The Implementation of the Triple Helix Model of Industry-University-Government Relations in Puerto Rico to Promote Knowledge-Based Regional Economic Development

By

Ana Lorena Ramos-Maltes

S.B. in Management Science
Massachusetts Institute of Technology, 2009

Submitted to the Department of Urban Studies and Planning
in partial fulfillment of the requirements for the degrees of

MASTER IN CITY PLANNING
and
S.B. IN PLANNING

at the
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

JUNE 2010

© 2010 Ana Lorena Ramos-Maltes. All Rights Reserved

The author hereby grants to MIT the permission to reproduce and to distribute publicly paper and electronic copies of the thesis document in whole or in part.

Author

Department of Urban Studies and Planning
(5/20/2010)

Certified by

Professor Alice Amsden
Thesis Supervisor
Department of Urban Studies and Planning

Accepted by

Professor Joseph Ferreira
Chair, MCP Committee
Department of Urban Studies and Planning
The Implementation of the Triple Helix Model of Industry-University-Government Relations in Puerto Rico to Promote Knowledge-Based Regional Economic Development

By

Ana Lorena Ramos-Maltés

Submitted to the Department of Urban Studies and Planning on May 20, 2010 in partial fulfillment of the requirements for the degrees of Master in City Planning and S.B. in Planning

ABSTRACT

Puerto Rico, an island in the Caribbean, has long sought to develop a high-tech economy and has struggled in the process. Two initiatives, Puerto Rico TechnoEconomic Corridor (PRTEC) and the Eastern Central Technological Initiative (INTECO) seek to encourage local firm formation, attract foreign capital, and improve infrastructure to develop a high-tech economy and an innovation culture in the island. The efforts of the initiatives focus on cooperation from the private sector, the government, and academia. Henry Etzkowitz’s triple helix model of university-industry-government relations explains the synergies and organizational infrastructure needed to ensure a sustainable economic growth based on technology and innovation. This thesis focuses on the two initiatives in Puerto Rico whose goal is to promote a high-tech economy in the island. The analysis focuses on the initiatives’ relationship with the triple helix’s three sectors and how they have been working together to achieve their goals. While the initiatives have made significant progress in firm formation through incubators and community outreach programs to educate about technology, organizational barriers such as lack of transparency in the local grant seeking process and the lack of an entrepreneurial culture have not allowed the initiatives to solidify themselves as the generators of the new knowledge-based economy in Puerto Rico.
ACKNOWLEDGMENTS

I am grateful to my thesis advisor, Professor Alice Amsden, for her encouragement and support. Her feedback pushes me to think outside the box and reminds me that the quest to answer the question is perpetual and ever-changing.

I would like to thank my family, especially my parents, Vilma and Edwin, and my brother Javier, for their encouraging words when MIT got tough and for never letting me give up.

Estoy eternamente agradecida. MIT no hubiese sido posible sin ustedes.

¡Gracias!
TABLE OF CONTENTS

INTRODUCTION .........................................................................................................................6

RESEARCH QUESTION & HYPOTHESES..................................................................................7

METHODOLOGY.......................................................................................................................8

THESIS STRUCTURE..................................................................................................................9

CHAPTER 1. THE TRIPLE HELIX MODEL AND REGIONAL ECONOMIC DEVELOPMENT ..........10

THE TRIPLE HELIX MODEL ....................................................................................................11

THE ENTREPRENEURIAL UNIVERSITY .................................................................................14

THE EVOLUTION OF INDUSTRY .............................................................................................17

THE ROLE OF GOVERNMENT .................................................................................................21

KNOWLEDGE, CONSENSUS, AND INNOVATION SPACES FOR REGIONAL KNOWLEDGE-BASED ECONOMIC DEVELOPMENT ..............................................................24

KNOWLEDGE CAPITALIZATION AND REGIONAL INNOVATION ......................................28

THE TRIPLE HELIX ERA: AN ENDLESS TRANSITION ..........................................................29

CHAPTER 2. CHALLENGES TO CREATE A HIGH TECHNOLOGY ECONOMY IN PUERTO RICO: FROM 2002 TO THE PRESENT .........................................................32

BRIEF INDUSTRIAL HISTORY OF PUERTO RICO AND CURRENT SITUATION ............34

TEN YEARS OF CHALLENGES TO CREATE A KNOWLEDGE-BASED ECONOMY IN PUERTO RICO ................................................................................................................36

INDUSTRY CLUSTER APPROACH IN PUERTO RICO ..............................................................39

CHAPTER 3. HIGH TECHNOLOGY REGIONAL ECONOMIC DEVELOPMENT IN PUERTO RICO: CASE STUDIES OF PRTEC AND INTECO INITIATIVES ..................................41

REGIONALIZATION AS A STRATEGY FOR DEVELOPMENT ................................................42

PUERTO RICO TECHNO ECONOMIC CORRIDOR (PRTEC) ..................................................43

INICIATIVA TECNOLÓGICA CENTRO.ORIENTAL/EASTERN CENTRAL TECHNOLOGICAL INITIATIVE (INTECO) .......................................................................................53

PRTEC AND INTECO: A COMPARATIVE LOOK ....................................................................61

RECOMMENDATIONS AND POLICY IMPLICATIONS ..........................................................66

CHAPTER 4. CONCLUSION AND FURTHER RESEARCH ..................................................75

WORKS CITED AND REFERENCES ......................................................................................78
INTRODUCTION

Puerto Rico is an island in the Caribbean that has long struggled to develop industries to support sustainable economic growth. Recently, various initiatives have emerged in several regions around the island to foster regional economic development based on innovation and technology. Two initiatives in particular have made progress in advancing the goal of creating high tech regional economy growth in the island: the Puerto Rico TechnoEconomic Corridor (PRTEC) and the Eastern Central Technological Initiative (INTECO). The success of the initiatives is based on cooperation from industry, government, and academia to train a better working force, promote local firm formation through incubators, and improve infrastructure through state-of-the-art technology parks, among other goals.

The model of university, industry, and government relations for economic growth based on innovation and technology is best described by Henry Etzkowitz, a Newcastle University professor, and his triple helix model. The triple helix model is a framework that describes the synergies necessary to achieve a knowledge-based economy. The model explains how the roles of the university with regard to regional economic development can be enhanced, how the government can encourage citizens in promoting innovation, how private citizens can influence governments and how collaboration between these three spheres can produce innovation.

The triple helix will be used as a framework to explain the promotion of innovation in Puerto Rico through the PRTEC and INTECO initiatives. The thesis
will then assess whether PRTEC and INTECO are reaching their goals and will identify the organizational and cultural barriers that prevent Puerto Rico from fully developing an economy based on high tech and innovation. The thesis will conclude with recommendations for ways which PRTEC and INTECO can improve to better reach their goals. Puerto Rico is an interesting case study because of its political status as a US territory, its culture, and its long history of struggles to develop industries and create a sustainable economy.

**Research Question and Hypotheses**

This thesis aims to answer the following questions:

How do alliances between government, the private sector, and academia foster regional economic growth by focusing on innovation and technology? More specifically, is the triple helix model relevant to Puerto Rico? And if it is, what are the best strategies to foster economic growth based on innovation and technology in Puerto Rico, given its strengths and constraints?

The thesis uses the triple helix model to study Puerto Rico’s economic growth through technology, and compares two high-tech initiatives in Puerto Rico to find practices that will ensure sustainable economic development in the island. I hypothesize that:

- Regionalization is a key strategy to develop a sustainable economy based on innovation as it allows for the formation of industry clusters that benefit from the region’s strengths and offerings;
• There are efforts in Puerto Rico to promote high-tech economic development, but there are many cultural and organizational barriers that prevent these projects from reaching their full potential;

• Further studies of the existing innovation-based economic development strategies in Puerto Rico are needed to identify a comprehensive model based on best practices that is relevant and ideal for Puerto Rico.

Methodology

The methodology for this thesis consists of a literature review as well as extensive review of other documents that include presentations, newspaper and journal articles, official government documents, and interviews. The two case studies of initiatives in Puerto Rico used to test my hypotheses were a product of document reviews and interviews.

The literature review consists of creating a theoretical framework based on the triple helix model around which the two initiatives used as case studies can be understood. The literature review also covers Puerto Rico's history and challenges in creating a high technology economy.

The interviews cited in this research occurred in Mayagüez, Puerto Rico on December 30, 2009 and January 12, 2010 with the Executive Director of PRTEC, Mr. Nelson Perea and in Caguas, Puerto Rico on January 20, 2010 with Ms. Ivelmar Salva, Administrative Director of INTECO.
Thesis Structure

The thesis will begin in Chapter 1 with an extensive literature review on the triple helix model that aims to create a theoretical framework with which to analyze the case studies. Chapter 2 looks at the history and challenges that Puerto Rico has faced in its attempts to create a high technology economy and Chapter 3 analyzes the case studies of PRTEC and INTECO to identify challenges and best practices in developing an innovation economy in the island. Chapter 4 will bring the thesis to a close with a general conclusion and topics and questions for further research.
CHAPTER 1. THE TRIPLE HELIX MODEL AND REGIONAL ECONOMIC DEVELOPMENT

The United States' (US) industrial policy is one of the most comprehensive in the world. Traditionally, the US government's efforts to foster innovation have remained hidden or ignored largely due to the common belief that government should have limited intervention in industry and innovation. In other regions of the world such as Asia, Latin America, and Europe policymakers have recently began to focus on knowledge and technology transfer as the future source of innovation (Etzkowitz, 2002). As innovation begins to emerge from non-traditional processes and sources, single organizations lose power and lateral relationships between multiple organizations become important.

The Triple Helix model developed by Professor Henry Etzkowitz from Newcastle University aims to analyze these new organizational developments and offer a guide for future development. The model explains relatively recent cooperation dynamics among organizational spheres, namely industry, government, and academia, and the relationship transformation that needs to occur to foster sustainable regional economic activity based on innovation (Etzkowitz, Webster & Healey, 1998).
The Triple Helix Model

Professor Henry Etzkowitz describes the Triple Helix model as "a spiral model of innovation that captures multiple reciprocal relationships in the process of knowledge capitalization" (2002). The three helices or spheres that make up the spiral are university, industry, and government. The triple helix explains the relationship between the three players as one where independent organizational spheres with equally important roles overlap and start taking the role of other spheres. The overlapping of roles and influence is very distant from the traditional US model where institutional spheres work separately with minimal interaction (Figure 1.1). It also represents a shift from the statist model of the Soviet Union or authoritarian Latin American regimes in which the state leads industry and academia (Figure 1.2). Older economic development strategies based primarily in one of the spheres have been replaced and supplemented by models such as the triple helix that, by drawing upon the three spheres, foster knowledge-based economies (Figure 1.3) (Etzkowitz, 2002).

