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PUERTO RICAN INFORMATION TECHNOLOGY FIRMS' RADIOGRAPHY: EMPIRICAL EVIDENCE

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PUERTO RICAN INFORMATION TECHNOLOGY FIRMS' RADIOGRAPHY: EMPIRICAL EVIDENCE

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Cipshi Authorization:

Determining factors for the success of Puerto Rican INFORMATION SYSTEMS firms (**#1213-178**)**.** Note that the title for the manuscript is similar to the Cipshi title.

Manuscript:

Attached. The manuscript title had to change due its revisions.

TOWARD A CPP MODEL FOR INTERNATIONALIZATION AND FIRM GROWTH

ABSTRACT

This paper seeks to provide insights and evidence about internationalization of Information Technology firms from the United States territory of Puerto Rico. Based on the analysis, we are proposing a new general theoretical model for internationalization and firm growth. Research objectives were set as (i) to examine the radiography of Information Technology firms in Puerto Rico, (ii) to identify the pattern and pace of the internationalization process of the Puerto Rican Information Technology firms with a clustering analysis, and (iii) to introduce a theoretical framework called the CPP (Conservatives, Predictables and Pacemakers) Model. This paper is based on primary data collected from the senior managers of those firms. Statistical analyses conducted included two-step clustering, and probability testing. The CPP Model can be used as a framework for industry analysis as well as in research dealing with the growth and internationalization of firms.

Keywords:

Internationalization, International Expansion, CPP Model, Industry analysis,

Knowledge intensive firms

1. INTRODUCTION

Studying how an industry operates can contribute in added value to the growth of the firm and economy. In that context, this article presents the radiography of the Information Technology sector in Puerto Rico and identifies the pattern and pace of the internationalization process. We also propose a theoretical framework titled CPP Model for analyzing the pattern and pace of internationalization as well as for carrying out the industry analysis, which will, in turn, help the growth of a firm.

The field of information technology (IT) has emerged as one of the fastest growing industries in many countries (Paul and Gupta, 2014). Furthermore, IT has the main characteristics, internationalization and innovation processes, which are required to compete in this period of globalization (Melnikas, 2011). Software and IT firms are mostly knowledge-intensive because those supplies can be replicated at a low marginal cost (López, Kundu, and Ciravegna, 2009). Knowledge-intensive businesses can more easily go global than other types of businesses and this is indeed the case with IT firms. Knowledge-intensive firms are based upon value creation, rather than labor or capital (Kärreman, 2010). IT involves investment of intellectual resources. An IT firm is classified as knowledge-intensive only if it has advanced technology capabilities and a well-educated workforce (Vasilchenko and Morrish, 2011). The IT firms in Puerto Rico, as it is a United States territory, have a close relationship with the IT companies on the mainland and very often collaborate and partner with these firms.

Although we have robust theories, such as the Uppsala Model (Johanson and Vahlne, 1977; 2009), Born Global (Knight and Cavusgil, 1996/2005; Madsen and Servais, 1997) etc., that explain the process of internationalization, we feel the need for a theoretical model that can serve as a benchmark framework for industry analysis as well as internationalization with reference to path, pace process, and pattern. Our intention is to propose a usable framework across the industries simultaneously. Therefore, this study proposes a model based on the data from Information Technology firms in Puerto Rico, a Caribbean island and United States territory, with a population of four million people. This study is based on the primary data collected from 63 firms from Puerto Rico.

The rest of the paper proceeds as follows: The literature review is given in the next section by classifying the theories and approaches on internationalization as well as the studies on firm growth and industry analysis. Research objectives are specified in section 3 and methodology employed in this study is elaborated upon in section 4. Findings are reported in section 5. Insights from the radiography analysis and cluster analysis are summarized and a framework titled CPP (Conservatives, Predictables and Pacemakers) model has been introduced in section 6. The conclusions and limitations of the study are reported in Section 7 and 8, respectively.

2. LITERATURE REVIEW

This section is divided into two sub-sections. i). Theories and Approaches on Internationalization and ii). Studies related to Firm growth and Industry Analysis.

2.1 Theories And Approaches On Internationalization

When discussing the internationalization of IT firms it is important to differentiate between born-global firms and gradually internationalized firms. The born-global firm, according to the Knight, Madsen, and Servais (2004) definition, is a firm that internationalizes, on average, within three years of founding and generates at least 25% of total sales from abroad. On the other hand, the Uppsala theory, according to Johanson and Vahlne (1977, 2009), deals with the gradual internationalization process of a firm. This type of firm would gradually enter into foreign markets outside of the primary market as it overcomes the psychic distance. The psychic distance, according to the Johanson and Vahlne (2009) definition, is the market remoteness of the firm exports. It is the effect of the liability of foreignness. A lack of knowledge about the language, laws, and rules of a foreign country increases the psychic distance, which influences the decision of whether or not to conduct business and relationships in that foreign location. They explain that, traditionally, firms start to internationalize in neighboring markets and subsequently move further away in terms of the psychic distance. To overcome the psychic distance, firms establish themselves in foreign markets using low-commitment modes such as a middleman and eventually subsidiaries.

