BRIDGING THE VALLEY OF DEATH: LESSONS FROM AN ENTREPRENEURIAL PROGRAM

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ABSTRACT

Nowadays, the governments and the private initiative destine budget and modify their regulations in favour of innovation, entrepreneurship, and scientific commercialization. Some mechanisms emerge as the bridge between research and the market. Their function is to support academics and researchers to cross the valley of death and start new science-based ventures. We analysed Binational Innovation Nodes (NoBI), a governmental program as a bridge to translate research into the market. This program aims to boost science and technology-based entrepreneurship through customer discovery. We describe and analyse the implementation of this program.

Our findings highlight two essential functions of this kind of entrepreneurial program. First, help to validate and discard research on less time. Secondly, this program helps to line research to market, preparing research to go to the commercialization phase. Also, this program has an impact beyond the validation of technologies, changing the mentality of the scientist.

Keywords: Valley of Death, Science-Based Entrepreneurship, Public Policy.

INTRODUCTION

There is a lack of success in commercializing research. Many public and private institutions have designed programs to boost research and entrepreneurship focused on science and technology. However, despite these efforts, a problem still exists in achieving the successful commercialization of science-based entrepreneurial ideas. As Frank et al. (1996) contend, most of these firms end up with no profitable products. Academic research gives no conclusive insights into the current benefits of such programs. As of today, few studies have analysed the impact of programs and policies in stimulating science-based entrepreneurial activity (Autio & Rannikko, 2016; Markham, 2013).

Currently, many centres, institutions, and universities produce science and technological research, but they usually lack the skills to commercialize their products successfully. This problem related to the successful marketing of products-to which all entrepreneurs are vulnerable-is called the "*valley of death*". According to Markham et al. (2010), this metaphor conceptualizes the problem of moving from research to the market. Relatedly, and continuing with the metaphor, there exist some mechanisms that work as bridges for crossing the valley of death. These mechanisms provide academics and researchers with the necessary tools for ending up with a successful commercial product.

We analyse the program of NoBI (Binational Innovation Nodes) as a support mechanism for science-based new firms to cross the valley of death. Specifically, this government support aims at technologies that have passed the test concept as a minimum requirement. The NoBI program follows an I-Corps methodology, prioritizing the customer discovery process. We collected and analysed data from several sources: interviews, participant observation, documents, and records of the projects immersed in the NoBI program.

The NoBI program is an initiative of the Mexican government, whose objective is to provide the skills and knowledge necessary to market technologies from Mexican scientists. Behind this program, there are many efforts to incentivize technology and innovation in this country and increase the rate of commercialized technologies.

We contribute to the understanding of the valley of death by, first, exploring how entrepreneurial programs serve as a bridge to cross the valley. Also, we contribute to examining the impact of this program on scientists, an important consideration to explore how research can cross to commercialization.

Our findings show how a governmental program helps scientists to identify their market and validate their technology or invention with a real customer. The NoBI program as a bridge has two important functions. The first is to help scientist's withdrawal research on time, if it is necessary, thus avoiding unnecessary consequential expenses. Second, this program is a bridge to improve research and prepare the commercialization phase.

BRIDGING THE VALLEY OF DEATH

The valley of death is a metaphor that represents the difficulty of moving from research to the market (Auerswald & Branscomb, 2003; Frank, 1996; Markham et al., 2010). To fill this gap, some mechanisms, as consortia, business incubators, and accelerators, have emerged as a bridge between research and the market. These bridges provide entrepreneurs with different methodologies comprising knowledge, experience, feedback, and mentoring (Gamo et al., 2017). Furthermore, there are many efforts from governments, such as the laws of science and technology or public policies focused on supporting the commercialization. Most government programs have to do with financing.

To understand how the bridges work is important in order to analyse the problem. There are many barriers to the commercialization of technologies and research, including inadequate analysis of technology needs or market size and a lack of entrepreneurial management, funding, and incentives, among others (Adams, 2012; Frank et al., 1996; Nemet et al., 2018). Even though funding programs help scientist, it is not enough in itself, because of the lack of other necessary expertise to cross the valley.

