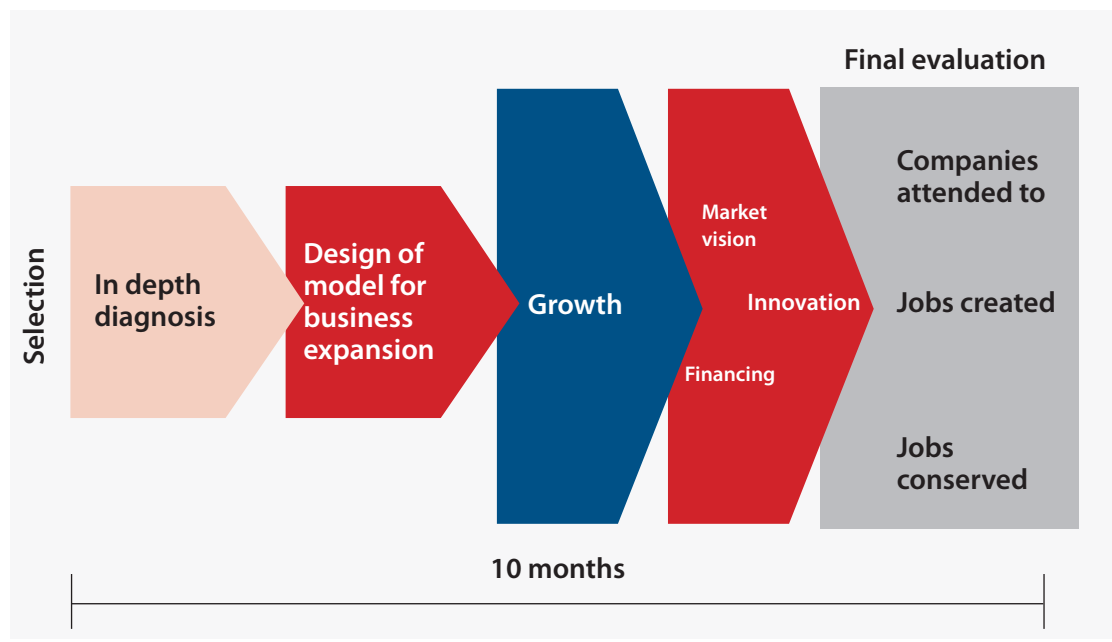
The whole process begins with an in-depth diagnosis of the company in order to identify its areas of opportunity. With that as the base, and in accordance with the consultants, the business leader defines the strategy or model of expansion which should be implemented to achieve the sustained growth which is sought. Afterwards comes the step by step accompaniment which the specialized consultants provide for the businessman with respect to the realization, supervision and follow-up of the commitments which were laid down in the work plan (Tecnológico de Monterrey, 2012).

Importance is also given to working hard to implement the expansion strategy, which may include the definition of new markets and products, the design of a different strategy for better commercial penetration or other approaches jointly decided on by the businessman and the experts. The specialists make frequent visits to the company for a precise and adequate follow-up of each strategy emerging from the consultancies (see Figure 4).

The implantation of company accelerators under this model was well regarded by the governments of several States of the Mexican Republic, which offered their support for the project and recognized its impact on the well-being and sustainability of their regions (Tecnológico de Monterrey, 2011).

In this model, attention is paid to “gazelle” companies through consultancies where their innovation processes are evaluated and improvements are made to them. The “gazelle” companies are those which are able to increase their sales and create jobs at a very fast rate; they also have an infrastructure which enables them to adapt to changes in the market and, generally, reach a rapid growth. In 2012, 16 accelerators spread around several campuses of the Tecnológico de Monterrey were operating, and each has attended to eight companies on average since its founding and helped to spur a sustained growth rate in sales of 46.5% on average (Table 2).

FIGURE 4. ACCELERATION MODEL



Source: Tecnológico de Monterrey

The Intellectual Property and Technology Transfer Center

Created in May, 2007 by the Tecnológico de Monterrey, the Intellectual Property and Technology Transfer Center acts as a support for professors and students of the institution, as well as external inventors and companies which require guidance on intellectual property matters. Its main function centers on administering and establishing strategies for the registration of patents or copyrights, and once they are obtained, promoting their commercialization. It also evaluates the potential of technological developments (Tecnológico de Monterrey, 2012).

It provides services of consultancy on intellectual property, the registration of trademarks and inventions, patent applications, the design of trademarks and logos, the registration of copyrights, the auditing of intellectual property, the drafting of agreements and contracts on technology transfer, among others. There are four centers, located on the Guadalajara, Monterrey, Sonora Norte and Estado de México campuses. In this way, the Vice-Rector of Research, Entrepreneurship and Social Development seeks to ensure that the Tecnológico obtains property rights to its inventions, a result of the investment in research by its teachers and students.