![Diagram of the Triple Helix Model](image.png)

*Figure 1.1 The laissez-faire model (Etzkowitz, 2008)*
Etzkowitz calls “dimensions” the requirements needed for the triple helix to function. The first is “an internal transformation in each of the helices” in which each helix commits to the mutual cooperation alliance by, for example, companies engaging in strategic alliances of cooperation and universities adopting economic development missions. The second dimension is allowing for the different spheres to
influence one another, and the third is promoting innovation by creating networks and/or organizations that facilitate the exchange between the three helices. The fourth dimension is a recursive effect of triple helix networks. When these four elements are present, the triple helix interaction can create dialogue and idea exchanges that lead to innovation and the emergence of knowledge-based economies (Etzkowitz, 2002).

The relationships among spheres have expanded beyond the traditional bilateral relationships (government and university, academia and industry & government and industry) especially at the regional level (Etzkowitz, 2002; Etzkowitz and Leydersdorff, 1997). The relationship between government, industry and academia has evolved to encompass institutional dynamics with the goal of promoting knowledge-based regional economic development (Figure 1.4).

Figure 1.4 The Evolution of the Triple Helix Model (Etzkowitz, 2002)
The Entrepreneurial University

One of the players of the triple helix model is the university, more specifically, the entrepreneurial university.

Universities are many times seen as rigid institutions with academic departments unwilling to change. However, their nature of innovation and research gives them the ability to adapt and evolve. Their educational mission culminates with the training of students across a wide range of disciplines and fields. This diversification allows the university to create hybrid fields and sometimes develop new ones. By doing this, the university goes beyond its traditional role of providing trained persons to the labor force and becomes a source of firm formation (Etzkowitz, 2008). Knowledge capitalization has thus become a new mission for the university and it allows the university to be linked to the users of knowledge and establishes the university as a recognized economic actor.

According to Etzkowitz (2008), there are four pillars on which an entrepreneurial and research university rests upon:

1. A strategic vision formulated and implemented by strong academic leadership
2. Legal control over academic resources which includes physical buildings as well as any intellectual property product of research
3. Capacity to transfer technology through licensing, patenting, and incubation
4. An entrepreneurial culture among the academic community including faculty, students, and administrators
The university is a natural incubator that allows its faculty and students to use their research to create new business ventures. To go beyond the exchange of ideas and research that occurs at a university, education institutions need to focus on certain areas of research and teaching to create “steeples of excellence” that will attract outside funding sources (Etzkowitz, 2008). An entrepreneurial university also seeks to have strong links with its community and often makes challenges and problems of the community the basis for its research (Drews, 1993).

As driver of the triple helix, the entrepreneurial university is an independent academic institution that is not under the control of the government or industry. Many times, as the university increases its entrepreneurial activities (commercialization of research), industry may start to see the university as a competitor in some cases, and a collaborator in others. Not every university fits the entrepreneurial model as there are some that are more focused on teaching or that are not interested in commercializing their research. Although this is true for some, there is a global movement to transform educational institutions into entrepreneurial universities thus blurring the line between academia and industry and allowing universities to participate in the market as independent entities.

One of the main ways a university can cement its place as a creator of innovation in industry as well as a player for social development is through incubators. Innovation is the term to describe research that produces new products, patents, and ultimately, new firms in the high tech fields of telecommunications, internet services, software, hardware, and biotechnology, among others. The
incubators’ potential for the emergence of new firms goes beyond the high-tech realm and incubators can be used as a means for empowering social projects that lead to social inclusion and wealth creation (Etzkowitz, 2008).

While the entrepreneurial university may seem like the antithesis of the ivory tower academic institution, academic entrepreneurship is actually an extension of the traditional university activities of teaching and research (Etzkowitz & Webster, 1998). It also aids in the internalization of technology transfer capabilities which is usually the role of industry (Etzkowitz, 2008). The evolution of university technology transfer capabilities usually begins with a liaison office in the university that works to take the knowledge out of the university. It is followed by a second stage in which the university develops the capacity to market, patent, and license the intellectual property it has produced, and in the third stage the knowledge and/or technology are packaged in a firm and moved out of the university usually by an entrepreneur such as venture capital firms (Etzkowitz, 2008). It is usually at this last stage where incubators emerge as a formal organization providing space and advice to the new firms (Figure 1.5).
The Evolution of Industry

In the 21st century, firm formation is considered by many central to innovation strategy. As big industrial firms downsize, a new phenomenon emerges: spin-offs (Etzkowitz & Webster, 1998). The spin-out of knowledge-based firms can be either from an industrial firm or the result of research in a university and is considered an up and coming player in economic growth. Also, creating a new firm from research is seen as a superior strategy than attracting a branch plant of a company from elsewhere.

The formation of high-tech firms is usually the product of entrepreneurial process that has players from multiple areas. Although Americans love the story of a successful single entrepreneur, triumphant ventures are often the result of a process and collaboration of multiple individuals. Firms that come out of academia usually
keep close contact with the educational institution. Also, in many areas considered high-tech regions such as Cambridge, Massachusetts there is often a presence on campus of firms (such as laboratories at MIT sponsored by certain companies) and of government programs affiliated with the research (Tournatzky, Waugoman & Gray, 2002). Because of this, innovation systems focused on the firm are creating new production models based on research and triple helix synergies (Etzkowitz, 2008).

There are two formats in which a search mechanism can identify knowledge that can be commercialized and packaged into a product, either as an entity that is part of the university or as a free-standing firm (Etzkowitz, 2008). The American model of knowledge and idea commercialization is anchored in patenting ideas through the firm. Previous to this, the firm is integrated into technology transfer offices and incubators with the help of venture capital firms. It is imperative for technical and business partners to be acquainted with each other, form alliances, and exchange views and ideas; only then will true innovation occur. A strong relationship is also key in the formation on startups that have actual long-term potential.

In the triple helix, university, industry, and government play different roles in an alliance that seeks to assist in firm formation and regional economic development. In the United States, the concept of public venture capital is unknown, and it is traditionally seen as a contradictory term since few Americans are willing to admit the significant role the government has in commercializing knowledge. This can also be especially true for other developing countries as indigenous firm formation may not
seem like such a wise investment, especially when compared to foreign firms that can set up plants anywhere in a matter of months.

In a traditional firm, contracts are negotiated to set price for inputs (materials) and outputs (products). In the triple helix, the firm is a part of a process of collaboration with other firms, non-firm entities such as venture capital groups, research groups in universities, and government (Etzkowitz, 2008). The collaboration revolutionizes the traditional supply chain from supplier to customers to a process where supplier and customer become co-producers. Thus, elements such as knowledge, technology, and funding that were previously interacting horizontally, now occur parallel and simultaneously (Etzkowitz, 2008).

According to Etzkowitz there are 10 conditions for knowledge-based firm formation and growth. The conditions are divided into human capital factors, material factors, and organizational factors (2008).

**Human Factors**

1. Scientists and engineers with enough critical mass to form a social network through universities, corporations, and government laboratories in a particular region
2. Research groups in areas that could potentially be commercialized
3. Scientists and engineers interested in forming their own firms

**Material Factors**

1. Seed capital available from public or private sources
2. Appropriate and potentially inexpensive spaces for new firms (incubators)

3. Equipment

Organizational Factors

1. Opportunities for scientists and engineers to learn business skills
2. University policies aimed to encourage faculty and students to interact with industry
3. Research institutes and incubator facilities to assist firms with challenges and problems in the firm-formation process
4. A residential community with resources that can attract people with the skills needed to run the firms

A combination of all of the above does not guarantee the formation of a successful firm while the presence of some may start the process of firm formation and the emergence of other factors may follow after a firm "innovates". Nevertheless, these factors can act as a rough guide for entrepreneurs and scientists alike looking to start their own enterprise.

The formation of new firms based on new scientific and engineering feats allow for innovation to be the focus of the organization (Etzkowitz, 2008). Innovation has evolved to have a focus on product innovation in the firms that has lead to changes in organization and interaction within the players of the triple helix. Cooperation among university, government, and industry can help extend the new product into a new source of economic activity in a region. The collaborative
interaction amongst the three actors also ensures that the conditions exist so the university can become as a source of renewal for existing firms and a source of new knowledge-based ventures that can lead to regional economic activity.

The Role of the Government

In the 21st century, the triple helix model is becoming relevant in many industrialized and industrializing countries even in those societies whose government previously had other ideas about its appropriate role. In “high-state” societies where the interaction between industry, academia, and state has typically been led top-down by the government, bottom-up initiatives are becoming increasingly popular especially with new regions that want to attract knowledge-based capital. In “low-states” societies with a laissez-faire tradition, the role of the government in the triple helix is seen as the emergence of the government as a player in the process of innovation (Etzkowitz, 2008). It is important to note that while there is a clear model of the triple helix and factors that need to be present for its development, the evolution of the model to a triple helix interaction of equally powerful entities (University-State-Industry) varies depending of the starting point of statist or laissez-faire societies (Etzkowitz, 2008). Different state models affect the impact and the visibility of a triple helix alliance and, thus, affect the development process. Regardless, it needs to be recognized that government innovation policies of most states have the common goal of producing knowledge-based economic development as well as social development.
A triple helix under the strict leadership of the government limits innovative ideas. Although these projects may be successful, it does not lead to a healthy triple helix relationship since the ideas come from a single source and are not the product of the interaction of the spheres. To develop sustainable ideas for innovation and implementation, it is imperative that there is input from universities and industry as well as knowledge pouring in from the regional and local level. Also, recent trends have been pointing at indirect and decentralized innovation policies. A decentralized strategy allows for regional differences to be taken into account and for the development of relevant bottom-up strategies (Etzkowitz, 2008).