The relevant question for this study is how a program, public or otherwise, transmits expertise for scientists beyond funding. Previous research has focused to measure the impact of public policy on innovation and entrepreneurship (Aldridge & Audretsch, 2010; Meslin et al. 2013; Sandström et al., 2018). Following this premise, we considered that education also emerges as a bridge. Previous research suggests that scientists need to acquire knowledge that facilitates their commercializing process (Frederickson, 2012; Gamo et al., 2017). Education programs are a crucial way to improve scientist skills. However, this kind of program needs to accomplish several characteristics Barr et al. (20009), mention that entrepreneurial programs must be real, intensive, multidisciplinary, and iterative. We analysed the NoBI program, an initiative combining education and practical methodology, to validate scientific ideas from research. Their goals, methods, and results. Figure 1 shows an integration between the valley of death conceptualization and the NoBI program as bridge.

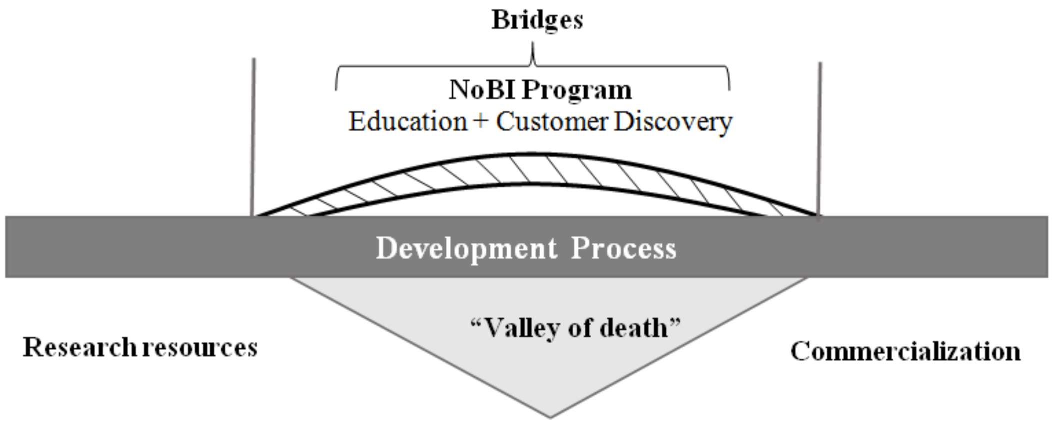

FIGURE 1
THE VALLEY OF DEATH

METHODS

Our methodological design follows a qualitative approach to analyse this program. Our study aims to describe and explore how a governmental program serves as a support for crossing the valley of death, what are the principal activities related to bridging the valley, and what is the impact of this program on the technology projects. We followed recommendations for qualitative research design and analysis (Brinkmann, 2013; Maxwell, 2013; Saldaña, 2016).

We selected the NoBI (Binational Innovation Nodes) program as a subject because of its uniqueness. This program is one of the first governmental programs and part of a new technology and innovation policy in Mexico to boost technology and science-based entrepreneurship. The program started with a pilot test in 2016 with a single node. We analysed the program during 2017 and 2018; during this period, the program included eight different nodes in the country.

TABLE 1
RESEARCH DESIGN AND ANALYSIS

Method	Subject	#	Principal Topics
Interviews (face to face)	NoBI Coordinator	4	Commercialization, barriers, Mexican context.
	Principal Investigator	5	Personal barriers, face reality, frustration, change.
	Mentor	5	Networking, mentoring.
	Instructor	2	Methodology, validation, frustration tolerance, change.
	Entrepreneurial Leader	5	Knowledge, experience, practice, market.
Participant observation	Kick-off session Webinars Closing sessions		Frustration, value proposition, iteration, market, change.
Documents	Web site Social networks		Methodology, validation, customer discovery, market.
Videos	Final videos of teams		Learning, change, frustration, reality.