The inventors and the Tecnológico de Monterrey obtain economic benefits that result from the exploitation of intellectual property. They may obtain up to 30% of the profits in the form of payments during the period when there is a labor relationship with the university and a licencing

TABLE 2. INDICATORS OF ACCELERATORS

Variables	2009	2010	2011	Total
Total Average sales in the year of starting and the year of finishing (thousands of pesos)	19,341	30,560	25,901	25,267
Employees per company (average)	26	37	41	35
Jobs created	650	1,122	1,366	3,138
Jobs conserved	2,864	5,371	3,608	11,843
Average growth in sales	35%	46%	58%	46.3%
Average no. consultants per company	ND	2	1.7	1.8
Average years of experience (consultants)	ND	15	16	15.5

Source: Vicerrectoría de Emprendimiento, Tecnológico de Monterrey

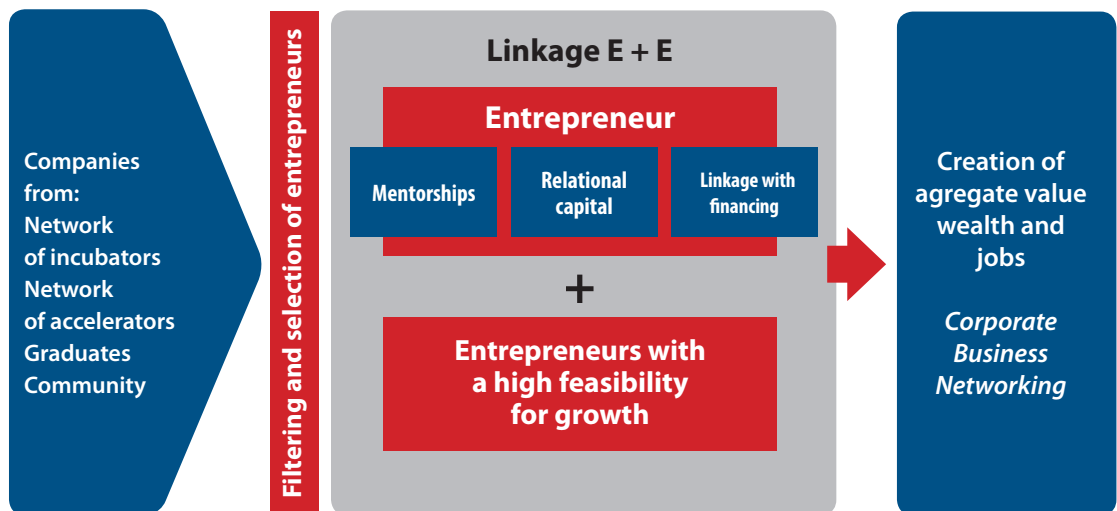
contract. Furthermore, 30% will correspond to the department, division or laboratory; another 30% will go the campus and 10% will be used to maintain the intellectual property rights of the inventions which belong to the Tecnológico de Monterrey (Tecnológico de Monterrey, 2012).

The E+E Linkage network

The E+E Linkage network (“Red Enlace E+E”) officially arose in Monterrey in 2008, thanks to the idea of a group of graduates who, already experienced in the creation of companies, decided to start an organization devoted to helping the businesses born from the Incubators or Accelerators Programs (Tecnológico de Monterrey, 2012).

The project was welcomed by the community of the Tecnológico and by 2011, ENLACE E + E included 145 business leaders with outstanding professional careers in different fields of business. The aim of their joint work is to spur the growth and consolidation of new companies, especially those which stand out for their aggregate value and high potential for development. The businessmen participate in an altruistic manner as mentors, provide guidance and relational capital to a select group of SMEs and thus contribute to the creation of wealth and employment in the country.

FIGURE 5. OPERATIONAL MODEL OF E + E LINKAGE



Fuente: Tecnológico de Monterrey

The services of this network are oriented towards legally-constituted companies which have been operating for more than 2 years and have sales higher than 1.5 million pesos per year (more than 107,000 dollars), and which also stand out for having scaled up their sales, innovation and entrepreneurial leadership. To be beneficiaries of the network's services, the companies are evaluated and chosen by the mentors, who form an Evaluation Panel which meets once or twice a year (see Figure 5) (Tecnológico de Monterrey, 2012). The chosen companies receive support from three or four mentors from the network, who serve as honorary members on their Advisory Council for a maximum period of three years and with whom they periodically meet (two hours per month with one of the mentors, who acts as a delegate advisor; and three hours every three months at the full session of the Council). The companies may also accede to guidance and business contacts from the other mentors of the network, pro bono consultancy and training opportunities or preferential rates from institutions allied with the group, and linkage with opportunities for financing and/or investment (Tecnológico de Monterrey, 2012).