The Uppsala proponents assume developing knowledge, with the experience in its current activities or operations, is fundamental to a firm's internationalization. That experience is gained progressively; in stages. A firm gains familiarity about foreign markets regarding business environments, laws, rules, languages, etc

gradually. Also, Johanson and Vahlne (2009) show the importance of business networks or partnerships in the internationalization process.

The hard reality of distance, discussed in the form of CAGE Theory by Ghemawat (2001), is an important aspect to take into account when considering internationalization. The distance between two countries relies on factors such as cultural, administrative, geographical, and economic (CAGE). Ghemawat argues that most firms enter into foreign markets that have less distance in terms of CAGE factors.

Kuivalainen, Sundqvist, and Servais (2007) discuss the entrepreneurial orientation towards internationalization. They explain that the likelihood of risk taking was higher among born international firms than among other types of firms. The management of these born international firms has a firm understanding of the environment in which they operate.. The employees of these firms also have mastered the skills and capabilities necessary for sustaining their competitive advantage. Conversely, it was found that born global firms are satisfied with their current market scope and are not proactively seeking new opportunities. They state that there are many potential benefits for a firm following the born global path to internationalization including increased sales, profits, and market presence. Also, their study differentiates between the true born global and the born international firms. They argue that the true born global firms perform better than the born international firms in terms of sales, profit, and sales efficiency.

Internationalization helps improve the performance of small firms and in turn facilitates firm growth (Lu & Beamish, 2001). Lu and Beamish (2004) also draw

the S-curve hypothesis showing the relationship between international diversification and firm performance. Using data on 1,489 Japanese firms, they report a consistent S-shaped relationship between multi-nationality and performance. Another notable point is that Small Knowledge Intensive Firms (SKIF) have unique characteristics in their internationalization process (Zucchella and Kabbara, 2013). Those types of firms go international in a series of phases characterized by triggering factors such as partnerships, alliances, networking, entrepreneurship, value-creating events, performance, and distribution. The partnership factor was found to be the most important trigger. Partnerships can be between the firm and it's customers, distributors, and knowledge providers, and determines the process timing, pace, pattern, and scope. Collaborations are critical in the knowledge and research-intensive industries.

Inter-organizational networks are important for innovation and internationalization, in the context of small, knowledge intensive firms (Jenssen and Nybakk, 2013). The development of networking skill is key for success. Through cooperation, those firms can gain exposure to new ideas by concentrating on their core expertise and enhance ways of conducting their business. They found that that a firm's size and intensity of knowledge will positively influence network development. As for competitive networks, the authors explain, there are two components, (i) a group of organizations with close relationships that are characterized by strong, long-term bonds, (ii) and a high degree of redundancy/density, and a large group of organizations that are characterized by

relatively weak relationships and a comparatively low degree of redundancy/density.

The knowledge-intensive firm, according to Kärreman (2010), is a firm whose competitive advantage is creating value by applying superior knowledge and judgment. Ruiner, Wilkens, and Kupper (2013) carried out a pattern analysis of the knowledge intensive firm's information technology related workforce in Germany. Their findings suggest that organizational flexibility is important due to the market dynamics. This type of organization often must contend with entrepreneurial thinking and acting employees as knowledge intensive firms often have a self-employed workforce. Organizational flexibility consists of the allocation of expertise. Organizations aim for a long-term relationship with their workforce. Knowledge intensive firms' workforces perform closely intertwined tasks in which distinctions may be difficult to identify. The perspectives of these employees have a direct effect on the organization's growth and internationalization. Autio, Sapienza and Almeida (2000) employed knowledge-based theory to cast light on the international growth of a firm and found that earlier initiation of internationalization and greater knowledge intensity are associated with faster international growth.

The importance of the IT sector internationalization studies can be seen in three studies (Lopez, Kunde, and Ciravejna, 2009; Vasilchenko and Morrish, 2011; Paul and Gupta, 2014) that have been published in the recent years. López, Kundu, and Ciravegna (2009) conducted a study based on 40 Costa Rican software firms selected from 150 listed software companies in Costa Rica. They argue that the

sample is adequate in proportion to the number of companies operating at the time their study was undertaken. They interviewed each of the companies in their sample to find out the firm size, the firm age, and the export experience. The firm size is obtained by dividing total sales by the number of employees. The firm age is the firm's foundation year minus the year in which the study was conducted. The export experience is the number of years the firm had been exporting. Their findings show that Costa Rican firms took an average of four years from their founding to start exporting and that firms do not export on a regular basis. The authors show that Costa Rican firms are born-locals meaning that firms were not born with an export orientation, and that less than 40% of their customers are foreign. For Costa Rican companies, the markets with close psychic distance are the Latin American markets. They argue that this study is one of the few studies conducted about the internationalization and the born-global phenomenon in small, developing countries. Their recommendations are to give incentives to knowledge-intensive industries, such as software firms, to increase their exporting capabilities. They also call for conducting an in-depth analysis of the modes and determinants of internationalization.

Vasilchenko and Morrish (2011) conduct a qualitative study in which the authors interview the founder/entrepreneur (responsible person) for the decisions related to internationalization of the firm. They analyze four New Zealand companies and their findings indicate that most New Zealand IT firms operate domestically. Their study focuses on how business contact and social networks facilitate the New Zealand IT firms internationalization process and presents

interesting ideas on the exploration of internationalization opportunities. Moreover, the role of social networks often allows to the subsequent establishment of business relationships that can facilitate internationalization.