We obtained data for our analysis from participant observation, interviews with different participants, documents, and archival records analyses. Participant observation consisted of assisting in a face-to-face closing session. We collected a total of 21 interviews. Documents include the governmental announcement, websites of nodes, reports of results, and news reports. Archival records of projects were obtained from the virtual platform of the NoBI program; these include descriptions of projects and final videos of projects. We analyzed and codified the data to obtain relations and classifications of activities, relationships, and the impact of the final results of the program. We integrated this analysis with documents and archival records analysis to complement and contrast the data. Table 1 shows collect methods and principal topics emerged from the analysis.

RESULTS

The NoBI Program

The NoBI program is an initiative of the Consejo Nacional de Ciencia y Teconología (CONACYT) National Council for Science and Technology) of Mexico in partnership with the National Science Foundation (NSF) of the United States of America. This program aims to train groups of researchers (scientists) and entrepreneurs in the exploration of the market for technologies developed in Institutions of Higher Education (IES) or Public Research Centers (CPIs) of Mexico. The goal of this program is to help the participants acquire the skills and knowledge necessary to market the technologies that they have developed and to direct their next scientific research towards a specific market.

The NoBI program started in 2016 with a pilot node. In 2017, the number of nodes increased to 5, and for the 2018-2019 periods, it increased to 8 nodes. A node is a set of scientific, academic, and business institutions. There are two kinds of nodes, sectorial and regional. Sectoral nodes are sector- or industry-specific (medicine or manufacturing). Regional nodes represent a geographical zone of the country (north or southeast).

NoBI invites scientists from different Mexican research centres through a call on their website. Selected participants are then grouped. According to the program’s administration, the grouping of participants considers different factors: similarity between projects, participants’ background, and availability. This program targets technologies and research projects past the concept test phase.

Composition of the NoBI Teams

NoBI program aims to Institutions of Higher Education or Public Research Centers; undergraduate and graduate students; and entrepreneurs, executives, or individuals related to science-based entrepreneurship, commercialization, and technology transfer in Mexico.

The NoBI teams are composed of 1) a principal investigator, who is a scientist or the inventor of the technology; 2) an entrepreneurial leader, who is an undergraduate or graduate student who knows the proposed technology; and 3) a mentor, who is an expert in the industry, innovation or technology transfer. Also, some teams have 4) a support student who is an undergraduate student.

The program is implemented by members of an I-corps certified teaching team, which imparts the lectures at the kick-off and closing face-to-face sessions and webinars, moderate presentation sessions, provide feedback through the platform and cover office hours.

The Methodology of the NoBI Program

The NoBI program follows the Innovation Corps (I-Corps) methodology. This method consists of the following steps: 1) Identification of the problem solved by the technology or invention; 2) Customer discovery; 3) Commercial validation of the technology or invention, and 4) Final decision of whether or not to proceed with the research. This methodology is iterative and intensive. The program lasts nine weeks.

The program consists of three phases: 1) Kick-off, 2) On-going, and 3) Closing. Each stage includes lectures and activities. Figure 2 shows the process and events of the implementation of the NoBI program. The interviewing activity represents the validation process when participants go out of the building and meet the market. The teams have to conduct one hundred interviews with customers and make a final video presentation for the closing session. They have a goal of fifteen interviews per week.

Classes are either face-to-face or virtual and cover the following topics: 1) business model canvas; 2) customer discovery; 3) best practices for conducting interviews; and 4) customers, buyers and ecosystem.

FIGURE 2
NoBI PROGRAM ACTIVITIES

Lesson Learned

Scientific mindset

At the beginning of the program, the participants presented resistance to learning and making the activities. The first shocking moment was the first interviews, after going out of the building and looking for customers, when they discovered that this process is complicated, even for those who have a good number of contacts related to the industry. They described this situation as frustrating, particularly when someone cancelled an interview, or they did not have access to institutions and people from the industry.

A second aspect associated with the entrepreneurial mind-set is the capacity to explain their technologies in business terms. During the kick-off activities, each team presented their projects and received feedback about their value proposition. We observed that the main critique for the teams is about the drafting and explanation of their technology. So, they show problems in communicating the business idea, despite the level of expertise of the teaching team and the rest of the participants. For scientists, it is not very easy to translate their ideas into the common language used in the market.