By the end of 2011, this network counted on four chapters at the Monterrey, Puebla, Chihuahua and Santa Fe campuses; had evaluated 267 companies and supported 44 of them, of which four had successfully completed the program, while 37 continued to receive its services; and three were liquidated. Every year each company receives an average of 52 hours of consultancy and six of training at no cost (it is estimated that each hour of consultancy or training would have a market cost of five thousand pesos, at the prices of 2012). In Monterrey alone, according to the survey done of the beneficiaries of this program, the rate of satisfactory evaluations was 4.12 on average, on a scale from 1 to 5. (Entrepreneurship Vice-Rector, 2012).

Social Entrepreneurship

To speak of social entrepreneurship means to take into account the needs of the educational sector, gender equality and the sustainability of the environment, among other concerns. For the Tecnológico de Monterrey, it has been important to form social entrepreneurs who have the tools needed to solve the problems the community faces, where innovation, creativity and civic commitment contribute to social development.

Beginning in August, 2007, the course on the Planning of Micro-Companies for Social Development was implemented, with activities focused on business plans for productive projects that generate resources and institutions can follow in order to provide services to support society without depending on donations (Sánchez, 2008).

To strengthen the work of social entrepreneurship, the Tecnológico incorporated the course on Planning of Micro-Companies for Social Development into the whole System and later the one on the Operation of Micro-Companies for Social Development.

It thus created the Model of Social Formation through the transfer of knowledge, both for its academic activities and the Civic Social Service (Servicio Social Ciudadano – “SSC”). It likewise created the Institute for Sustainable Social Development (“IDeSS”, in its Spanish initials), which is responsible for promoting and coordinating programs and projects in which there participate both professors and researchers involved in the participant social incubators.

Among the achievements of the IDeSS, the “Maizud” project in Guadalajara stands out, a franchise which arose thanks to the students’ and professors’ involvement with a group of producers of maize dough for tortillas. The project integrated the productive chain of maize from its growing to the commercialization of the tortillas, with the creation of a plant which efficiently processes the nutritionally-enriched inputs. It also managed to diversify the trademark with complementary products. In that way, the company expanded in the Metropolitan Zone of Guadalajara, with the establishment of 80 tortilla bakeries (León, 2010).

In addition to that, there are social incubators which spur the creation and strengthening of micro-companies. In 2012, 70 social incubators were operating throughout the country: they provide support and consultancy, create sources of work and stimulate the growth of the communities where they are established (Sánchez, 2008).

Ernesto Benavides Ornelas (2007), director of Social Formation of the Vice-Rectorate of Social Development at the Tecnológico de Monterrey, declares: “There is one thing we must be sure of: we finally have to be part of the job of encouraging social development if we aspire, as a society, to attain a quality of life in accordance with the most basic ethical and civic levels proclaimed by our Mission. We must contribute to that if we hope to be a Socially-Responsible University”.

Consolidation of the Entrepreneurship Ecosystem

Combining all of the factors that boost entrepreneurship which the Tecnológico de Monterrey has been integrating into its academic and extra-academic programs over the years gave rise to a dynamics unprecedented among the country's institutions of higher education, that is, these steps have not been taken in isolation but are part of an integral and conscious strategy, designed by its leaders and taken up by the whole academic community to the point where everyone is now immersed in the Entrepreneurial Ecosystem.

Arturo Torres (2012) explains the workings of this novel model in the following way: "To create synergy, we decided to integrate all of it under a single umbrella, what is known as the Entrepreneurial Ecosystem. Now we are in a new stage, which goes even further, by trying to focus it on the entrepreneurial families found among our students, without ceasing to attend to those entrepreneurs in the community or former students, even though they may not necessarily come from an entrepreneurial family".

This concept was considered so relevant that the Tecnológico decided to establish an Entrepreneurship Directorate on each of its campuses, which would be responsible for coordinating all the efforts in that field in order to link its students, on the one hand, and, on the other, experts, business leaders, scientists, researcher, investors, government officials and members of the civil society.

The Tecnológico de Monterrey has obtained excellent results, as Carlos Cruz (2012) has confirmed: "We had courses in entrepreneurship, industrial parks, incubators and the E + E Linkage, and venture capital clubs, among others. We agreed to join everything together under the concept of the Entrepreneurial Ecosystem and appointed an Entrepreneurship Director on each campus. This will increase the synergy and coordination among the different actors, and the entrepreneur and the community will be the major beneficiaries".