Paul and Gupta (2014) studied the internationalization process of 19 leading IT firms from India. They selected the sample based on the total revenue generated by the firms. The study presents how the IT sector played a major role in the country's economy during the last two decades. Their findings reveal that firm age has no relationship with internationalization. In addition to this finding, their study shows that Indian IT firms do not qualify as born-global since they have taken more time to go global. Paul and Gupta (2014) follow the Knight, Madsen, and Servais (2004) born-global definition and conclude that internationalization can be considered an in which knowledge and learning are critical to succeed in the international markets. They conclude that the younger the firm is, the higher the possibility of expansion to the international markets. They also report that firms tend to go through stages of resource accumulation and engaging in different markets after gaining some experience. In short, their study is useful for describing the process of internationalization in the knowledge-oriented industries, regardless of their country of origin.

Our study derives inspiration from two other notable works (López, Kundu, and Ciravegna, 2009; Paul and Gupta, 2014). They analyzed the process of internationalization in respective countries whereas we focus on the pattern and pace of internationalization. Besides, we extend and go one step further with developing a theoretical model as a framework for analyzing the growth of an

industry and internationalization as well as analyzing the path, process, pace, and pattern of internationalization of 63 firms from Puerto Rico in the form of Radiography and theoretical model.

2.2 Studies Related To Firm Growth And Industry Analysis

In this section, we present a brief overview of some of the prior research focusing on industry analysis and firm growth. We do this in order to examine the scope of carrying out industry analysis and to find the gaps in the literature for a new framework.

T software industry, in general, is leaning towards dedicating more emphasis on services (Suarez, Cusumano, and Kahl, 2013). However, it was found that companies focusing on products tend to have higher profitability than those companies which rely heavily on services. The authors recognized that only some companies, such as Microsoft and Adobe, are successful in product development. Other companies must focus on the relationship and dynamics between the product and its services. In this case the term services refers to business applications, business intelligence modules, customization, integration, and training. Services allow the company to communicate with its customers to determine their needs as well as to transfer useful product knowledge to the customer.

The information processing industry in Jamaica has progressed slowly over the years (Shirley, 1998). There are currently 49 companies involved in exporting data processing services from Jamaica. The types of services included are data entry, telemarketing, geographic information services, sales, training, and marketing. Some of the companies are locally owned while others are foreign-owned. Most of the

companies are dedicated to data entry, data processing, and data manipulation. Recognizing this trend, the Jamaican government has established incentives, telecommunications infrastructure, and marketing support to an export-driven data processing sector by attracting firms to set up operations in Jamaica. These attractions, as well as the availability of a large pool of trainable workers, have attracted.companies from United States, India, the Philippines, Ireland, and Mexico to establish operations in Jamaica. The competitiveness of the Jamaican information-processing sector relies on low labor rates, rapid transportation to United States, quality of the telecommunication system, cultural and linguistic similarities with large markets, and a time zone similar to the United States. The factors against doing business in Jamaica, according to the authors, are the high cost of marketing, and the internet cost.

The construction industry in Iraq is highly dynamic and shows technological advances such as (Akhlagh, Moradi, Mehdizade, and Ahmadi, 2013). That industry is characterized by high rate of product and process innovation. The authors explain innovation strategy and performance diversity for the construction industry. They found that factors such as aggressive, analyzer, futuristic, proactive, risk taking, and defensive strategies have great influence on innovation and performance. Proactivity was found as the most important factor for innovation. Analyzer strategy was found important for performance development. Their results showed the risk-taking strategy as an insignificant factor. However, innovation does involve risk as it consists of applying something inherently new and different. Finally, defensiveness was found to have no significant effect on either innovation or performance. The

authors believe successful innovation strategy must be based on knowledge and facts, supplemented by creativity.

Frattini, Dell'Era, and Rangone (2013) analyzed the mobile value-added service industry in Italy in the context of innovation as well as advertising. They explain that innovation has to be sustained with corporate advertising. Their study focuses on the mobile technology industry, which offers services such as mobile voice and fax transmissions. Also, corporate advertising has a strong association with early market survival. The authors advise investment in service advertising are to be considered when innovation services are offered. Investment in corporate advertising increases potential adopters of the new service.

The South Africa pharmaceutical industry has undergone many dynamics and changes, as Naudé and Luiz (2013) explain. The pharmaceutical sector is more a knowledge intensive industry because of the high skills that are required for research, development, and production. They suggest that the South African pharmaceutical industry needs to be consolidated with the global generic medicine demands. The uncertainty and unpredictability in the pharmaceutical regulations need to be improved. There must be more incentives for innovative-patented medicines than for generics in the local pharmaceutical sector. They also call for the government and industry to communicate and work together cooperatively as a strategic step towards achieving their objectives. Based on the industry analysis, the researchers concluded that the establishment of Public Private Partnerships between local companies and government could be a solution for reducing prices and increasing access to medicine in South Africa.

Nag, Han, and Yao (2014) identified patterns in the United States manufacturing industry based on levels of raw material and inventory of finished goods to determine appropriate strategies. They classified industries based on average levels of raw materials and finished goods. Their findings show that the level of inventories depends on the type of products, processes, and dynamics managed. The term "dynamics" refers to the relationships with suppliers, customers, and treats of substitutes and new entrants.

