



## Novel Model to Foster Technology Base Entrepreneurship through the Doctorate Spinoff Program

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### Abstract

*Efforts have been made by Universities to correlate knowledge with entrepreneurship activities to enhance the educational experience of students and achieve success. The creation of intellectual property is an important factor of these entrepreneurship activities. Throughout the past six years ITESM has been the Institution with the largest number of patents granted to a University in Mexico. The mission of ITESM has been not only to generate knowledge, technology, and expertise but rather deal with the convergence of its development and further capitalization. In response to this objective, academic programs and specific projects have surfaced in academic areas, such as “The Sphere of Innovation Program”, “The Doctorate Spinoff Program”, “Entrepreneurship Family Program”, “Technology Transfer Innovation Park (PIT)” among others. These programs accompany the students along their undergraduate and/or postgraduate education, in search of technology transfer that will promote a new nation’s competitive advantage. On this regard, “The Doctorate Spinoff Program” can be highlighted due to the strategic efforts on technology based entrepreneurship, encouraging students to enrich their doctoral research with the creation of new ventures. These efforts have influence positively the process of technology transfer from the University to startups. ITESM exhibits a great commitment to guide, protect and mobilize the production of scientific and technological knowledge to the productive sector, the ability to enrich innovation and to create mechanisms that increase Mexican competitiveness through highly qualified job creation, add value to the industrial environment and toss young people as entrepreneurs. The aim of this paper is to present the structure and results to date of the Doctorate Spinoff Program at ITESM, presenting the evolution, challenges and threats of this program and proposes a novel model to deal with those difficulties.*

### Introduction

The Global Entrepreneurship Monitor (GEM) is one of the research projects in the field of entrepreneurship with greater recognition, initiated by the London Business School and the Babson College [1]. One of the most important indicators is the rate of entrepreneurial activity, which measures the percentage of people between 18 and 64 years old involved in a company with less than 3.5 years of operation. In Mexico, this indicator increased from 9.6% in 2011 to 12% in 2012, even though there was a low percentage of Product Gross Domestic Product (GDP) dedicated to research and development through subsidies or capital funds. In the last decade, the government has helped to promote the transfer and adoption of advanced technologies to enhance the competitiveness of the priority economic sectors with programs like PRODIAT\_ Programme for the Development of High Tech Industry [2].

The Mexican National System of Business Incubators has 503 registered institutions by 2013, with a presence in over 190 cities. Of these, 217 are traditional incubators, 262 are intermediate and 21 correspond to high technology incubators. Given the low percentage of high-tech incubators, a development program for these businesses within a university will be a distinguishing feature of this growing economy. According to data from the National Association of Universities and Institutions of Education Superior (ANUIES) [3], there are 955 universities and higher education organizations distributed in all 32 states of Mexico, only 18% offer some support for business creation or spinoff development. This paper aims the addition of new elements to the actual spinoff model for the doctorate programs at ITESM which seeks to launch new technology-based firms (NTBFs) from the Ph. Degree students research balancing the scientific knowledge development, the societal challenges and the commercial interest needed to constitute cooperation and interaction among entrepreneurs and investors.



This article is organized as follows: the first section explores the ITESM doctorate spinoff program called Incubation Cells, the second section presents the survey made through interviews with 60% of the spinoff founders, the third section presents a new model proposal for this program in order to face the weakness detected and the last section presents the results and conclusions as well as managerial implications of the model proposed.

## **The ITESM doctorate spinoff program: Incubation Cells**

ITESM is a higher education institution that prepares students to become responsible citizens who trigger the development of their communities. For the last 25 years, ITESM has been addressing broader objectives not just generating and transferring knowledge, but also participating in new business creation. In the graduate programs, ITESM has been promoting the creation of NTBFs, involving teachers, researchers and doctorate students in generating knowledge that trigger jobs into the Mexican economy. Its role in fostering the commercialization of research is materialized in spinoffs.

The definition of university spin-offs used in this article is “new firms created to exploit commercially some knowledge, technology or research results developed within a university”[4], that can be founded by a faculty member, a staff member or a student as long as the knowledge that is actually exploited has been nurtured within a university.

The number of Ph.D. students at ITESM in Monterrey is currently 380 students. In 2006, to foster their entrepreneur spirit, the Incubation Cells Program for the doctoral students was created. This program was developed by Dr. Francisco Cantu, director of Research and Graduate Studies, explained that the cells aim to link the doctoral programs and the research results. In the traditional way, the doctorate student joins a research chair, takes program courses, publishes articles with his research advisor, and develops his dissertation and graduate. But, in the Incubation Cells Program, the student joins a research chair, defines its incubation project from a previous environmental scanning and develops new knowledge that allows him to establish a business to provide a robust solution to this problematique. By participating in this program, the student has access to the support of a large university infrastructure and human capital including: office space at the Incubation Center and Technology Transfer (CITT); access to laboratories and specialized software; support for patenting process; administrative, legal and fiscal guidance; access to venture capital, and a faculty adviser on business strategy. At the present year, there are 26 Technology Based Incubation Cells at Monterrey. In addition to this, it was created the group Link E+E. This network is aligned to the ITESM mission for 2015: driving the development of new businesses, in particular, through a sustainable and replicable model that relies on corporate governance practices to complement the potential new entrepreneurs with the knowledge and contacts of experienced entrepreneurs and consultants recognized this group allies.