All of these ideas are closely linked with the best international practices in the field of building companies and the trends which support the idea that universities are the best place to activate the economic development of each country, since they combine the conditions which are suitable for generating knowledge and scientific research: what is known as the R&D economy (Bustani, Cantú, Molina & Moreira, 2009; Scheel & Vázquez, 2011; Hofer & Potter, 2010), which the Tecnológico has taken further by adopting the I+D+i2 strategy. That is, it seeks to transform ideas into knowledge, and knowledge into new technologies, through processes for administering innovation which mobilize proposals and resources towards the creation and commercialization of new products, services, processes and technologies (Molina, Romero, & Ramírez, 2008).

Speaking of this, Arturo Molina, vice-rector of Research, Entrepreneurship and Social Development, reports that a new institutional model has been created to focus the research work of the Tecnológico, based on three areas which are a priority for development, namely: The Base of the Pyramid, Sustainability and Public Policies (Ortiz, 2012).

“Our hallmark for the Tecnológico de Monterrey’s System will be entrepreneurship, but with a social and human sense. The former will be as important as the latter,” stressed José Antonio Fernández when he took up the post of president of the Council of the Tecnológico de Monterrey System (February 14, 2012).

The inter-relations between the Tecnológico de Monterrey and other institutions, whether of the government, civil society or the private sector, are also fundamental for encouraging this environment, this ecosystem, and for that reason there is a permanent search for new ways to strengthen the collaboration which nourishes the system. Likewise, world trends stress the importance of giving continuity to and deepening plans like the Federal Government’s “Advance Program” (Programa Avance), which serves to provide funding for the development of technology and the creation of high aggregate value products and services (OECD. 2010b).

However, these models of growth underline the need for a strategy of long-term development, because they tend to create companies that do not employ many people (Márquez, Pérez & Suchil, 2006). This may inflate the figures for macro-economic impact but it is unlikely to meet a key requirement of emerging economies like the Mexican one: the creation of jobs in the short term. That is why the Tecnológico de Monterrey also takes into account and promotes models of entrepreneurship with a traditional base and a social vocation, given the context in which it acts.

Entrepreneurship programs in Mexico

For a decade or so now, the ratings of Mexican competitiveness on a world scale have fallen and while its macroeconomic level has remained relatively stable, in no way can its growth be compared with that of other emerging economies in Latin America and Southeast Asia. The percentage devoted to research and development in Mexico is minimal when it is compared with international standards. Furthermore, the promotion of entrepreneurship has focused on investment of low risk and little aggregate value, even though the international trend is to encourage knowledge-based development (Aguirre, Giordano & Torres, 2010).

When Felipe Calderón Hinojosa became the President of Mexico in 2006, he set out to give continuity to the plans implemented by his predecessors and increase the resources and programs devoted to boosting employment, creating businesses, improving the competitiveness of companies and creating a juridical and institutional framework favorable for national and foreign investment, as seen in the National Development Plan (Presidency of the Republic [of Mexico], 2007).

A variety of programs operate in the country, which have gradually been set in motion since 2003 by the Secretary of Economy, above all since the creation of the office of the Under-Secretary for the Small and Medium Company (Subsecretaría para la Pequeña y Mediana Empresa – “SPYME”), for the purpose of promoting the founding of companies. Among them, there are four devoted to “MIPyME”s (micro, small and medium companies), four to innovation and technological development, one to create employment in marginal zones and one to make industry more

competitive. The Nafin (the Mexican State development bank) has also substantially increased its funding and the number of companies which are its beneficiaries.

Nevertheless, the allotment of this funding has bypassed sectors of the population who are in a marginal situation. While they do not represent an aggregate value investment, they are the ones who most need support to obtain a job or become self-employed and thus be able to make a living. According to an analysis of government spending made by México Evalúa (2010), a private-sector think tank, it is estimated that “60% of social spending is regressive, that is, it is disproportionately concentrated on the groups with the highest incomes”.

The public policies currently in force for the creation of jobs, companies and entrepreneurs are guided by the presidential decree (2008) which authorized the “Sectorial Program for the Economy 2007-2012”. Its impact was seen in the considerable increase of the budget of the Secretary of Economy in the following year, above all for the PYME (SMEs) Fund. In the Decree published on May 14, 2008 in the Official Gazette of the [Mexican] Federation, the Secretary acknowledged that “among the main obstacles to competitiveness are found excessive bureaucracy, corruption, the lack of access to financing, an inadequate infrastructure and insecurity (Secretaría de Economía, 2008).