Through the development of such strategies, the government encourages university and industry interaction and it plays key role by becoming a public venture capitalist. The government fills gaps left by private venture capitalists or the university entities in charge of firm formation (Etzkowitz, 2008). The enhanced government participation may be unusual from some government such as the US which citizens have typically perceived to be at the margin of industry. The triple helix calls for a more active government role and sees its participation imperative for science-based economic development.

A way governments can become involved in the process is by supporting local universities to work closely with firms whose research interests go hand in hand with the industries the government wants to support and develop in its state or in certain regions. States or regions without technology industries may try to create knowledge-based economic activity by luring in scholars with the promise of funding and grants
(Etzkowitz, 2008). The triple helix gives equal importance to physical infrastructure development of a university as it does to the support of research with potentially future implication for local economic development. A such, the government should continue to support research in the university through programs such as the ones created in postwar US to encourage research at major universities through land, sea, and space grants (Etzkowitz & Webster, 1998). Other structures that could be explored to encourage innovation are public/private partnerships, among others.

To be a player in a fully functional triple helix alliance, the government needs to evolve to become an “innovation state” whose mission is to regenerate the sources of productivity in science and technology by encouraging science-related research and industry. Following this, Etzkowitz (2008) further puts forth basic precepts of an “innovation state” so that the state can transform traditional functions into ones that promote innovation.

1. Private capital receives government guarantees that, with its backing and insurance, it may invest in new, riskier ventures

2. Research and development (R&D) tax credits and reduced capital gains taxes are made available

3. The government established new agencies to promote innovation

4. Establish special rights for universities such as patents for intellectual property product of state-funded research to encourage universities to become involved in technology transfer and innovation

5. Create a linear model of innovation using public venture capital funding
Although traditionally the role of government in innovation has been marginal, it is impossible to develop successful university-industry relations without considering the government (Etzkowitz, 2008). Nevertheless, there needs to be a balance in the government’s power as too much power limits innovation and too little does not lead to the fulfillment of the innovation state. The triple helix model seeks to find this balance by providing for quasi-governance models in which the three spheres create and implement innovation policy initiative (Etzkowitz, 2008).

Knowledge, Consensus, and Innovation Spaces for Regional Knowledge-Based Economic Development

Etzkowitz conceptualizes the triple helix as a “series of knowledge, consensus, and ‘innovation’ spaces” that become the building blocks for regions to overcome “the barriers to regional development inherent in national boundaries” (2005). These regions are a product of university-industry-government collaboration that seeks to promote regional renewal. The knowledge, consensus, and innovation spaces replace the traditional regions which were based on natural features like the New York harbor or the Tennessee Valley watershed.

To create a successful knowledge space, a concentration of R&D activities in related fields must be in place (Etzkowitz, 2008). The critical mass of research is often considered imperative for science and innovation-based regional economic development.
The concept of “knowledge space” was first used by Profesor Rosalba Casas at UNAM to describe the decentralization of research institutes from Mexico City to other regions after a 1985 earthquake (Etzkowitz, 2002). After the earthquake, the research laboratories moved other regions, incorporated themselves into the new territory, and a new phenomenon took place: the researchers began to think how to apply their research to solve local problems (Casas et.al. 2000). As more research institutes move to the area, the opportunity to create a knowledge space to create, develop, and transfer ideas becomes possible. The knowledge space makes the location of research relevant and gives research immense economic power. Before, the location of research centers was irrelevant as research was seen as an activity whose primary goal was to publish papers that were available to everyone. Recently, as the economic implications (firm creation, patents) of research have gained importance, the location of research institutions has become a political issue with regional relevance (Etzkowitz, 2005). Regions wish to attract these institutions because they provide an opportunity to create long-term regional economic development.

The consensus space is a neutral ground in which people from different backgrounds, be it academic, public or private, can come together to generate, gain acceptability and support new ideas to, ideally, promote regional economic and social development (Etzkowitz, 2008). One example of such consensus space is local joint venture and venture capital associations that sponsor brainstorming sessions. Such exchange of ideas from actors of different sectors allows the transformation of a
knowledge space from a potential to an actual source of regional economic development.

One of the main challenges of the consensus space is attracting representatives from the different spheres (government, academia, and industry) that enjoy credibility and decision-making power in their fields to “not only formulate a viable plan but to carry it forward” (Etzkowitz, 2008). Another debate that arises in consensus space discussions is whether the vision for a certain project should be short or long term. One example is, should a project be incorporated into an already existing enterprise or should it be developed further so that it can potentially be the backbone for a new firm? (Etzkowitz, 2008). The answer varies depending on the case and is often found in the balance between projects of different dimensions.

The innovation space is where the plans outlined in the consensus space are carried out. Etzkowitz describes it was a “dual set of ladders with crossbars between them” (2008). One ladder represents the a linear model of innovation starting from research, the other is innovation resulting from societal needs, and the crossbars represent specific innovation mechanisms such as incubators, research centers, and science parks (Stankiewicz, 1998; Etzkowitz, 2008). The interactions in this space may result in the creation of new organizational mechanisms to jumpstart knowledge-based regional economic development such as a venture capital firm or an existent organization or political instrument may be adapted.

Although the process for science-based economic growth calls for certain elements to be present, replicating mechanisms that have been successful in one place
does not imply automatic success. For example, a region that lacks a knowledge base may construct a science park expecting high-tech companies to move in even though the region is not attractive to the firms in the first place because of the lack of an established knowledge base that the firms can tap into (Etzkowitz and Webster, 1998; Etzkowitz, 2008). The innovation space allows for involved parties to make a strengths and weaknesses analysis of the region and to develop an appropriate development strategy plan.

Although in the way described above the spaces seem to constitute a linear process, the spaces were originally conceived to be nonlinear. They can be created in any order with one of them used as the basis for the creation of the next. Table 1.1 outlines each of their spaces and their characteristics and Figure 1.4 on page 12 illustrates the link between the paradigms behind the triple helix, the actual model, and the intended outcome of regional economic growth.

<table>
<thead>
<tr>
<th>Stage of development</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creation of a knowledge space</td>
<td>Focus on “regional innovation environments” where different actors work to improve local conditions for innovation by concentrating related R&amp;D activities and other relevant operations</td>
</tr>
<tr>
<td>Creation of a convivial space</td>
<td>Ideas and strategies are generated in a “triple helix” of multiple reciprocal relationships among institutional sectors (academic, public, private)</td>
</tr>
<tr>
<td>Creation of an innovation space</td>
<td>Attempts at realizing the goals articulated in the previous phase: establishing and/or attracting public and private venture capital (combination of capital, technical knowledge and business knowledge) is central</td>
</tr>
</tbody>
</table>

Table 1.1 Characteristics of Triple Helix Spaces (Etzkowitz, 2002)
Knowledge Capitalization and Regional Innovation

The main goal of the triple helix model is to integrate players to forge an alliance that can successfully encourage research, produce innovation, and capitalize from it. The conditions for economic growth based on innovation and technological activity have been identified and specific measures can be taken to ensure that it occurs. Although the process outlined by the triple helix may seem strange since it is lead neither by industry or the government, it takes into account new synergies that have been observed among the spheres. In the triple helix, science-based development arises from research firms or universities and is coupled with either industry, government or both to, potentially, commercialize the product. As the process progresses, new topics such as an educated workforce, funding, and infrastructure, may be added to the mix to promote a broader conversation for regional development (Etzkowitz, 2008).

The key strategy for sustainable regional economic growth is firm-formation rather than attracting existing firms. Regions such as Silicon Valley and Route 128 in Massachusetts are good examples of this (Saxenian, 1994). These regions are known for firm-formation fostered by the proximity to university and research centers. After a region has critical mass of technology firms, it is able to participate in a self renewal process that transcends specific technologies. An important criterion for a successful knowledge-based region is “the ability to move from one technological paradigm to another without a gap” (Etzkowitz, 2008). Once an ecosystem that supports innovation and firm-formation is in place, it becomes the driving force of the
creation and attraction of new business and technologies to the region that can adapt to change (Saxenian, 1994).

**The Triple Helix Era: an endless transition**

The triple helix model aims at describing the evolving relationship between science, industry, and government to create innovation. The model hopes to evolve as organizational models for innovation are reinvented and the role of region is reexamined as well as the individual roles and interaction of firm, government, and university (Etzkowitz, 2008). The model pushes for indirect and decentralized innovation policies across the spheres as they are more effective in considering regional differences and encouraging bottom-up innovation (Etzkowitz, 2008). The model also proposes new dynamics for knowledge production which include giving knowledge capitalization a prominent role in regional economic development and encouraging an entrepreneurial dynamic within the university. The new trends of knowledge capitalization call for the university to be the regional innovation organizer or the leader of innovation and for the traditional linear paths of entrepreneurship to be challenged. In light of this, Etzkowitz presents policy recommendations for further steps to ensure knowledge capitalization that takes advantage of what the synergies described in the model can bring (2008):

1. *Spread entrepreneurial education throughout the university.* Include entrepreneurial courses in the curriculum of technical and business students and provide the opportunity for the students from different fields to interact.
2. Develop network incubator and incubator firms. Incubator networks can bring together firms to collaborate in projects that they could otherwise not do by themselves. They can also give start-ups an international reach to develop and market their product.

3. Incentivize regional actors to collaborate and cooperate. In larger regions, bigger incentives may be needed to bring triple helix actors together.

4. Create an array of venture capitals. Variety in venture capital agents is essential to the full economic and social development of the region.

5. Develop multiple knowledge bases. Alternative knowledge bases give the region the opportunity to shift from one technology to another when a particular technology becomes obsolete or is temporarily irrelevant.

6. Create an entrepreneurial academic entity. If a region does not have a university interested in the capitalization of knowledge and entrepreneurship, then one must be created.

The evolution of the triple helix model is what Etzkowitz calls "the endless frontier" and the above recommendations are just the first steps in the expansion of that frontier. What is then the end of the evolution and transition of the triple helix for Etzkowitz (2008), the premier scholar of the triple helix? There is no end for him:

Beyond the 'endless frontier' lies a continuous series of experiments on the relationship between science, industry, and government in creating the conditions for future innovation...what is the endpoint of transition?
There is no endpoint: innovation is an endless transition.