Rajasekar and Raee (2013) used Michael Porter's five forces model as a framework to analyze Oman's telecommunication industry's competitive structure. Oman's telecommunication industry is a dynamic one comprised of big national and regional operators. As deregulation and innovation rise, many new competitors arrive. Those new competitors, who once were government monopolies, confront high treat entering the market. Those treats include customer switching cost, capital requirements, unequal access to distribution channels, and restrictive government policy. The authors advise that it is crucial that the government establishes full deregulation of the market for Oman to achieve significant growth on the Information and Communication Telecommunication Development Index. Similarly, Dobbs (2014) presents guidelines to applying Porter's five forces framework for industry analysis. The set of industry analysis templates included in this study consists of a visually compelling, user-friendly format to assist those analyzing industries from the strategic and competitive advantage points of view. Jedlicka and Jumah (2006) analyzed the insurance industry in Austria using the industry structure, firm conduct, and market performance approach. As for industry

structure, the authors explain, Austria has many insurance companies and each accounts for a relatively low market share. As for firm conduct, those companies' average profitability is the same for the whole market. As for market performance, life insurance industry profit rates were found to be very low. The market performance suggests Austrian life insurance industry is mature with characteristics close to perfect competition.

In a nutshell, we find that industry analysts help the firms to take intelligent entry and exist decisions in domestic, as well as international markets. Last, but not least, we find that regulatory entities and policy makers responsible for monitoring competition, as well as managers must review industry analysis results in order to better serve the market.

3. RESEARCH OBJECTIVES

The review of theory and literature indicates that internationalization in the knowledge intensive sectors is critical for its growth and success. Therefore, the research objectives of this paper can be specified as:

- Research objective 1 (RO 1) => To examine the radiography of Information Technology firms from Puerto Rico.
- Research objective 2 (RO 2) => To identify the pattern and process of internationalization of the Information Technology firms in Puerto Rico using a clustering analysis.
- Research objective 3 (RO 3) => To propose a theoretical framework CPP Model for carrying out industry analysis and internationalization studies.

4. METHODOLOGY

The Global Competitiveness Index 2013 ranked Puerto Rico as 30th among 148 countries around the world (Schwab and Sala-i-Martín, 2013). Taking into account its importance, we conducted a quantitative study in 2014 to examine the radiography, pace and pattern of internationalization of Puerto Rican Information Technology (IT) firms. Puerto Rican firms are defined as companies which are born in Puerto Rico, aUnited Statesterritory. To comply with the criterion a total of 70 questionnaires were sent to the executives, who are members of the Puerto Rico IT Cluster. Those executives were all active partners, owners, or top managers.

First, the questionnaire was administered online by using Formstack.com. The data of 63 Puerto Rican firms was obtained based on the population (according to the Puerto Rico IT Cluster) of 70 firms. This study has a response rate of 90% (63/70), which is based on a 95% confidence level and 5% confidence interval (Sample Size Calculator, 2013 and UCLA Academic Technology Services, 2014), constitutes an acceptable sample of the population. Respondents answered all of the questions.

The questionnaire was distributed to the executives who, according to Jadesadalug (2011), are the key informants while conducting such studies. The information collected included demographic data such as the primary industry of service, places of operation, and the age of the company in Puerto Rico, the United States, and internationally. Additional information requested was the total number of employees in Puerto Rico, the total number of customers, and the total annual revenues. As part of statistical analysis, we estimated Cronbach's alpha to measure

the internal consistency reliability following Gliem and Gliem (2003), and (UCLA, 2014). Alpha for the study is 0.7. Since alpha is equal to 0.7 thresholds, the survey instrument used was considered reliable.

Following Lopez et.al (2009), Verma (2013) and Paul and Gupta (2014), cluster analysis was carried out to summarize data by grouping similar IT firms together into clusters. This analysis is useful to understand how those firms are classified. Firms were segmented based on the similarity of the collected from the firms' executives. Euclidean distance was selected to compute the distance between two samples. The procedure to determine the clusters or groups was performed in SPSS Two-Step Clustering (IBM SPSS, 2012). The two-step clustering features a tree whose leaves represent each distinct dataset. Mooi and Sarstedt (2011) explain that this type of clustering combines the principles of hierarchical and partitioning methods.

The general variables used for the clustering process included the primary industry of service, places of operation, age of the company in Puerto Rico, age of the company in the United States, age of the company internationally, and the economy sector of service. Following Mooi and Sarstedt (2011), we use specific variables such as the total number of employees in Puerto Rico, the total number of customers, and the total annual revenues. A first two-step clustering iteration was done including all variables. However, the total number of employees was removed by the second two-step cluster iteration to improve the cluster quality, which constitutes a better classification of the groups.

The continuous variables used were as follows: age of the company internationally, age of the company in United States, total annual revenues, and total number of customers. Since only continuous variables were used, the Euclidean distance was chosen. There was no special treatment to outliers. For output, the additional variables, also called evaluation variables, to describe the clusters were places of operation and primary industry of service. Under the number of clusters, three was the number of clusters specified (Mooi and Sarstedt, 2011). This number of clusters allows a better explanation of each based on its characteristics (Verma, 2013).