On the basis of the sectorial program, that federal government agency deals with challenges which are centered on the integral encouragement of the “MIPyME”s, the promotion of exports and direct foreign investment, a simplification of the official procedures for starting businesses, the promotion of more efficient markets, the creation of a system for competitiveness, increasing the production of high aggregate value goods and services, consumer protection and the strengthening of investment banking.

One of the programs which has the largest budget allocation is the PYME Fund, operated by the Undersecretary for the Small and Medium Company, since it has disbursed between five and six billion pesos annually since 2009, which amounts to nearly a third of the total budget of the Secretary of Economy. It is worth noting that the nominal value of the budget assigned to that fund has risen 600% since 2004 (Garrido, 2011). Among the strategies of this program there stand out, as fundamental guidelines, the promotion of new entrepreneurs and company incubators, the encouragement of micro-companies and franchises, and the provision of resources to small and medium companies, as well as “gazelle” companies and “tractor” companies (those able to drive smaller ones). For the Federal Government, fostering the creation of small companies today lays the foundation for the big companies of tomorrow (Secretaría de Economía, 2008).

Participation of the Tecnológico de Monterrey

In the light of the circumstances at that time and to confront the growing demand for jobs that the demographic window would bring about in the following years, the Secretary of Economy and the Tecnológico made a formal agreement to join forces in order to support 30 social incubators

through the Universidad Tec Milenio (the newspaper El Porvenir, February 16, 2007). Since then, the Tecnológico has constantly increased the transference of its incubation models to other organizations.

In addition, with the aim of consolidating the work of the Tecnológico de Monterrey on a national level, both in the public and private sectors, its directors have been interested in forming alliances which are compatible with its institutional Mission and Vision.

In that regard, for example, the Cámara de Diputados (Chamber of Deputies, the lower house of the Mexican legislature) and the Tecnológico signed an agreement in June, 2008 whereby the Tecnológico's System, in the person of its Graduate School in Public Administration and Public Policy ("EGAP", in its Spanish initials), would undertake research and analysis to facilitate the work of the legislators, in return for which its students would have the possibility of doing their "Social Service" (the community service obligatory for university students in Mexico) in the Congress (Estrop, 2008). In turn, to make official procedures for establishing companies more efficient, the Federal Commission for Regulatory Improvement (Comisión Federal de Mejora Regulatoria –"Cofemer") made the Universidad Nacional Autónoma de México and the Tecnológico de Monterrey responsible for supervising the operation of the informatics aspects of its System for the Quick Opening of Companies (Sistema de Apertura Rápida de Empresas) (González, 2008).

Furthermore, each regional rector and campus of the Tecnológico de Monterrey has the authority to sign agreements with local governments and institutions, an activity which constantly occurs and grants it an organizational dynamism which allows the university to establish ties with the economic, political and social life of each region, in accordance with their characteristics and needs.

International Links of the Tecnológico

On an international level, the institution seeks to reflect the excellence which characterizes it, and for that purpose, its collaboration with other relevant actors is fundamental. For example, the Government of Spain and the Tecnológico de Monterrey signed an agreement for technological cooperation on August 6, 2008, focused on the specialities of biotechnology, Technology Parks and information technologies, through the linkage between Spanish higher education institutions and companies, and Mexican universities. Its aim is to create a reciprocal flow of knowledge, experiences and human capital, based on a continuous interchange (Garza, 2008).

The Tecnológico de Monterrey also collaborates with the Government of Costa Rica in the field of institutional strategy and business development, in order to promote a sustainable competitiveness in that country, an agreement that was formalized when representatives of the two parties decided to implement pilot projects for entrepreneurship in different regions of that country and thus strengthen the links previously established in 2010 (Notimex [the Mexican government news agency], August 24, 2011).

Another initiative resulted from a cooperation agreement between the Tecnológico de Monterrey and the Multilateral Investment Fund of the Inter-American Development Bank (IADB), signed in 2010: a program for the development of infrastructure and services through a public-private partnership scheme, whose aim is to spur the competitiveness of Mexican municipalities in those fields, a response, in turn, to a World Economic Forum report that rated the competitiveness of Mexico's infrastructure 64th out of the 125 countries in the study (Notimex, April 15, 2011).

This concern for coming up with sustainable business solutions led the Tecnológico de Monterrey and Arizona State University to inaugurate the first Mexican office of the Global Institute of Sustainability, which will initially develop a pilot program in Mexico City with Walmart and Femsá (the largest beverage company in Mexico) (Rodríguez, 2011). Likewise, its commitment to entrepreneurship is behind the strategic alliance established between the Tecnológico de Monterrey and the Business Council of Latin America (CEAL, in its Spanish initials), which includes spurring research, as well the political, social and technological development of the region (Notimex, December 16, 2011).