In order to validate this model in practice, a survey was conducted within the actual spinoff of ITESM that could draw its strengths and weaknesses, and generate new strategies to trigger more NTBFs.

## **The survey**

To develop new strategies to enhance the ITESM doctorate spinoff program, a survey was conducted with 13 doctoral spinoffs (out of 26). The survey was based on a semi structured detail interview with the NTBF founders/doctorate students. The questionnaire had three sections: in the first section, the entrepreneur was asked about the process of creating his company and the current market position (history, actual customers and how is your relationship with them, prices, value proposition and strategic alliances to boost the business); in the second section, asked about the university contribution to the entrepreneurial ecosystem (institutional conditions favorable to the development of the business, difficulties perceived in the ecosystem for the creation / the boost of the spinoff and intellectual property issues). In the last section, was about their opinion of the program, their complaints and recommendations.

These interviews were addressed to thirteen doctorate students; three have already been constituted as start-up companies. Some companies are related to biomedical devices, e.g. IDIMED 3D bone printing; biotechnological development, e.g. Bio-recombine biomolecule synthesis; sustainable technologies, e.g. Alteso biofuels production with microalgae; nanotechnology, e.g. Elvia Nanofluid nanoparticles enhanced refrigerants. After detailed analysis of each interview, it was found that the program has two approaches,



one consisting of exploiting the commercial potential of an existing patent, e.g. ProHealth, and the other one involving starting a project from scratch and end the program with a patent and a start-up company, e.g. Ibox Microdevices. In between, many important issues were outlined in order to propose new strategies to strengthen it.

## New model proposal

The entrepreneurs/students interviewed showed a great deal of openness and shared their gratitude to ITESM because of the resources and infrastructure given to start their NTBF, but they also expressed their concerns in some important issues.

The interview made to the Ph.D. students showed the relationship between the doctorate and the entrepreneurial activity: both have the same origin: uncertainty, and yet they obtain the same result: discovery[5]. One key aspect is the need to recognize the personal and professional priority of knowledge and science development over the entrepreneurship project. For every doctorate student, during his graduate studies, generating science is far more important than building a firm. And because of that, as an institution it's important to acknowledge this and to synchronize the time frame to achieve both. To summarize our findings, table 1 presents the key internal factors of the actual model.

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### Strengths

- Support in financial and administration management (training courses of finance, marketing and intellectual property protection are highly valuable)
- Access to promotion and networking of their ideas to investors
- Gain strategic alliances
- Opportunity to incorporate undergraduate and graduate students
- Access to infrastructure

### Weakness

- Weak communication and networking among doctorate students (national/international)
  - Lack of special events like Ph.D. entrepreneurs colloquium and successful stories
  - Poor accessibility to funds
  - Little or no incentives for entrepreneurial motivation
  - Low quality of managerial courses or exceeds in theoretical approach
  - Little follow up of start-ups
  - Inconsistence of program information
  - Inefficient communication between the students participating and their coordinator
  - Lack of personalized counseling to the students, with clear communication regarding the policies and tangible as well as intangible assets available for them
  - Need and expectation of greater business support
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Figure 1. Strengths and weakness of the ITESM Spinoff program.

Students identified that at the beginning of their doctorate they had a high entrepreneurial spirit, motivated, eager to success; however the institution's indicators of performance focus on continuous academic publication, high-tech investigation and quality proposals, thus leaving aside the development of their economic analysis and personal investment in entrepreneurial skills.

The quality of entrepreneurial courses has been rated well by all students; however they stated that the courses could improve in quality and be focused on technology based companies. Finally when the student graduates, the program finishes, there is no follow-up for the now Start-up Company therefore the leader is left with suddenly no support whatsoever and with no prior transition from receiving advice to taking decisions on their own. One important challenge present in the program is the time limitation. This is a consequence of the disintegration between the academic formation of the student and the Spinoff program. Since the work overload of the PhD academic formation causes schedule saturation, the student does not have enough time to exploit all the resources to which he/she has access.



We emphasize the need of institutional policy to be responsive not only to the needs and motivational states of entrepreneurs, but also to the general economic development in the Mexican economy. The model proposed seeks to encourage universities to find pathways to commercialize their research, without sacrificing the need for intellectual space and pace for the doctorate students. Figure 2 synthesizes the main elements of the model proposed.