(p. 127)

Innovation is a complex process that is bigger than any of the independent spheres. The interaction among university, industry, and government playing their traditional role and each other’s is the model’s basis for creativity that results in a triple helix global system of innovation.
Puerto Rico is an island in the Caribbean that has been an incorporated territory of the United States since 1898. The island's economy transitioned from agriculture to manufacturing in the 1950s. Manufacturing grew to be Puerto Rico's main economic driver thanks to subsidies from the Federal government which came mainly from a law known as Section 936. The law granted US companies exemption from paying federal income tax on profits earned by their Puerto Rican manufacturing subsidiaries. In 1995, Congress approved a 10-year phase out of Section 936 and although investment laws in Puerto Rico have been changed to attract investors, it still has not been enough to offset the impact of losing many pharmaceutical companies which were the main beneficiaries of Section 936. This, coupled with a worldwide economic downturn, and massive government layoffs for budget control, has made unemployment an astonishing 16% on February 2010 (Bureau of Labor Statistics, 2010).

Given this, Puerto Rico has long sought to reinvent its economy. It is impossible to be a true player in the 21st century's economy without integrating technology. In 2002, the Center for the New Economy (CNE), a Brookings Institution affiliated Puerto Rican non-partisan think tank, published a paper titled *Silicon Reef: Puerto Rico’s Path towards the Digital Economy* that discussed Puerto Rico's
potential to develop an economy based on high technology\(^1\). The background for the paper is a conference that was held to discuss the topic and concluded with pledge of cooperation from the private and public sectors to develop the technology sector of the economy. Although the paper is eight years old, its findings still describe the struggles faced with developing a knowledge-based economy in Puerto Rico and its recommendations are still relevant today.

**Brief Industrial History of Puerto Rico and Current Situation**

Puerto Rico was discovered by Columbus on his second trip in 1493. From 1493 until the Spanish American War of 1898, Puerto Rico was a Spanish colony. Puerto Rico was “obtained” by the US from Spain under the Treaty of Paris as a spoil of war to compensate for damages suffered (Dietz, 1986). From the early period of American control until the 1940s Puerto Rico was an agrarian society that exported coffee in the earlier years and then sugar.

The middle of the twentieth century proved to be a definitive time in Puerto Rican history. In 1952, Puerto Rico became a commonwealth of the United States, El Estado Libre Asociado de Puerto Rico, and was experiencing rapid industrialization. The island’s economy experienced drastic changes in the first three decades of the century as the economy changed from subsistence farming to complete dominance of the sugar cane industry in the coasts and then to manufacturing. The shift from an

\(^1\) High tech industries include but are not limited to telecommunications, internet services, software, hardware, and biotechnology rather than in a specific segment of an industry.
agricultural economy to an industrial one and from a rural economy to an urban one was rapid due to the efforts of Operation Bootstrap (Dietz, 1986).

Section 936 of the Internal Revenue Code, originally section 262 of the Revenue Act of 1921, which granted US corporation tax incentives to operate in US territories, was successful in spurring Puerto Rico’s industrialization and development of infrastructure during the 50s and 60s as well as addressing the rising unemployment and increasing the gross national product (GNP) (Hexner & Jenkings, 1995). However, by the mid 1970s, job creation benefits for the island took a backseat to the US companies’ tax planning and the profits were not being reinvested in the island as was the original idea. The tax incentives to American corporations coupled with the introduction of the Federal minimum wage also put native firms at a strong disadvantage. The lack of native industries and firms able to compete with its American counterparts may help explain the overall lack of entrepreneurial culture in Puerto Rico.

In 1995, Congress approved a 10-year phase-out of the Section 936 tax subsidy grandfathering companies already in Puerto Rico but denying the benefit to newcomers. The program ended completely on December 31, 2005. As a result many pharmaceutical companies left the island. In October 2000, Xavier Romeu, Puerto Rico's then secretary of economic development and commerce, said that Section 936 economic activity would be replaced by an expansion in manufacturing, particularly in high-tech contract manufacturing and R&D (Luxner, 2000). He mentioned multiple US and international companies that had plans to make investments in PR. Ten years
later, Puerto Rico is plagued with high levels of unemployment, a large population living on welfare, and the closing of even more factories. Just like a decade earlier, it is possible to see with a brief visit to the Puerto Rico Industrial Development Company's (PRIDCO) website that it is focusing on attracting foreign companies instead of encouraging local firm formation based on knowledge created at local universities. PRIDCO is a government-owned corporation dedicated to promoting Puerto Rico as an investment destination for companies and industries worldwide and that mission has been unaltered since its inception in the 1950s. Although the initiatives in the case study have received funds from PRIDCO, they are seed funds seen as experimental rather than considerable funds aimed at local firm formation.

As put forth by Etzkowitz (1998), the triple helix is only successful and effective when local firms become the backbone of regional economic development rather than imported firms. Although the interaction between local and foreign firms and their respective innovation systems may give rise to a positive development cycle, mobility of production capital and faulty economic and industrial policies may hamper the development of national economies and may favor the foreign firms to exploit the opportunities that arise through the globalization of the local economy. Given this, PRIDCO should reevaluate its mission to include the fostering of local firm formation through explicit policies to ensure sustainable regional development in Puerto Rico. Table 2.1 presents Puerto Rico's economic indicators as of July 2009.
Table 2.1 Puerto Rico Economic Indicators as of July 2009 (Government Development Bank for Puerto Rico, 2008)

Ten Years of Challenges to Create a Knowledge-Based Economy in Puerto Rico

In 2000, the CNE sponsored a conference to identify the challenges and foster alliances to overcome them, and jumpstart the creation of knowledge-based economy in Puerto Rico. The conference titled “Puerto Rico in the e-economy” was held in August 2002 and brought together opinion leaders from different sectors (public, private). Its goal was to foster “innovative thinking and novel proposals to
grow and develop the local high technology sector” (Lambda-Nieves, 2003). Multiple recommendations came from the conference, some which were incorporated into public policy and others that still need to be addressed in 2010. From that first conference, the CNE saw that it “was evident that any efforts to promote or grow the high technology sector were compromised from the outset due to the lack of collaboration and dialogue between the private and public sector and other non-governmental organizations and business groups” (Lamba-Nieves, 2003).

As a follow-up to this conference, the CNE hosted a second conference in 2002. The main goal and message of this conference was for the participating parties representing the different sectors to understand the importance of building “Team Puerto Rico”, a collaboration network of influential players. This collaboration network is a main pillar of the triple helix and only when all parties have the common goal of innovation will a sustainable regional growth strategy emerge.

After the 2002 conference, the CNE put together a list of challenges and recommendations to encourage the growth of Puerto Rico’s tech economy.

- There is a desire to advance specific initiatives but there seems to be little capability to execute
- Collaboration among spheres seems to be lacking and there are major institutional limitations for advancement
- There have been recent public policy decisions that support the growth of high technology sector. Nevertheless, prominent projects are left in the
shadows when there is a government change or when original seed funding runs out.

- The private sector resists collaborating in many of the initiatives because they feel there is a lack of firm commitment from the public sector and it relies on the dependability of its partner to invest in projects.

- Although the government has committed to facilitating private sector initiatives in the high technology sector, private sector efforts have not been made in a strategic manner and the government is reluctant to provide funds for strategies that have not been well thought out.

- Give a prominent role to universities in the high technology initiatives

- Make the application process for PRIDCO’s seed funding more transparent

The conference discussed topics from infrastructure, education, and entrepreneurship to human capital, but no specific sectors within “high technology” were named to be the most promising for development. The lack of chosen sectors to be focused on as a pillar of the island’s development shows that while the idea of the triple helix is being discussed, there is a gap between the idea and undertaking action.

Although these challenges and recommendations were the product of a conference that was held almost eight years ago, I have included them to help me understand the rate of progress that has occurred from 2002-2010 and whether any
of the recommendations have been addressed through the initiatives I will be using as case studies.

Industry Cluster Approach in Puerto Rico

In 2002, the CNE published another paper titled *Assessing the Industry Cluster Approach to Economic Development: Identifying Challenges to Growing Puerto Rico’s Digital Economy* which discussed high-tech clustering as a strategy to promote regional economic development in the island. At the time, the top 114 metro areas in the US had 67 percent of jobs and 81 percent of all high tech jobs (Center for the New Economy, 2002a). The high concentration of high-tech jobs is an indication of industry clustering, a dominant trend in high-tech industry growth (CNE, 200a). In this discussion, I will be referring to clusters of high-tech industries in general which include telecommunications, internet services, software, hardware, and biotechnology rather than in a specific segment of an industry. Although clusters can emerge organically as it is normal for contributing players to want to be close to each other, there are policies that can help create clusters.

Clustering goes beyond geographic proximity to be described by Dr. Edward Fesser from the University of North Caroline as “a group of business enterprises and non-business organizations for whom membership within the group is an important element of each member firm’s individual competitiveness” (CNE, 2002a). A cluster is characterized by a high degree of interaction, information flow and interdependence among different firms. Clustering can be achieved through industrial
parks and incubators which occur in the triple helix's innovation space. To achieve this, a social infrastructure, or a means of healthy communication must be established and maintained (CNE, 2002a).

While clustering seems like a good approach to market a certain region as a niche for a certain industry, Puerto Rico still needs to address the other triple helix spaces, consensus and knowledge, before being able to fully commit to this regional development strategy: “to make high-tech clustering a viable option for Puerto Rico, economic-development policy makers are challenged to create a skilled workforce, invest in infrastructure for innovation, and improve the quality of life on the island” (CNE, 2002a).

By 2002, PRIDCO had embraced fostering clusters in Puerto Rico. However, for the initiatives to materialize it needed to be coupled with a firm strategy of creating a highly skilled labor force, encouraging and investing in infrastructure projects, and improving the quality of life on the island (CNE, 2002a).
CHAPTER 3. HIGH TECHNOLOGY REGIONAL ECONOMIC DEVELOPMENT IN PUERTO RICO: CASE STUDIES OF PRTEC AND INTECO INITIATIVES

At about the same time the CNE published the papers that were reviewed in Chapter 2, a newly formed initiative called VTEC (later Puerto Rico TechnoEconomic Corridor and VTEC2) was emerging as an incubator facility in Mayagüez, the main city in the western part of the island. The initiative, which celebrated its tenth anniversary in 2009, was born from the private sector's urge to develop a high tech economy in the area taking advantage of the city's University of Puerto Rico-Mayagüez campus (RUM), the island's public university's campus dedicated to engineering and technology. Throughout its ten years of existence, the private sector has been the regional organizer of innovation in this initiative and has, unconsciously, forged triple helix alliances with the government and university. PRTEC focuses in new firm incubation and their current project is the construction of a new science park.