Following Vega (2013), to study the total number of employees among the three clusters a Bartlett test was first done to examine homogeneity. The total number of employees' variable represents the total number of active employees working from Puerto Rico. A Kruskal-Wallis was done to test for the medians if there was no homogeneity. Further one-way ANOVA was employed to test for the means if there was homogeneity. If the ANOVA reflected that there was a difference among means, a Tukey HSD was run to discover the differences in the total number of employees' means among the three groups. All of these runs were done in R Statistics.

In order to test the potential total annual revenue of the Puerto Rican IT firms as explained by Vega (2013), probabilities in the sample were performed. A binomial test was used to assess the total annual revenue of $10,000,000 for all Puerto Rican IT firms. The binomial test was performed as an exact test of a simple

null hypothesis about the probability of success in a Bernoulli experiment. This test was also run in R Statistics.

5. FINDINGS

5.1 Radiography

A radiography analysis was performed in order to examine research objective[1] (RO 1). We found that all 63 firms in our sample were established in Puerto Rico. The minimum age is one year old, and the maximum is 46 years old. The mean age is 14 years old. The average age of the firm in United States is 4 years (mean), and 29 years (maximum). The corresponding figures for firms in the International markets are 3 years (mean), and 19 (maximum).

The primary industry of service provided by the IT firms in our sample (as reported by 63 participants) is broken down as follows: 25% in pharmaceutical and biotechnology, 18% in related industry, 13% in health care, 11% in professional services, another 11% in manufacturing, 11% in government, and lastly 11% in banking. Figure 1 shows these data pictorially.

Insert Figure 1 here

As regards the service provided by the Puerto Rican IT firms, 83% of the firms serve in the private sector, 14% of the firms serve in the central government sector, and 3% of the firms serve in the city government sector. Figure 2 shows these data as a graph.

Insert Figure 2 here

The main information requested in our survey was the number of employees, the number of customers, and the annual revenue. The minimum total number of employees is 10, and the maximum is 1,000. The mean of total number of employees is 95 and the median is 25. The minimum total number of customers is 10, and the maximum is 150. The total number of customers mean is 61, and the median is 50. The minimum total annual revenue is 50,000 USD, and the maximum total annual revenue is 10,000,000 USD. The total annual revenue mean is 3,354,762 USD, and the median is 1,000,000 USD.

An in-depth annual revenue subdivision is presented in Table 1. Total annual revenue is segmented into the revenue that is generated in Puerto Rico (Annual Revenue from PR market), the revenue that is generated in the United States (Annual Revenue from the United States market), and the revenue that is generated in the international markets (Annual Revenue from International markets). The addition, the last two revenues are presented as Annual Revenue from Abroad (US and International markets). By observing the statistical mean revenue from both the the United States and International markets is similar, and most revenue comes from the Puerto Rican market.

Insert Table 1 here

5.2 Clustering

We carry out clustering to discuss the phenomenon of internationalization, as outlined in research objective two (RO 2). Two-step clustering was employed as a tool to analyze Puerto Rican IT firms to identify the internationalization process. The clustering model is based on four input variables which include age of the company internationally, age of the company in United States, total annual revenues, and the total number of customers. These four variables were used equitably to create three clusters. The number of clusters specified was three. The cluster quality and overall goodness-of-fit is fair which is a satisfactory solution due to the sample size and the number of clusters specified.

The overall importance of the variables in the clustering process was, in order of importance, i) age of the company internationally, ii) age of the company in United States, iii) total annual revenues, and iv) places of operation.

Figure 3 presents the cluster structure. There are three clusters or groups that are classified by the size of each cluster and four other variables. The variables are the age of the company internationally, the age of the company in the United States, the total revenues, and the total number of customers. . Age in the United States and age internationally refer to how long the Puerto Rican firms have been operating in those places.

5.2.1 Cluster Structure

The first cluster has the highest number of firms (52 firms). It has an age internationally of almost a year since becoming an international company (0.73 years). The firms in this cluster have almost four years of serving the United State

market (3.67 years). Its total annual revenues are approximately two and a half million dollars ($2,614,423.08).

The second cluster has the lowest number of firms (2 firms). It has an age internationally of two and a half years since becoming an international company (2.50 years). This cluster has almost thirty years serving the United States market, which represents the oldest age (27.50 years) among the three clusters. Its total annual revenues are approximately five million dollars ($5,200,000.00). It has almost forty customers (37.50 customers).

The third cluster has nine firms (9 firms). The average age of the firm operating in the international market is a little more than a decade (exactly 13.3 years). This cluster has almost three years of serving experience in the mainland United States market (2.78 years). It has the highest total annual revenues with approximately seven million dollars ($7,222,222.22).

5.2.2 Cluster comparison

The first cluster is similar to the rest of the clusters in all variables since its median falls inside the overall clusters. The first cluster is different from the rest of the clusters in all variables since its median falls in the lower area of the lowest quartile for all clusters. In the case of this first cluster, all variables are important to describe it.

The second cluster has variable medians falling higher than the highest quartile for all clusters, except for the total number of customers in which its median falls close

to the lower quartile of all clusters. For this second cluster, age in United States is the variable that distinguishes this cluster from the other clusters.