Also, participants manifested resistance through disgust when asked about the utility and the market. We heard phrases like "*everybody is my market*," "*I have many different markets for my technology*," and "*We think that this project will change the industry*". These kinds of expressions reflect high confidence in their technologies. Additionally, they defended their ideas with force even when the evidence showed contradictory results.

The Confrontation: Face the Reality

After some interviews and feedback with the teaching team, we found that teams fell in a phase of confrontation. This phase consists of having information that confronts their ideas about everything related to their technology to the reality: market, industry, sales, and business plan. We defined this confrontation as a moment of the truth. These confrontations occurred, during interviews, the lectures, or feedback sessions. At this moment, the participants realized that they needed to change their ideas to adjust their technologies to the market. During this phase, they obtained responses from the market, such as: *"We do not have a problem that your technology can solve", "I have a problem, but I am not interested in solving it.", "If this is not obligatory, I will not do it", "I am comfortable with the current solution."*

We found different aspects related to the confrontation.

1. Market fit: the majority of teams did not have information about their customers, including who they are and what they need; they worked to develop their research without taking account of the market. They tried to sell their ideas, but they did not have clarity about the identity of the buyer.
2. Lack of industry knowledge: some ideas have a market, but the teams did not know the rules of the industry (e.g., regulations or requirements to sell in this market).
3. Competitors: many scientists think that their technology is unique. During the program, the participants came to understand the crucial factors for launch a business. Such as the competitors, industry requirements, and, in some cases, the fact that the problem that they were attacking had already solved.
4. Feasibility of technology: many participants left the laboratories to discover that their technology was expensive or needed many requirements that the market or industry could not cover.

Changing the Mentality

Finally, after the program, we observed a change of the mentality. First, the participants expressed that, after the program, they realize the limitations of their technology and the reality of the market, using phrases such as "*I believed that everyone wanted my technology*", "*I thought I was going to become a millionaire*", "*I thought they (the market) were going to fight to buy my patent*". These expressions reflect the fact that because they started with ideas outside the reality of the market, they gradually limited their projects. In the final sessions, the participants expressed: "Now I understand the importance of knowing the market", "*This program changed my life as a researcher", and "Now I know what I need to validate my ideas*".

This change of mentality conveys a transformation of the participants' mind-set to include a scope beyond the research. Also, we observed that participants wanted to share this new expertise with their colleagues; during the final session they mentioned that it is necessary to bring programs of this kind to all the research centres of the country. They manifested plans to show this methodology in their institutions; for example, investigators that are professors expressed their desire to teach this methodology to their students.

CONCLUSIONS

Our findings show that the main impact is on the principal investigators, who underwent a paradigm shift about the research connected with the market. This study highlights how a program can serve as a bridge between research and commercialization. This program focused on changing the participants' mentality, which we consider a crucial factor to cross the valley of death. The combination of education and the process of customer discovery provided the participants with a series of lesson about markets and business models. This new knowledge provoked a change and a new perspective toward their research.

We found three pathways for scientists after the implementation of this program. First, after the technology validation, they decide to abandon the research. This decision reduces time and avoids unnecessary expenses. Second, this program serves as a bridge to improve research and prepare participants to go to the commercialization phase. In this case, scientists decide to follow the process to launch their technologies to the market. Finally, there are scientists that after the validation discover a market but still need to work more in their technologies. They decide to come back to the lab to improve their projects and align them with the new findings from the interviews. This research has important implications for practice. First, science-based new ventures can develop a business model that validates the market quickly, implementing a lean start-up approach. This process serves as a bridge to cross the "*valley of death*". Our results complement and give insights to traditional frameworks in order to contribute to the discussion on the particularities of science-based new ventures. Additionally, because our research is based in a developing country's institutional set-up, the implication for policy is very relevant. Many developing countries seek to invest in science but also face challenges in their ability to commercialize and benefit from the economic impact of science (Miozzo & DiVito, 2016). This challenge is more critical in developing economies that necessarily need to invest in more pro-market initiatives.

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