Institutional Adaptation

To respond to the changes in Mexican society and especially the challenges which the country's development constantly faces, the Vice-Rectorate of Research and Development was restructured in 2008, with the creation of three institutes: The Institute of Regional Development and Public Policies, the Institute of Public Administration and the Institute for the Development of Entrepreneurs, as well as 11 directorates.

The then vice-rector explained that these initiatives followed the guidelines established in the Tecnológico's Mission 2015, which sets out, among its priorities, cooperating in the professionalization of public administration, and analyzing and setting forth public policies for the country's development: "Our country has repeatedly come out poorly in competitiveness: we don't get worse, we simply don't advance. We are being left behind by Brazil, China, India, Israel and Ireland, among other countries; we stay the same". He also recalled that between 1990 and 2008, the standard of living in Mexico only grew by 10%, which is why he stressed some ideas for growth:

- Create a close link between the public sector, universities and the business sector. Only in that way will they be able to successfully shape new bodies of knowledge in productive processes. It is worth nothing that, in many countries, the private sector plays as much as a role or a more important one than the public sector in the development and application of new ideas.
- Facilitate the financing of science, innovation and technology activities. Public financing is not sufficient for that purpose. A key element is the development of new options of financing with private resources which allow for the creation of companies, as well as the acquisition, adaptation and development of new technologies.

He also singles out the role of incubators, since the companies which emerge from these centers have an 85% chance of success, compared to 30% for those established by other means. And therefore, he added, an entrepreneur does not have any limits. He sees opportunities where others see problems, but he also sees them first. In times of crisis, he prefers to sacrifice profits instead of sales: that is how growth is achieved.

The challenges of entrepreneurship in Mexico

Estimates by the OECD (Organisation for Economic Cooperation and Development) indicate that monopolies and difficult access to financing are the main barriers to the establishment of new businesses in Mexico. Robert E. Litan, former anti-trust czar of the United States and now in charge of the Entrepreneurship Research Center of the Kauffman Foundation, points out that the lack of an opening for competition is one of the biggest barriers which entrepreneurs confront. This expert explains that while the obstacles also depend on the economic organization of a country, if an economy wants rapid growth, it must look for entrepreneurial capitalism (Reyes, 2008).

According to the annual "Doing Business" ranking published by the World Bank, Mexico's indicator for the ease of doing business fell from 41st in 2007 to 53rd in 2012 among the 183 economies studied. In Latin America, it is surpassed by Chile (39th), Peru (41st), Colombia (42nd), Puerto Rico (43rd) and Saint Lucia (52nd) (Doing Business, 2012). Mexico has become a place where it is even more complicated to do business.

Among the other difficulties it discusses, the same study emphasizes that while entrepreneurs are generally men between the ages of 18 and 34 in other countries, the proportion of men and women who start businesses is nearly the same in Mexico, but their ages fall into two groups – 18 to 34 and 45 to 68 – according to a report by the Global Entrepreneurship Monitor, GE, 2008. According to the director of the Center for Regional and National Development of the EGADE (Graduate School of Business Administration and Leadership) in Monterrey, Marcia Campos, these age differences are due to the economic situation in recent decades. She explains that to open a "changarro" (small business), which was the modality encouraged during the government of President Fox, is not the same as being an entrepreneur. The problem in only opening businesses, adds Marcia Campos, is that they apply to activities which are not productive and do not generate an aggregate value or survive long, and also have a high financial cost (Reyes, 2008).

For that reason, the director of the Center explains, the difference between business and entrepreneurship has to do with the term "social responsibility". Thus, for an entrepreneur to make an impact on the economy, he or she must create a business which leads to the multiplication of jobs and offers innovative goods or services.

Like Marcia Campos and Robert Litan, Ernesto Cervera, general director of the "Grupo de Economistas y Asociados" (a Mexican consultancy firm), agrees that to make a transition from an oligarchic system to "a good capitalism", public policies which spur entrepreneurship are

needed, with legal, institutional and taxation changes. Entrepreneurs, he says, are the answer for making it simple to enter and leave the market, guaranteeing competition and discouraging corruption in the country. They can do it, because they make the market more competitive. He cites the case of Amazon, which transformed the publishing industry (Reyes, 2008).

In this regard, the publication *Emprendedores Mexicanos* (Mexican Entrepreneurs) provides information which suggests that businesses in Mexico generate low levels of income and have little potential for growth. Nearly 200,000 companies are created each year, joining the 3.7 million which already exist. While these figures are impressive, most of these new establishments are a response to the shortage of jobs and are small enterprises which do not have a high aggregate value. Therefore, they only make a marginal contribution to the Gross Domestic Product and do not meet the conditions which are suitable for obtaining capital, long-term investments or risk capital.