The third cluster has all variable medians falling higher than the highest quartile for all clusters, except for the age in the United States. For this variable its median falls in the lowest quartile of all clusters. For this third cluster, age internationally is the variable that distinguishes this cluster from the rest of the clusters.

The testing homogeneity for the total number employees variable involves the statements of hypotheses. The null hypothesis is: On average, the total number of employees is homogeneous for the three clusters. The alternative hypothesis is: On average, the total number of employees is not homogeneous for the three clusters. The results according to the Bartlett test were a p-value of 2.111e-07, which is less than .05. Therefore, the null hypothesis is rejected. The total number of employees was not homogeneous among the three clusters. Since no homogeneity existed, a test for equality of medians was performed. The testing for equality for the total number employees variable involves the statements of hypotheses. The null hypothesis is: The total number of employees' median is equal for the three clusters. The alternative hypothesis is: The total number of employees' median is not equal for the three clusters. At least, the total number of employees for one cluster is different. A Kruskal-Wallis test is performed.

The result for the equality testing by using Kruskal-Wallis chi-squared is a p-value of 0.001425, which is less than .05. Therefore, the null hypothesis is rejected. At least, one of the cluster's total numbers of employees' median is different. Indeed, the total number of employees' median is different for each cluster, as shown in

Table 2. The median total number of employees for the first cluster (Cluster 1) is 10 employees, the median total number of employees for the second cluster (Cluster 2) is 128 employees, and the median total number of employees for the third cluster (Cluster 3) is 56 employees.

Insert Table 2 here

Figure 3 shows a detailed description for each cluster in a graph. The median total number of employees is the x-axis, the median total annual revenue is the y-axis, and the size of each bubble represents the total number of firms in each cluster. For the Cluster 1, the size is 52 firms, for Cluster 2, the size is 2 firms, and for Cluster 3, the size is 9 firms.

Insert Figure 3 here

5.3 Testing The Potential Annual Revenue Using Probabilities

Testing was done to determine the probability that one of three Puerto Rican IT firms (all firms) has a total annual revenue of $10,000,000. This involves the statement of hypothesis. The null hypothesis is: A probability of 33% (1 of 3) Puerto Rican IT firms has total annual revenue of $10,000,000. The alternative hypothesis:

A probability of 33% (1 of 3) Puerto Rican IT firms has total annual revenue greater than $10,000,000[2].

The result for the binomial test was a p-value of less than 2.2e-16, which is significantly low, compared to the .05 level of significance. The null hypothesis is rejected. Briefly, there is a 95% probability that 33% (1 of every 3) Puerto Rican IT firms have total annual revenue of ten million US dollars or more.

6. DISCUSSION

In this section all three research objectives are addressed comprehensively. Based on the cluster analysis results, we introduce a CPP model for internationalization and firm growth. This study of the Puerto Rican IT firms provides a platform for developing a model to analyze the pattern and pace of internationalization and firm growth, a framework that could be used worldwide for analysis and research.

6. 1 Radiography Analysis (R0 1)

The insights from the radiography analysis can be summarized as follows:

The age of IT firms in our study ranges from one year to the maximum of 46 years. The mean age for Puerto Rican IT firms is 14 years. Most of the firms serve the pharmaceutical and biotechnology industries. Eighteen percent of the firms serve in related industries and thirteen percent serve in the health care industry. The remaining firms serve the industries of professional services, manufacturing, government, and banking. Most firms provide services to the private sector of the economy. Fourteen percent of firms offer services to the central government, while three percent offer services to the city government.

It was found that most firms (52) operate in Puerto Rico only. Two firms operate in Puerto Rico and the United States. Nine firms operate in Puerto Rico and internationally. The median total number of employees is 25 and the median total annual revenue is one million US dollars.

6.2 Pattern And Pace Of Internationalization Of IT Firms (RO 2)

In order to study the pattern and pace of internationalization, Puerto Rican IT firms were classified into three clusters. As mentioned earlier, the main variables considered for the classification were the number of years that firms have been operating internationally, the number of years firms have been operating in the United States and the total annual revenue. Cluster 1 is the largest in size with 52 firms, has a mean of 1 year operating in the International markets, 4 years operating in United States, and a total annual revenue of two and a half million US dollars.

Cluster 2 is the smallest in size with 2 firms, has a mean of 3 years operating in the International markets, 28 years operating in United States, and total annual revenue of five million US dollars.

Cluster 3 is medium in size with 9 firms, has a mean of 13 years operating in the International markets, 3 years operating in United States, and a total annual revenue of seven million US dollars.

All firms in the three clusters serve mostly in the pharmaceutical and biotechnology industry. The places of operations and the total number of employees varied among the clusters. The first cluster operates only in Puerto Rico, while the

second cluster operates in Puerto Rico and the mainland United States, and the third cluster firms operate internationally. The median total number of employees for the first cluster is 10 employees, for the second cluster is 128 employees, and for the third cluster is 56 employees.

6.3 CPP MODEL (RO 3)

In order to address the research objective 3 specified earlier (RO 3) earlier, here we propose a theoretical model named CPP Model for industry analysis in the context of internationalization based on our study of Puerto Rican IT firms, of which one-third has a potential total annual revenue of ten million US dollars or more. Figure 4 shows the CPP Model visually. In this model the C stands for conservatives, P stands for predictables and the other P stands for pacemakers. We discuss the meaning of CPP model in the following sub-sections, in the context of findings from cluster analysis of our study.