Other initiatives that started six years ago with the same purpose but unrelated to PRTEC are the Eastern Central Technological Initiative (INTECO, Spanish acronym), the Northern Technological Initiative (INTENOR), the Northeast Technological Initiative (INTENE), and the Alliance for the Integral Development of the South (DISUR). The initiatives are the brainchild of the Sistema Universitario Ana G. Méndez, a private university with several campuses across the island. The
university was directly inspired by the Triple Helix Model to create regions around the island to foster economic growth (Salva, personal communication, Jan. 20, 2010). The university collaborates with the government and the private sector to identify and maximize the strengths of a region. Although these initiatives are collectively not specifically aimed at high tech industry, the initiative I will be using as a case study, INTECO, also the oldest, has a particular focus on science and technology.

Looking at PRTEC and INTECO will allow me to compare regional development initiatives led by the private sector and a university, respectively. Also, analyzing their successes and failures to date will allow me to see why a triple helix alliance is or is not adequate and/or possible for Puerto Rico, and to identify challenges and recommendations moving forward.

**Regionalization as a Strategy for Development**

In August 2008, the results of a study commissioned by the Department of Economic Development and Commerce of Puerto Rico (Departamento de Desarrollo Económico y Comercio or DEC) to consulting firm Estudios Técnicos were made public (Díaz, 2008). The results of the study advocated for Puerto Rico’s economic development strategies to be based on regionalization and called to strengthen existing regional economic development initiatives such as PRTEC and INTECO. The study also recommended the island be divided in six regions, five which are already in place (PRTEC, INTENOR, DISUR, INTENE and INTECO) and a sixth to be comprised of San Juan, the capital, and its metro area. The Law of
Autonomous Municipalities of Puerto Rico had to be amended for the non-profit economic development organizations representing the regions to become recognized government structures\textsuperscript{2}.

The secretary of DEC, Bartolomé Gamundi, recognized that for regionalization to be successful it must have full support from municipal and central government, academia, and business (Díaz, 2008).

**Puerto Rico TechnoEconomic Corridor (PRTEC)**

The Puerto Rico TechnoEconomic Corridor (PRTEC) is a non-profit organization committed to innovation, development and commercialization of new technologies. As an organization committed to innovation, PRTEC has created strategic alliances with private companies, government entities, and academia with one purpose in mind: to be partners in prosperity (PRTEC, 2007). The ultimate goal of PRTEC is to transform the western part of Puerto Rico, also known as Porta del Sol (Figure 3.1) into a region that encourages local firm formation and also attracts foreign firms into the area to stimulate economic growth with a focus in innovation and technology. It is important to note that the western region of the island has had a great influx of investments in the past years, especially in infrastructure as part of the

\textsuperscript{2} Law of Autonomous Municipalities of Puerto Rico of 1991 (Ley de Municipios Autónomos del Estado Libre Asociado de Puerto Rico) grants municipalities powers typically reserved for the central government to promote the economic, cultural and social development of its inhabitants. The amendment to allow municipalities to be a part and sponsor nonprofit organizations focused on economic development became Law Number 137 of August 9, 2009.
preparations for the Central American Games to take place in summer 2010 and the
development of the port of Mayagüez. The investments are expected to total over $1 billion. The improvements in infrastructure will add to the appeal of the region to potential investors.

![Map of Puerto Rico with municipalities labeled]

*Figure 3.1 PRTEC region and municipalities (PRTEC, 2007)*

The idea for a technology corridor in the western part of the island was first conceived during the second term of Gov. Pedro Rosselló from 1996-2000. The idea was to bring together the private sector, the government and the RUM to encourage innovation and attract capital to the region (Figure 3.2).
Figure 3.2 PRTEC Conceptual Model (PRTEC, 2009).

PRTEC was founded and incorporated as a non-profit organization in 2001 with a $600,000 grant from PRIDCO. The original seed money ran out in 2005 and PRTEC's funds currently come from PRIDCO (33%), rent from VTEC2 incubator tenants (33%), and from private proposals, proposals to Federal programs, and private sponsors (33%). The current budget for the fiscal year 2009-2010 is $500,000 (N. Perea, personal communication, Dec 30, 2009).

The initiative started as a product of an alliance between the government and RUM and later became a private entity of its own when it was incorporated in 2001. PRTEC currently has three people on its full time staff as well as a board of consultants.
PRTEC has five main objectives (PRTEC, 2010):

- To bring recognition to western Puerto Rico as a center of high-tech excellence
- To create and maintain jobs in the region
- To support the creation of a culture of innovation, research, and development in western Puerto Rico
- To foster an entrepreneurial culture in local society
- To contribute to the quality of life of the region’s residents

There are four main areas that PRTEC focuses on to reach its objectives:

1. Firm Formation and Incubation

PRTEC operates the only high tech business incubator in Puerto Rico known as VITEC2. The incubator focuses on helping tenant enterprises in the commercialization of their products and technologies. It provides the new enterprises with expert advice, facilities, access to seed funds, and the necessary infrastructure to launch their products (PRTEC, 2010).

VTEC was originally an initiative led by the RUM but after bureaucracy and lack of interest failed to launch the initiative, PRTEC took over its administration in 2003 and renamed it VTEC2 (N. Perea, personal communication, Dec 30, 2009). VTEC2 is currently its own corporation and is PRTEC’s main initiative. It has a 22,000 ft² building in Mayagüez that PRIDCO loans to VTEC2 and PRTEC. Due to the economic crisis, the incubator has not had as many funds as it previously has had.
and occupancy is at 40 percent down from 2007 when the facility had 100 percent occupancy with 14 high-tech tenants (PRTEC, 2007). The space is rented at $9/ft², well below the market rate, and the spaces can be customized to fit the clients’ needs (N. Perea, personal communication, Jan 12, 2010).

The success rate of the firms and ideas that pass through VTEC2 is very high at about 97 percent although this may be a result the criteria to enter the incubator in the first place as only firms with true potential are selected. Nelson Perea, the executive director of PRTEC, said that in the seven years that VTEC2 has been running (from 2003 to 2010) there have 15 new firms formed of which 5 are running independently after having “graduated” the incubation program. Alumni companies include:

- Crawlability, developers of a search engine optimization software
- Medirec, developers of an electronic medical record software
- Renewable Solutions, a company that develops renewable energy and energy efficiency solutions
- Rebexa, pharma and medical device registration outsourcing providers

Current tenants include Caribbean Thermal, Caribbean Bio Technologies, Entevia, Mutual Link, and Phidelix Technologies among others (PRTEC, 2009).

To attract new tenants to the incubator, VTEC2 has been running a local contest called Innovación Empresarial sponsored by the Chamber of Commerce of the West (N. Perea, personal communication, Dec 30, 2009). It invites contestants to submit projects in the following categories: informatics, biosciences, renewable
energy, tourism, and agro industries (PRTEC, 2009). In 2009, they received 40 entries of which about 50% were projects from RUM students. The winner of this competition goes on to represent the western part of the island in Enterprize, a national entrepreneurship competition sponsored by Grupo Guayacán, a not-for-profit organization dedicated to fostering and developing a vibrant market for private equity in Puerto Rico (Grupo Guayacán, 2010). Seven of the top three projects in the past five years have been the representatives from the west and six have been VTEC2 tenants (N. Perea, personal communication, Dec 30, 2009).

The services that VTEC2 provides its tenants include support during the pre-incubating period, creating a master business plan, guaranteed initial funding, virtual incubation, aid in funding proposals, evaluation of the progress, marketing, and, ultimately, finding a permanent space for the company after the incubation period is over. Incubation period is usually two to three years although given the slow economy, this period may be lengthened.

PRTEC also looks to expand its incubation efforts to include a Municipal Incubator Network (PRTEC, 2009). The network will be comprised of mixed-use incubators in the towns or municipalities in the western region. The incubators will be housed in unused PRIDCO facilities and will rely on funds from Economic Development Administration (EDA) and other Federal and State Agencies. The lessons learned from VTEC2 will be used to complement the Municipal Business Development Programs (PRTEC, 2009). PRTEC will act as the program manager and will deploy entrepreneurial and business development activities.
2. Industrial Clustering

An interesting unexpected byproduct of the incubator was that the space has not only served to foster local firm formation but the space has played an important role in attracting foreign firms to relocate in the area. After the September 11 attacks, many US companies were looking to relocate to avoid potential production halts that further attacks could bring. In 2003, a joint venture between aerospace giant Pratt & Whitney and Indian company Infotech was looking at Puerto Rico as a potential place to establish a plant but they needed a space of about 2,000 ft\(^2\), much smaller than any of the buildings PRIDCO was able to offer. PRIDCO contacted PRTEC and they were able to offer the smaller space at their VTEC2 facilities. The joint venture’s Puerto Rico offices grew from 16 employees and 2,000 ft\(^2\) to 100 employees and 5,000 ft\(^2\) in a year (N. Perea, personal communication, Dec 30, 2009). In 2004, the firm moved permanently to Isabela, a nearby town that is part of Porta del Sol. They are currently the tenants of a 40,000 ft\(^2\) facility owned by PRIDCO and employ about 600 people which over 90% are Puerto Rican. A spin off consulting firm also created over 300 jobs for the region (N. Perea, personal communication, Dec 30, 2009). The creation of jobs aids helps prevent local talent from leaving the island once they have graduated and also attracts foreign talent that brings fresh ideas to the table.

This joint venture attracted other companies such as Honeywell, Lockheed Martin, General Electric, and Florida Turbines among others which collectively have
created over 2000 new jobs (over 90% are currently held by Puerto Ricans) and has helped create an aerospace industry cluster in the region.

Other clusters that are present in the area include a Medical Devices cluster with companies such as Johnson & Johnson, Edwards Life Sciences, Baxter, Roche, Zimmer, and Medtronic, and a Biotechnology and a Pharmaceutical cluster with Bristol Meyers and Eli Lilly (PRTEC, 2007).