Taking into account international trends of economic growth and the characteristics of the new economy, we find that there are five fundamental pillars which a country like Mexico should have to produce companies of high aggregate value and thus move towards a knowledge-based economy: (a) qualified human capital and the intensive use of knowledge in production, (b) the development of systems of innovation and entrepreneurial capacity, (c) an orientation towards foreign markets, based on competitiveness and the attractiveness of international ventures, (d) an adequate infrastructure of information, communication and technology, and (e) a solid institutional framework and a social capital which encourage certainty and reduce transaction costs (Hernández and Molina, 2011).

To increase the economic and social growth of Mexico, Héctor Robles Piero (interview, January 22, 2012), ex-director of Social Development of the municipality of Zapopan and a researcher who specializes in public policies, suggests that the government should expand its programs for the promotion of investment in science and technology, because, while countries like Singapore, India, China and even Chile invest nearly 8% of their GDP in that area, Mexico invests less than one percent. Thus, on a world level, the country is far behind in the field of technological competitiveness.

In addition to the reforms needed to achieve a greater profitability from investment and raise the level of education, it is necessary to follow specific strategies and policy lines to promote technological progress. Carlos Cruz (2012) thinks that the Tecnológico de Monterrey can influence the design of public policies and the creation of a new entrepreneurial corps. "A new entrepreneurial caste is needed, one that is ethical and has more social responsibility. The entrepreneur must be clear that if he creates wealth, he has a social debt. He has to support society. This wealth must not only be for him and his family, but he should return it to Mexico".

Opportunities

While the entrepreneurship model of the Tecnológico de Monterrey is exemplary on a world level, there are still a number of opportunities it has not yet exploited. Francisco Tomás Zapata Guerrero (2011) recommends establishing a procedure for advising companies about intellectual property, the development of patents and licensing, since, in his opinion, they do not receive enough information and tend to turn to the government agencies in those fields. He also believes that clearer criteria should be established to “graduate” the incubated companies and better delimit the time of incubation. He proposes the creation of a body which would evaluate and monitor the performance of each of them, and mechanisms to ensure that the consultancies given to the entrepreneurs are more practical, above all in regard to production and industrial design.

For his part, Julio César García Martínez (2011) agrees on the need to give more depth to the development of the intellectual property deriving from academic research, and notes that the linkage between the university and the incubators is strongly focused on undergraduate students, whose knowledge is not as advanced as those in the Masters program, and for that reason it would be convenient to involve the latter segment in the formation of innovative and high tech companies.

Thus, as a pro-active institution, the Tecnológico de Monterrey’s “Vision for the year 2105” has given priority to the promotion of a knowledge-based economic development in the regions where it is located and has an influence.

In general, this development can be attained through key factors like the capitalization of the knowledge of researchers and students, the creation of ambits which encourage innovation in entrepreneurs and companies, the incubation and acceleration of businesses and attracting high-value companies, among others. All of these factors should lie within a framework of a vision and strategy aligned with the opportunities for development in the region.

That is why the role of universities in high-value economies has been fundamental, these institutions being the promoters of the creation and transfer of knowledge, and catalysts for business activities mainly based on entrepreneurship and technological innovation.

Conclusions

Thanks to its 68 years-long experience in an educational enterprise oriented towards strengthening the business sector, the Tecnológico de Monterrey has contributed to the building of an entrepreneurial culture which seeks to inspire the economic, political and social development of the country.

From its founding to the present time, the Tecnológico has developed educational models which are now a foundation for what is known as the Entrepreneurial Ecosystem. The innovative vision which has been promoted by each of the directors who have guided the institution awakens the entrepreneurial spirit found in the educational community as a whole nowadays, which is made up of its professors, students, former students and administrative personnel, and businessmen and society in general.

The results of this work in entrepreneurship are reflected not only in the academic prestige of this institution on a national and international level, but also in the thousands of companies which have found the Tecnológico a suitable ambit for creating jobs of the highest quality. Another outstanding feature is the skill at innovation of its graduates, whose creative vision has been responsible for the Tecnológico's first place in the production of patents on a national level.

The strategies implemented by the Tecnológico have been responsible for a multiplier effect in other educational institutions. They have facilitated the promotion and development of an entrepreneurial spirit in different regions and socio-economic strata in Mexico. Its model has encouraged the integration and social commitment of students, consultants, researchers, scientists, businessmen and public officials in the interests of a better use of resources.