6.3.1 Conservatives (C)

The conservative firms follow a slow approach regarding internationalization; as they are concerned about cultural, administrative, and geographic barriers such as those discussed by Ghemawat (2001) and Kuivalainen, Sundqvist, and Servais (2007). Those firms entering the neighborhood begin with the most prosperous country first and start serving in other countries later in stages, as the Uppsala theory explained by Johanson and Vahlne (2009). In addition, the conservatives take into account the Johanson, and Vahlne (2009) psychic distance and the liability of foreignness before operating in the international markets. Furthermore, its annual revenue is approximately two and a half million

dollars and it has almost sixty customers. These firms have similar characteristics with other firms from the same country including the primary industry of service, which is Pharmaceutical and Biotechnology. Conservative firms make up the most numerous firms in the country and have the lowest number of employees of the three types of firms. The conservatives study their international market well before entering much as the firms described in the López, Kundu, and Ciravegna (2009) study do. The conservatives are also similar to the companies following the gradual internationalization process described by Paul and Gupta (2014).

The Puerto Rican IT firms belonging to the first cluster serve mainly on the island of Puerto Rico. They have a negligible presence in the mainland United States and internationally. Furthermore, their average revenue (2.5 million US$) is less than the average revenue of firms in other clusters. These firms are called conservatives mainly because they did not have plans and strategies to expand beyond the local market. In other words, the conservatives operate and generate revenue mostly from the local market. Most firms (52 out of 63) in this study are found to be conservatives. Their average age in terms of operations in the mainland United States market is less than four years and they have just started to offer their services internationally.

6.3.2 Predictables (P)

We define as predictable those firms mostly serving the domestic market plus the nearest predictable markets (this could include markets which are part of regional trade agreements or markets with bi-lateral agreements, etc.). The predictables enjoy a reputation earned by their stakeholders (Sheehan and Stabell, 1992)

statement. The strategy of predictables is consistent with the Kuivalainen, Sundqvist, and Servais (2007) pattern of internationalization in that these types of firms are not actively seeking for non-predictable market environments in which to operate.

Thus, Puerto Rican firms belonging to the second cluster are identified as predictables since they serve primarily in the predictable market of the mainland United States (but not internationally), for three decades. The average annual revenue of predictable firms is 5 million US dollars. Since Puerto Ricans are United States citizens it is easy for the firms to do business in the United States and therefore this tendency to expand into the mainland is predictable. However, only two firms were identified as predictables in our study. Though the United States is a predictable market for firms from Puerto Rico, because Puerto Rico is a Spanish speaking island in the Caribbean there is a great psychic and geographic distance between Puerto Rico and the mainland United States. This leads to fewer firms being classified as predictables in this study.

6.3.3 Pacemakers (P)

The pacemakers tend to employ more people compared to other type of firms and tend to attract the highest number of customers. The pacemakers expand into the international market within a few years much like a born-global firm, stringing along the Knight, Madsen, and Servais (2004)' s born global firm framework. The pacemakers emulate a global orientation by partnerships as Zucchella, and Kabbara (2013) proposed. The pacemakers heed Jenssen, and Nybakk (2013) and Kärreman (2010) explanation that innovation by knowledge skills is a competitive advantage

and a key for success. Acting upon the Valsilchenko, and Morrish (2011), the pacemakers have a well-educated workforce. The pacemakers act upon the Ruiner, Wilkens, and Küpper (2013) and are flexible organizations that respond well to the dynamics of the market.

Puerto Rican firms from cluster 3 are identified as pacemakers. They have served not only in the mainland United States but also internationally for a little more than a decade. This represents the longest time when comparing this cluster with the rest of the clusters. These firms' average annual revenue is (7 million US dollars) and total number of customers is the highest of all clusters. These firms are defined as pacemakers due to two reasons. (i) They are truly international players with business plans and strategies. (ii) They generate more average revenue than the firms belonging to the categories such as conservatives and predictables. Nine firms out of sixty-three firms were identified as pacemakers.

Insert Figure 4 here

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7. CONCLUSIONS

This paper discussed important factors that describe IT firms in Puerto Rico with a focus on internationalization. Radiography of the Puerto Rican IT firms was analyzed to study the recent trends, path, and progress. The pattern and process of internationalization was examined based on the clustering method. Finally, the CPP Model was developed as a framework useful for carrying out industry analysis as

well as analyzing the pace of internationalization. The CPP Model development is the main contribution of this paper. Future studies can focus on using the CPP Model to carry out industry analysis and internationalization studies across the industries and across countries, selecting an interesting industry sector. For instance, CPP Model can be used in a European context, taking into account the integration of the European Union (EU). Firms operating only in their home country (for example, only in France) can be considered Conservative (C) firms. Firms operating in France and other European Union countries can be treated as Predictables (P) as the European Union has become a predictable market for a French firm. Accordingly, French firms operating outside of the European Union can be classified as Pacemakers (P). Similarly, countries with bilateral and multilateral free trade agreements can be considered as predictable markets (For example, the North American Free Trade Area (NAFTA) – USA, Mexico and Canada are predictable markets for United States firms). Researchers and consultants would find it useful to use CPP framework in any industry considering the recent developments such as regional trade agreements, which have created predictable markets such as the European Union, NAFTA, ASEAN (Association of South East Asian Countries).