These companies are attracted to the incentives the local government grants to stimulate industrial development. They allow for deductions, lower taxes and benefits that include deferral of US income tax through CFC structure, local corporate tax rate of 2 percent to 7 percent, 2 percent or lower tax rate for pioneer products, training and wage incentives, and PRIDCO incentives including matching funds for Small Business Innovation Research (SBIR) grantees (PRTEC, 2007).

3. Technological Parks-Guanajibo Research & Innovation Park and Las Américas Technology Park

Since 2005, there have been plans to renovate Guanajibo Industrial Park, an existing industrial park. The plan includes renovation of two buildings and the construction of three new buildings in three phases (PRTEC, 2005). EDA funded the master plan which is finished and ready for execution. The park will be renamed Guanajibo Research & Innovation Park (GRIP) to reflect the objective of fostering innovation and technological firm formation and attraction. The park will include R&D laboratories for RUM and lots and spaces to be leased to interested tenants. In
2007, GRIP had over $20 million invested and committed for its initial phase including a new Bioprocess Development & Training Complex and tenants like Bristol Meyers, Honeywell, Lockheed Martin and other local technology startups (PRTEC, 2007). The second phase will involve an investment of $50 million, and the third phase will be approximately $30 million with the completed project having had around $100 million in investments. The project is expected to take 10 years and should be completed by 2018 (Thurston, 2008).

As of January 2010, PRTEC expected to move its offices to a facility in GRIP by the end of 2010 although the total completion of the park is paused due to the current economic situation (N. Perea, personal communication, Jan 12, 2010).

One of the most important and relevant components of GRIP for PRTEC is the Guanajibo Industrial Center. The 11,000 ft² is designed to house landing site projects and to provide permanent space for the companies that have graduated from VTEC2.

Las Américas Technology Park (LATP) is another project that has its two phases completed and ready for marketing as of 2009 (PRTEC, 2009). The park, located in the municipality of Moca, also part of Porta del Sola, is a brand new world class technology park geared towards international projects in Computer & Information Technology and Aerospace. It was possible through a joint public-private collaboration between Hewlett-Packard and PRIDCO. The project involves constructing custom made buildings for its tenants and the tenants’ shared services and common areas will be managed by PRTEC (PRTEC, 2005).
4. Community Outreach

One of the barriers to entrepreneurship that Nelson Perea has noticed is the lack of entrepreneurial and innovation culture in Puerto Rico, especially in the high technology sector (personal communication, Dec 30, 2009). He says that although there have been times where the VTEC2 incubator spaces have been at 100 percent capacity, there is hardly any competition for the spaces and that they would expect many more applications than what they have been receiving for their services and support. As the only high tech incubator in Puerto Rico with graduated companies he would expect a much higher demand for a spot a VTEC2 and he thinks that Puerto Ricans are risk averse and that there are not enough technology-based ideas to call for an considerable growth in VTEC2 facilities and services.

To make an impact in the region's youths, PRTEC along with others3 organizes and sponsors “Tecno Jóvenes”, a community outreach program to teach youth about computers and also about entrepreneurship. They offer computer classes of all levels as well as entrepreneurship workshops and occupational forums on potential job opportunities in the technology sector. As of 2009, the program has served over 200 young people and over 1000 people had attended the entrepreneurial forums. PRTEC also does outreach efforts to the region's community leaders and over 250 leaders have participated in the workshops (PRTEC, 2009).

---

3 Other collaborators include Microsoft, Fundación Comunitaria de Puerto Rico and regional business consortiums.
These four factors have proven to be crucial in growing and developing business and an entrepreneurial culture. From 2002 to 2006, the region attracted over $110 million in external R&D funding, mostly in Federal funds, and generated over 50 patents from RUM, VITEC2 tenants, and other technology companies in the areas (PRTEC, 2007). Another six patents were granted to RUM from 2006 to 2009 (N. Perea, personal communication, Dec 30, 2009).

In just ten years, PRTEC and VITEC2 have been able to make an impact in the western region of the country by fostering an attractive environment that promotes innovation, development, and commercialization in the global economy.

**Iniciativa Tecnológica Centro-Oriental/Eastern Central Technology Initiative (INTECO)**

The Eastern Central Technological Initiative (INTECO) was founded in September 2003 as a non-profit organization. INTECO is the first of five regional initiatives for economic development that is a product of outreach efforts by the Ana G. Méndez University System (SUAGM, Spanish acronym) to the government, academic, and business sector (SUAGM, 2009). SUAGM is the second largest private university system in Puerto Rico and is comprised of three universities – Universidad del Este, Universidad Metropolitana and Universidad del Turabo – plus thirteen off-campus center in Puerto Rico and two in Florida. SUAGM’s enrollment was approximately 40,000 students for the fall 2008 semester (SUAGM, 2009). The
system offers a variety of academic programs towards technical certificates, associate, bachelors and master degrees.

The main goal of SUAGM’s collaboration with government known as INTECO is to promote the socioeconomic development of the central oriental region of Puerto Rico through the commercialization of new technologies and innovative products (SUAGM, 2009). In a January 2010 meeting, Ms. Ivelmar Salva, administrative director of INTECO, stated that INTECO was directly shaped after Etzkowitz’s triple helix model. She provided me with the article *The Triple Helix of University – Industry – Government Implications for Policy and Evaluation* (2002) and stated that the article had been widely used and distributed among the original players that shaped the initiative (I. Salva, personal communication, Jan 12, 2010).

The first known strategic draft for INTECO was commissioned by SUAGM and produced by Estudios Técnicos (2001a), a Puerto Rican consulting firm, in 2001. Professor Criseida Navarro Díaz of University of Puerto Rico’s Graduate School of Planning was part of the Estudios Técnicos staff that produced the draft that ultimately became the first action plan (Estudios Técnicos, 2001b). In a January 2010 meeting, she said was unaware of the triple helix model and was unable to confirm that Etzkowitz’s model was indeed directly referenced when developing INTECO (C. Díaz Navarro, personal communication, Jan 25, 2010). Nevertheless, after reading the master plan, it is possible to identify Etzkowitz’s principles in it even if his work is not directly referenced.
The INTECO region is made up of eight municipalities (Figure 3.3) and its official vision is “to be a multisectoral model known as an instrument of excellence for the continuous socioeconomic transformation of the central oriental region of Puerto Rico to achieve global competitiveness through entrepreneurial innovation and an optimum standard of living for its entire components” (SUAGM, 2009). Municipalities must pay a yearly fee to take advantage of INTECO’s programs and all of the region’s municipalities participate. For the past years, however, it has been difficult to collect the fees of some municipalities because of political tensions of those municipalities’ leadership with that of the mayor of Caguas, the main city in the region and the municipality with the most investments in INTECO. The participation in INTECO, however, has not been suspended for lack of pay and INTECO is currently working on a more effective fee collection system.

Figure 3.3 Map of INTECO region and municipalities (SUAGM, 2009)
There are six strategic projects INTECO pursues to achieve its goals:

1. *Workforce Innovation in Regional Economic Development (WIRED)*

In March 2007, the US Department of Labor and the Federal Administration for Training and Employment granted INTECO $5 million in H1-B funds to be used during a three year period to develop the Workforce Innovation in Regional Economic Development (WIRED). The program is “an innovative initiative to promote the development of human talent as the main motor of economic development and regional prosperity” (SUAGM, 2009). The main goals of WIRED are:

- Retain and retrain people currently employed in the central oriental region
- Educate the future labor force in the areas of science, technology, engineering, and mathematics
- Build an ecosystem of enterprising technologies

Around 2000 people have already taken advantage of WIRED by participating in their employment workshops and technology forums and 5000 people are expected to have been reached by the summer of 2010 where the original three-year phase of the program will be completed (I. Salva, personal communication, Jan 12, 2010). WIRED funds have been used to help people pay for tuition for any of SUAGM’s 63 courses related to Science, Technology, Engineering and Math (STEM) fields. WIRED also hosts a summer camp for the region’s youth that focuses on science and technology. Firms such as Amgen have collaborated by offering their facilities to host some of the camp’s sessions.
As of June 15, 2009, 1,123 participants had been granted a computer skill certificate thanks to the classes and educational vouchers provided by WIRED.

2. Incubation and Innovation Center (INOVA)

INOVA is an incubator whose main objective is to help develop human potential and the resources to facilitate the process of creating, transferring, and commercializing new technologies and the expansion of local and foreign companies. The incubator currently has two locations in Humacao (opened 2007) and Caguas (opened 2008) with a total of 75,000 ft² available. Specific tenant information was not available in my meeting with Ms. Salva but she did mention that firm failure had been more common than they would have hoped for.

3. Technological Innovation Centers

The Technological Innovation Centers (CIT, Spanish acronym) were created to offer the citizens of the central oriental region spaces to close the gap and foster the interest in science, technology, math and engineering. The centers are located in the municipalities of Caguas, Juncos and Cayey with others planned for Humacao and Gurabo. The goal is to create an entrepreneurial culture guided by innovation. As of 2009, more than 450 teens had participated of the “SmartTeens” programs and more than 350 in “Foamship” since the program started six years before (INTECO, Brochure). Also, more than 50,000 had used CIT’s network services such as access to the internet, workshops, and study areas.
In October 2009, INTECO’s CITs received $440,990 from Microsoft as part of the company’s Unlimited Potential/Potencial Ilimitado program (Primera Hora, 2009). The donation was to be used to install Windows 7 on the centers’ computers and to expand the training curriculum. Since 2004, Microsoft has been INTECO’s strategic partner to reduce the digital gap and to train low income youth and adults about technology (Primera Hora, 2009). The Unlimited Potential program is carried out via the CITs which offer everything from basic computer training to advanced business applications. The initiative has a strong focus on entrepreneurship and encourages self employment.

4. Secondary School Specialized in Science, Mathematics and Technology

The Secondary School Specialized in Science, Mathematics and Technology (CIMATEC, Spanish acronym) received its first eighty students in August 2008. The school runs from 7th until 12th grade and only receives students from the INTECO region. The cost to build the school was $5.3 million of which the Autonomous Municipality of Caguas contributed 75 percent and PRIDCO the remaining 25 percent. Half of the student body is composed Caguas residents and the remaining half come from the region’s other municipalities. Each municipality sponsors its students and pays for most of their tuition. INTECO administers the school and although the specific terms were not researched in depth, Ms. Salva said that the CIMATEC is not considered a charter school because of INTECO’s status as a

---

4 Escuela de Ciencias, Matemáticas y Tecnología
nonprofit organization (I. Salva, personal communication, Jan 12, 2010). CIMATEC’s student body is expected to grow to 500 by 2013 and the school hopes to become one of Puerto Rico’s only magnet schools (INTECO, 2008).