1. From the macro to the micro

The stability of Mexico's economic indicators has been an important factor in the sustainability of the country. It will be necessary in the future to strengthen the mechanisms for the creation of a virtuous circle in which both the macro-economy and the daily operations of companies benefit workers and entrepreneurs. It will not be sufficient to maintain a healthy trade balance, control inflation and ensure an equilibrium in the variations of the exchange rate and between public debt and tax collection. Government policies must also have positive repercussions in human development, by transferring the achievements of national growth to the economic units. Entrepreneurial strategies will be the link which enables the population as a whole to participate in these macroeconomic results.

Large companies are indispensable for the national economy but so too are new enterprises. To form a just and equitable nation, it is fundamental that organizations supported by educational institutions provide the multiple actors with whom they are involved (owners, collaborators, suppliers and governments) with an adequate level of revenues, which generates value to drive human, scientific and technological development.

On the basis of data from the Mexican National Institute of Statistics, Geography and Informatics (Instituto Nacional de Estadística, Geografía e Informática – “INEGI”), Fernando Fabre said (interview, June, 2010) that to increase the size of the Mexican economy by 1%, 400,000 micro-companies or 50 large companies, each with more than 500 jobs, will have to be created, adding that “99% of the companies in Mexico have fewer than 250 employees: micro, small and medium companies are responsible for nearly half of the economy and nearly half of formal employment. That means that the other 1%, represented by the large companies, is responsible for the other half. What Mexico needs is to create jobs, quality jobs”.

2. Creating wealth instead of alleviating poverty

Welfare and charity have been useful tools for reducing marginalism in Mexico, but the country needs to apply public policies which help to generate wealth and a better distribution of incomes, and rest on the best practices for promoting companies with innovative products and services, especially those oriented towards research and technological development, which are vital aspects for the country’s development. Therefore, it is indispensable that those who are responsible for designing government programs be in constant touch with experts from the universities. For the former Secretary of Economy, Sergio García de Alba (interview, June, 2010), it is impossible to create the number of jobs which Mexico needs. For that reason, the fewer people willing to engage in entrepreneurship there are, the more serious the problem becomes, and it is clear that foreign investment is not going to solve the question of employment.

García de Alba argues that any country knows that big companies tend to create less and less employment, due to the automatization of their processes. “The small companies, the SMEs, are the ones which can solve this problem, so it is fundamental that educational institutions go deeper into the subject of entrepreneurship. Part of this social problem has to do with the ebullience of the informal economy, insecurity and the rise in organized crime. One of the challenges is to invest a bigger budget in programs for incubating companies, and on the academic end, provide youngsters with the tools.”

This ex government official and businessman also said: “It was only a few years ago that the public policy of the federal and state governments began to deal with the question of entrepreneurship and the SMEs, but, in proportional terms, the resources which they invest in the budgets [for this purpose] are low. In Mexico, we invest a lot of resources in social development for the creation

of wealth. We should reserve part of that budget for investments to buy a better future, knowing that we cannot solve the problem of poverty only by feeding people" (García de Alba, 2010).

3. The challenge of social entrepreneurship

If we wish to consolidate a dynamic and developed economy, it is crucial to take into account the establishment of socially responsible companies. That means not only thinking about boosting profits, but also ensuring the conservation of resources for the well-being of future generations and giving persons in marginal conditions access to better opportunities.

Aware that the Tecnológico de Monterrey is an institution that confronts challenges, Armando Laborde believes that undertaking social entrepreneurship in Mexico requires work in different dimensions. "We not only need to create jobs, we need to solve many social problems, and it's all connected. Thus, if we aim at the solution of social problems, in the end we are aiming at an integral form of development, and if we encourage this approach or this niche of social companies we are setting off many other things at the same time" (Laborde, interview, June, 2010).

The future of Mexico is necessarily associated with the involvement of different social and economic actors -- from institutions of higher education, businessmen, scientists and support agencies, to the citizenry as a whole -- in a mechanism which aids the functioning of a model of economic development centered on the entrepreneurial culture.

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Eversince it was founded, the Tecnológico de Monterrey (Monterrey Technological University) has been an institution widely known for its excellent university training and instilling an entrepreneurial culture in its students and professors. It has complemented this business vision with a firm intention to encourage the creation of sources of employment and wealth for the most vulnerable classes in Mexico through social incubators, whose aim has been to promote the transition from self-employment to the founding of micro-companies within the formal economy.

The current document describes the critical processes and strategies implemented by the Tecnológico de Monterrey for the creation of an ecosystem aimed at entrepreneurship, ranging from educational processes to the physical infrastructure and programs for technological support geared to different publics: its students, the business community, the social sector and public and private bodies, revolving around the task of training entrepreneurs for the benefit of their community.

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