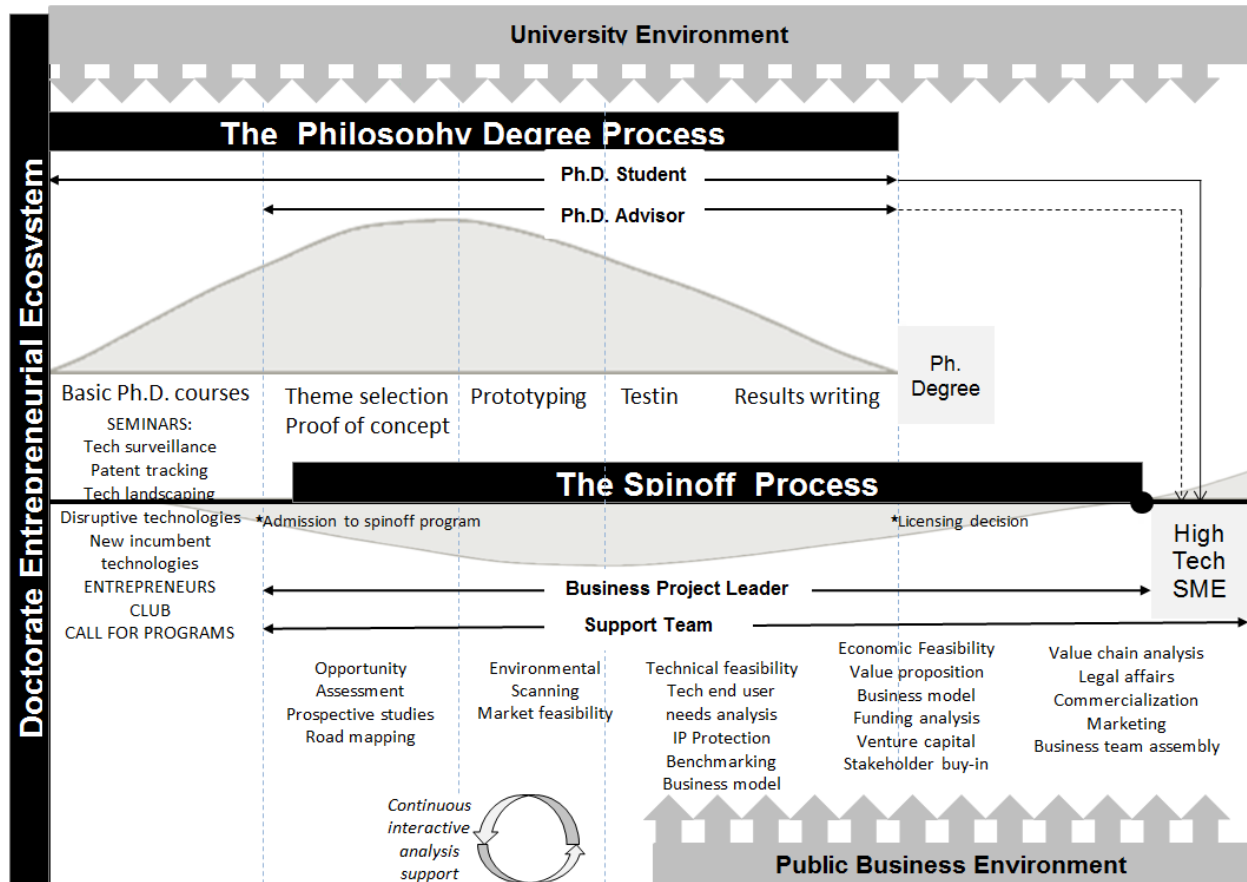


Figure 2. Doctorate Spinoff Model Proposal

In this model, it is important to consider factors of the incubator cells performance [6] like the strength of their linkages to the research university sponsoring the technology incubator: we propose that a university link to the sponsoring institution reduces the probability of new venture failure. According to this research, the main problems to address in the delivery of NTBFs are: (1) a new technology does not make a company itself, (2) a researcher or technical research team is not a businessman, (3) current support tools and training programs provided by the ITESM does not give a complete solution (4) regulations constitute one external condition for business and entrepreneurial activity, thus their risk has to be considered. Some of the robust features of this proposal are: (1) assembly of multidisciplinary teams, (2) early financial and venture education, (3) formal mechanism of networking with business strategists and consolidated entrepreneurs (4) open and free access to venture capital events (5) cluster creation incentives to strategic sectors and science development and (6) Incorporating coaching, mentoring, reciprocity, trust, and other bonds that connect networks of individuals and institutions.



## Conclusions

As a developing country, Mexico needs to relay its future on innovation and knowledge creation. Through the doctoral studies, new science is developed, and through this program, feasible technologies are poised to take off as business opportunities. Through the survey, the opinions of novice entrepreneurs made possible the proposal of a new set of institutional arrangements that foster technology base entrepreneurial activity leading to the prevalence of firm start-ups and high growth firms. To facilitate start-ups of highly productive University NTBFs and skilled employment, the underlying inefficiencies, and failures in the organizational support also need to be addressed. One of the major challenges of the current model resides therefore in the transformation of the results of research and technological innovations into competitive business advantages. A doctoral student in the scientific area has personal and professional characteristics that enables him to research and develop technology, but not necessarily this implies to have the skills needed to manage high-growth companies, and this is the space taken by this proposal: to assemble a business strategic team, trust based, that collaborate in the creation of new high-tech ventures to our economy.

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