5. Science and Technology Center of the Caribbean

The Centro Criollo de Ciencia y Tecnología (C3Tec) is a tool to make people aware of the vital relationship between science, technology and their own quality of life (SUAGM, 2009). Construction for C3Tec started in October 2008 with a $13 million budget and INTECO is expected to administer it once completed. Although completion was expected by December 2009, it was pushed back to 2011 (I. Salva, personal communication, Jan 12, 2010). The center’s design was designated “green” by the US Green Building Council and it hopes to become one of Puerto Rico’s emblematic structures. The center will include an interactive Museum of Science as well as a concert hall.

6. Puerto Rico Energy Center (PREC)

The Puerto Rico Energy Center (PREC) is a research and development center located in the Universtiy of Turabo campus. It hopes to join government, industry and academia under the INTECO banner to develop projects that focus on alternative energy. The center was expected to be inaugurated in March 2010 although a quick internet search did not produce any local newspaper articles.
highlighting the event which means the opening was likely pushed back for a later date.

7. Other projects

Other projects that INTECO is pursuing in the area include a Regional Office for the Processing of Permits, a Technological Park in Cayey and Tren TODOS.

Puerto Rico is known to have a very difficult permit process for construction and with a $600,000 grant from PRIDCO, INTECO hopes to restructure the process to make it quicker and more transparent. Several legal barriers related to the Law of Autonomous Municipalities had halted the program as of January 2010 (I. Salva, personal communication, Jan 12, 2010).

The Cayey Technological Park (PTC, Spanish acronym5) will provide the region with a 100 acre facility to house firms whose products are related with innovation and knowledge-based economies. INTECO is a strategic partner that is working to attract private capital to finance the construction and development of the plan. Although in 2008 the PTC’s ground breaking ceremony was expected to occur in 2009, by early 2010 there was little to no private capital committed to project and it seems to be halted indefinitely (I. Salva, personal communication, Jan 12, 2010).

Tren TODOS is a proposed light rail train to connect Caguas to San Juan. In 2007, civil engineering firm Behar & Associates finalized the design at a cost of $8.7 million (INTECO, 2008). A viability study was also completed in 2007 by Estudios

5 Parque Tecnológico de Cayey
Técnicos thanks to a $250,000 grant by PRIDCO (INTECO, 2008). As of 2010, the train’s construction was halted mainly due to the change in government after the 2008 elections (I. Salva, personal communication, Jan 12, 2010).

In 2003, a strategic plan was developed for INTECO’s first five years. As of early 2010, a new strategic plan to follow up on the original had not been produced although Ms. Salva commented that a new strategic plan for the coming years is one of the main issues on INTECO’s agenda (personal communication, Jan 12, 2010). The new strategic plan will surely look to continue with unfinished projects such as the Permits Center, the technological park and the light rail train.

PRTEC and INTECO: a comparative look

Although PRTEC and INTECO are strategies for regional economic development based on technology and innovation there are great differences in their approaches and programmatic initiatives.

1. The creation of the initiatives

The INTECO initiative was developed after careful study of the model that would best suit the initiative’s goals. Ivelmar Salva mentioned that they closely looked at Etzkowitz’s model as an inspiration for the initiative and Estudios Técnicos also produced a feasibility study as well as an action plan for INTECO. The plan was born as a conscious effort from academia and government to foster innovation in the central oriental region of Puerto Rico.
On the other hand, PRTEC is an initiative that although started by government and academia, was developed to what it is today by the private sector via a non-profit organization. The process was more organic and the realization that an alliance between government, academia and the private sector is imperative when creating a knowledge-based economy seemed to have occurred by observation and common sense.

2. Regional Innovation Organizer

Although both INTECO and PRTEC are nonprofit organizations, the forces behind the initiatives are quite different.

PRTEC’s driving force is the private sector and the government through PRIDCO and although there is participation from the region’s municipalities’ mayors their influence is not as extensive as in INTECO. PRTEC is associated with the University of Puerto Rico through the Mayagüez campus. Mayagüez is very well known for its science and engineering curriculum and is, therefore, an ideal partner for PRTEC. The best high school students interested in STEM fields usually receive a spot in RUM and many well-known employers such as NASA and Lockheed Martin recruit there as well as highly regarded universities like MIT and Georgia Tech.

INTECO, on the other hand, is driven by the SUAGM, a private university. Although SUAGM has recently made efforts to transform its university system into one known for its research many still see it as a private "diploma mill" university whose educational merit is consistently questioned. As part of a 2009 decision
regarding a suit brought forth by SUAGM against the Higher Education Council of Puerto Rico\(^6\) (CESPR, Spanish acronym) because, among other issues, the CESPR has adopted new, stricter policies regarding part-time professor appointments which SUAGM said would be detrimental to its financial stability. The Appellate Court dismissed SUAGM’s claim and in its rendered opinion said (Estado Libre Asociado, 2009):

SUAGM with its past and present postures, promotes the detriment of higher education’s quality by giving more weight to the economic analysis [of its organization] than to the quality of education it is imparting. This results in the economic benefit of SUAGM’s employees and the detriment of the services that students receive and that they paid for either with state, federal or personal funds. (p.59)

Although SUAGM is no MIT, its efforts are in line to what my literature review and research has indicated is the norm to promote innovation and the development of a knowledge-based economy. Nevertheless, after talking to Ivelmar Salva of INTECO it was still unclear why SUAGM would undertake such a big initiative and there was no clear link that she could point out between all of the initiatives and SUAGM. Whether economic gain is SUAGM’s motivation is unclear but what is clear is that SUAGM needs to work on its reputation and its quality of education and alumni to ensure that it can truly been seen as a driver of innovation.

\(^6\) Consejo de Educación Superior de Puerto Rico
3. Size and areas of influence of initiative

PRTEC’s main initiative is VTEC2, the technology incubator and all other initiatives are centered on education and attracting firms to the area. Their sphere of influence is extremely local and the projects and budget seems modest when compared to INTECO. INTECO, on the other hand, has much grander projects on its radar such as the CIMATEC school, the C3TEC, and the TODOS train. Their involvement with local politics is also greater and the initiative may also be associated with a for profit scheme due to its association with the SUAGM. Overall, PRTEC seems to be focusing on key projects and goals it wants to complete and INTECO seems to be involved with projects that go beyond incubation and firm formation to also sponsor major transportation projects (TODOS Train) and real estate projects (C3Tec).

4. Age of initiative

PRTEC started in 2001 although the original VTEC has been in operation since 1999. They recently celebrated their ten year anniversary and have much to show for the ten years. They have been able to offer incubation facilities to up-and-coming firms and have also offered support to help the companies “graduate” the incubator and established themselves as bona fide firms. INTECO, on the other hand, started in 2003 and it only recently completed most of the goals stipulated in the original five year plan crafted in 2003. In the five years they have embraced many
large scale programs but its incubator is still in its baby phase, especially when compared to PRTEC’s.

5. Political participation in strategies

Although the government has played a significant role in both strategies, INTECO’s structure allows for more political participation. They charge a fee for the municipalities that want to participate (all of them say they want to participate) and although some pay and others do not, INTECO has not been able to figure out a good system to collect the fee and has not still implemented the strict policy to eliminate all of INTECO’s services to the morose municipalities. This may lead to other tensions between the municipalities that pay and those that do not especially if they are from opposing political parties.

Too much political participation and affiliation to political projects such as the TODOS train is always tricky, especially in Puerto Rico. Tension between the two main parties are never ending and changes in government may also put at risk the completion of some of the projects as has been the case of the light rail train.

Both INTECO and PRTEC have the mission of fostering innovation and entrepreneurship in Puerto Rico. More time is needed to assess both initiatives and identify which is the best university-government-academia participation that is optimal for Puerto Rico and that can overcome political and organizational barriers. Both efforts are producing results but some of the programs of both initiatives need to be solidified so they have enough time to mature and actually have a long time
impact that can create and develop the knowledge base needed to foster firm formation and sustainable economic growth for both the western and the central oriental region.

**Puerto Rico and the Triple Helix: Recommendations and Policy Implications**

Although PRTEC and INTECO are good steps towards Puerto Rico’s path to regionalization and creating a knowledge-based economy, there are policy and cultural changes that need to occur to solidify the role innovation plays in Puerto Rican society and economy to ensure sustainable economic growth based on innovation and technology.

*Develop the other regional initiatives*

INTECO and PRTEC are the more developed and advanced of all of the regional initiatives. INTENOR, INTENE, and DISUR need to be on the radar of their region’s governments to develop them into initiatives than have impact on the local economy. Currently, these initiatives focus on big projects such as Northern Mass Transportation System (INTENOR), development of the area formerly occupied by the Roosevelt Roads Naval Base (INTENE), and Port of the Americas (DISUR). While all of the initiatives include technological parks in the regions, only INTENOR has plans for a business incubator. PRIDCO and the government should reach out with funds for educational programs through the initiatives but the
initiatives need to solidify their goals and mission to include such programs and, ultimately, foster firm formation and entrepreneurship.

**Education and the Labor Force**

In the 2002, CNE working paper *Assessing the Industry Cluster Approach to Economic Development* highlighted the importance of focusing on education and having an educated labor force in the skills needed for a high tech-based economy. That recommendation is still very much relevant on 2010.

For the regional programs and initiatives to be successful, the region must be able to provide a high quality labor force for the high-tech firms. This includes not only higher education but emphasizing math, science, and engineering in grade school curriculums. Unfortunately, Puerto Rico has extremely poor academic performance in the public school system and only 20.8 percent of the population holds a bachelors degree according to the 2005 Puerto Rico Community Survey by the US Census Bureau. The RUM provides excellent training for engineers and scientists but one single institution will not be able to provide training needed to build a skilled labor force in the whole island. Technical and vocational schools focusing on computers and technology could provide support to the university and would train people for jobs needing very specific skills but do not require a college degree.

There also needs to be a focus on teaching English as it is the international language of business and science. Although English is one of Puerto Rico’s official languages, only a small percentage of the population speaks functional English. This
is especially important when attracting foreign firms. Being able to develop and attract high-tech firms will also stop the brain drain that has been occurring in Puerto Rico, as many graduates of the RUM choose to leave for mainland US in search of better opportunities than the ones Puerto Rico can offer.

Infrastructure

All of the regional initiatives have plans for technology parks to house foreign firms looking to settle in Puerto Rico and also local firms. While the plans seem promising some of the technology parks with more advance construction such as Guanajibo still have the last phase pending construction and others such as the Cayey Park are still waiting for construction to begin although original plans had it completed by now. These spaces are imperative because they not only provide a physical space for the firms but also promote idea exchanges among tenants. Nevertheless, the buildings can also become a white elephant if the demand for the spaces was wrongfully assessed and tenants to occupy the spaces cannot be found.

Documentation

One of the hardest parts of my research was getting up-to-date information from INTECO and PRTEC's leadership. Since the offices are small, many statistics are not officially recorded, and therefore, many of the information presented here is anecdotal or not very recent. The lack of documentation is not only a challenge for firms trying to establish themselves in the region and want to learn more but also for
the organizations because not having updated documents can hamper their ability to access grants. The government also needs to work to have updated economic statistics available. The access to this information can help local entrepreneurs identify opportunities and allows outsiders to become familiarized with the island and evaluate whether it is a good option to establish their firms there.

Fostering Entrepreneurship

The PRTEC and INTECO have visible community outreach initiatives encouraging computer and technology education as well as entrepreneurship. It is imperative for citizens to feel empowered so they can take the leap to start their own business. Support from the programs to develop business plans and seek grants is very important and incubators is a means to so this for more sophisticated business ideas.

Puerto Rican culture is very averse to entrepreneurship and initiatives like INTECO and PRTEC need to be put in place in all regions to educate citizens in firm formation and the opportunities available for funds from regional, state, and federal government.

Grant Process

The 2003 CNE policy paper *Silicon Reef* mentions the need for a more transparent PRIDCO grant process as well as clearer expectations and criteria for the grants. Also, PRIDCO needs to allocate funds for local firm entrepreneurship. A visit
to their website makes evident that they focus on attracting foreign capital rather than local firm formation. PRIDCO currently has seed funds available for local firms but the process for follow up grants after the seed funds have been used is not so straightforward. Nelson Perea from PRTEC aid that after PRIDCO's original seed funds for the initiatives ran out, they applied for more funds from PRIDCO and currently get about a third of their yearly budget from the government entity.

Focus on Firm Formation

PRTEC and INTECO are encouraging local firm formation with their incubators. To follow with the triple helix's approach to sustainable economic growth based on innovation and technology, firm formation needs to be a priority over attracting foreign capital.

The educational programs are a step in the right direction but much more needs to be available. Continuous support in the incubators for business plan development, marketing, and financing is important. PRTEC incorporates that into its VTEC2 program.

Also, PRIDCO needs to make seed funds for new firms more accessible and provide support for the new entrepreneurs. This calls for a change in PRIDCO's strategy from focusing on attracting foreign capital to creating a more balanced approach to include local firm formation as well.

There are many challenges to transform Puerto Rico into a high-tech mecca. The workforce needs to be better trained, better infrastructure needs to be in place to
sustain high-tech businesses, and the grant process needs to be more transparent. While these are organizational changes, efforts to promote a cultural change towards entrepreneurship are also important. PRTEC and INTECO are initiatives that work towards making Puerto Rico a high tech and knowledge-based economy and while many successes have come from their efforts there are still cultural and organizational barriers that prevent them from reaching their full potential. I believe that revisiting the initiatives once they have had more time to mature and the economic crisis of the past years has stabilized will let us make a better evaluation of the initiatives and will let us better identify programs that are relevant and successful in Puerto Rico.

*A Call for Action*

Although the triple helix is successful in explaining the synergies and relationships that need to be present to foster high-tech innovation, it does not mention mechanisms, governmental or sociological, that need to be in place before the model can become relevant and can be transformed into action.

In the case of Puerto Rico, the triple helix fails to provide a framework for the evolution of policies into action, and fails to provide knowledge on whom or what institution would be an ideal driving figure. In Puerto Rico’s history there are individuals who are seen as the drivers of a specific era of change as is the case of Teodoro Moscoso and Operation Bootstrap and Luis Muñoz Marín and the Commonwealth of Puerto Rico. Today, it is almost impossible to identify figures in current Puerto Rican politics that could have such influence and provoke such change. Then, the question still remains about who or what should take the
leadership position and push for the policies that will foster high technology. In the case of Puerto Rico, the academic sector is not strong enough to take that position and the private sector is too involved with government to be considered a strong candidate to drive change. The government, therefore, becomes the main player without which the policies cannot be developed. In Puerto Rico, PRIDCO and other entities that have been traditionally responsible for defining and promoting development strategies do not possess the tools to promote high-tech ventures nor to provide the necessary inputs. Policies to promote high-tech have, therefore, not been a priority. Who then should take the reins of the process? Some have suggested new institutional actors such as the non partisan CNE as an alternative (Lamba-Nieves, 2002). The institution would be able to propose and develop policy recommendations while avoiding the common political game that colors almost everything in Puerto Rico. The big challenge is for the institution to garner enough visibility, legitimacy, and supporters so it can drive action. If the CNE is able to do this, it can potentially change the policymaking process in Puerto Rico and will be able to ensure continuity of initiatives through political changes.

From INTECO and PRTEC we have learned that while there are efforts to foster entrepreneurship in the high-tech sector, there is still a long way to go to operationalize the hubs of knowledge being created through the initiatives (mostly PRTEC as INTECO’s incubator is still recent). One of the major challenges is the lack of a coherent agenda among all of the initiatives and the process of information sharing. Information sharing may become increasingly difficult to achieve as SUAGM
considers many of their proposals and programs proprietary and decline to share many of it (I. Salva, personal communication, Jan 12, 2010). This is mainly due to a non-collaboration culture, especially in the private sector, and although SUAGM is a nonprofit organization, its board members receive considerable compensation through a university that many see as a diploma mill and more as a business than an educational institution. The CNE with its proposals and policies could become itself an intermediary between the different initiatives and could help with information sharing, monitoring, and developing a collective agenda. Having the CNE as a player ensures the participating institutions that their information is not compromised and that it will not be used in political scheming.

Although institutions like the CNE as proponents of the high-tech economy in Puerto Rico show potential, there are numerous hurdles that prevent the CNE from becoming a visible player in Puerto Rico’s policymaking process. The biggest obstacle is the never ending political ideological battle among Puerto Rico’s parties and for the CNE to be seen as a legitimate institution of influence without being endorsed by a political party. Also, the CNE needs to be delicate to not be seen as a threat to PRIDCO’s traditional influence in economic policy and needs to find a way to make high tech a priority for PRIDCO so that the agency can become a CNE collaborator. In the end, the CNE’s research is influencing Puerto Rico beyond the policies it proposes. Its invitation for collaboration between public and private sectors and between the private sector itself as is the case of PRTEC and INTECO,
is, ultimately, a call for a cultural change towards collaboration than can become the
CNE’s biggest challenge yet.
CHAPTER 4. CONCLUSION AND FURTHER RESEARCH

Transforming Puerto Rico into a high-tech economy will require changes in culture and organizational structure and efforts need to be made by all spheres, academia, industry, and government. Initiatives such as PRTEC and INTECO are working towards making innovation a cornerstone of Puerto Rico’s economy and culture but the initiatives are still too young to assess their long term impact. Although they have been able to make significant progress in some areas, namely firm incubation, it is easy to see the initiatives being abandoned by politicians or simply biting off more than they can chew as seems to be the case on INTECO with very large scale projects while still not being entirely solid in the most modest programs such as the incubator and the technology park. Nevertheless, the fact that these initiatives exist shows that Puerto Rico knows that innovation and technology is the new economy of the future and that it needs to fix certain aspects such as education and infrastructure to become a real player in the high-tech economy.

While both PRTEC and INTECO are based on a collaboration of university, government, and industry spheres, they are still far away from Etzkowitz’s model of an entrepreneurial university that fosters firm formation and with the help of government and industry is able to market a product with the ultimate goal of creating a high-tech region. However, by understanding regionalization is the best strategy and embracing it through the various initiatives, Puerto Rico is on its way to maximize each region’s strengths to ultimately offer their services to the world.
There are several areas of research that one could examine in the future. For instance, it would be useful to revisit INTECO, PRTEC and potentially the other initiatives as well in three to five years to see how they have matured and whether they are closer to achieving a triple helix region. I believe time will let the initiatives to solidify, will allow for a more in depth analysis, and will help us learn from best practices across all the initiatives.

Puerto Rico has a very peculiar political status as a US territory and many have called it the “welfare state”. I would be very insightful to study the extent to which the status and cultural perception of politics could have an impact on the pro-innovation initiatives. Perhaps Puerto Rico’s history and political status could help explain the lack of entrepreneurial culture in the island and could help shape the initiatives to better deal with the phenomenon.

In addition, it would be interesting to compare economies that are similar to Puerto Rico’s but with a different cultural context such as Singapore to see whether regionalization and the triple helix has been embraced there and what can Puerto Rico learn from it. A similar comparison could be done with other technology corridors that aim at creating triple helix regions such as FundaciónChile in Chile and Ciudad del Saber in Panama.

Overall, INTECO and PRTEC are good starting points for Puerto Rico’s transformation into a high-tech economy. However, there are organizational and cultural barriers that have made it difficult for them to jumpstart. If the initiatives are able to overcome the current financial situation and are able to keep the interest of
politicians, and the private and academic sector alike they can truly make an impact on Puerto Rico’s path towards innovation. New institutional actors such as the CNE can become relevant in Puerto Rico’s development of high-tech economic policy and its influence could start to fill a gap in policymaking that the government, academic and private sector could not address alone.
WORKS CITED AND REFERENCED


www.census.gov/acs/www/Area%20Sheets/Area%20Sheet%20PR.doc
H. Etzkowitz, A. Webster & P. Healey (Eds.), Capitalizing Knowledge: The New
Intersections of Industry and Academia (95-110). New York: State University of
New York Press.