8. LIMITATIONS OF THE STUDY

The limitations of the study can be specified as follows: since the sample used was obtained by convenience from the Puerto Rico IT Cluster, an apex organization coordinating the firms in the Information Technology sector in Puerto Rico, the firms which are not members of this cluster are not part of this study. Another

constraint is that CPP Model cannot be used in any industries, which are not internationalized.

NOTES

1. The R command used to test for equality of medians for the total number employees variable was kruskal.test(NumEmpPR~group). The output obtained was Kruskal-Wallis rank sum test, data: NumEmpPR by group, Kruskal-Wallis chi-squared = 13.1072, df = 2, p-value = 0.001425.

2. The R command wrote to calculate the probability of 33% (1 of 3) Puerto Rican IT firms has total annual revenue greater than $10,000,000 was: binom.test(NROW(which(TotalRevYear<10000000)),NROW(TotalRevYear),p=0.33, alternative="greater"). The output obtained was: Output: Exact binomial test, data: NROW(which(TotalRevYear < 1e+07)) and NROW(TotalRevYear), number of successes = 54, number of trials = 63, p-value < 2.2e-16, alternative hypothesis: true probability of success is greater than 0.33, 95 percent confidence interval: 0.7639487 1.0000000, sample estimates: probability of success 0.8571429.

REFERENCES

Akhlagh, E., Moradi, M., Mehdizade, M., and Ahmadi, N. 2013. Innovation Strategies, Performance Diversity and Development: An Empirical Analysis in Iran Construction and Housing Industry. *Iranian Journal Of Management Studies, 6*(2): 31-60.

Autio, E., Sapienza, H. J., & Almeida, J. G. 2000. Effects of age at entry, knowledge intensity,

and imitability on international growth. *Academy of management journal*, *43*(5), 909-924.

Caribbean Business 2011. Puerto Rico's leading information systems consulting firms. *The*

Caribbean Business Book of Lists 2011, 23, 93-95.

Dobbs, M. E. 2014. Guidelines for applying Porter's five forces framework: a set of industry analysis templates. *Competitiveness Review*, *24*(1): 32-45. doi:10.1108/CR-06-2013-0059

Dransfield R.D., and Brightwell R. 2012. *How to Get On Top of Statistics: Design and Analysis for Biologists, with R*. Influential Points, UK.

Frattini, F., Dell'Era, C., and Rangone, A. 2013. Launch Decisions and the Early Market Survival of Innovations: An Empirical Analysis of the Italian Mobile Value- Added Services (VAS) Industry. *Journal Of Product Innovation Management, 30*: 174-187. doi:10.1111/jpim.12070

Ghemawat, P. 2001. Distance still matters: The hard reality of global expansions. *Harvard Business Review, 2001*, September.

Gliem, J. A., and Gliem, R. R. 2003. Calculating, Interpreting, and Reporting Cronbach's Alpha Reliability Coefficient for Likert-Type Scales. *2003 Midwest Research to Practice Conference in Adult, Continuing, and Community Education, October 8-10, 2003*. Columbus, OH.

IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.

Jadesadalug, V. 2011. The impact of organizational flexibility and autonomy on global competitiveness via the mediating effect of corporate mindset towards globalization. *Review of Business Research*, *11*(3): 27-32.

Jedlicka, L., and Jumah, A. 2006. The Australian Insurance Industry: A structure, conduct, and performace analysis. *Reihe Ökonomie*, 189.

Jenssen, J. I., and Nybakk, E. 2013. Inter-Organizational networks and innovation in small, knowledge-intensive firms: A literature review. *International Journal Of Innovation Management*, *17*(2): 1. doi:10.1142/S1363919613500084

Johanson, Jan, and Jan-Erik Vahlne. 1997. "The internationalization process of the firm-a model of knowledge development and increasing foreign market commitments." Journal of international business studies (1977): 23-32.

Johanson, J., and Vahlne, J. 2009. The Uppsala internationalization process model revisited: From liability of foreignness to liability of outsidership. *Journal of International Business Studies, 40*: 1411-1431.

Kärreman, D. 2010. The Power of Knowledge: Learning from 'Learning by Knowledge-Intensive Firm'. *Journal Of Management Studies, 47*(7): 1405-1416. doi:10.1111/j.1467-6486.2009.00898.x

Knight, G., and Cavusgi, S.T., 1996. The born Global Firm: A Challenge to Traditional Internationalization Theory, Advances in International Marketing. 8, 11-26.

Knight, G. A., and Cavusgil, S. T. 2005. A taxonomy of born-global firms. *Management International Review*, 15-35.

Knight, G. A., Madsen, T. K., and Servais, P. 2004. An inquiry into born-global firms in

Europe and the USA. *International Marketing Review, 21*(6): 645-665.

Kuivalainen, O., Sundqvist, S., and Servais, P. 2007. Firms' degree of born-globalness, international entrepreneurial orientation and export performance. *Journal of World Business, 42*(2007): 253-267.

López, L. E., Kundu, S. K., and Ciravegna, L. 2009. Born global or born regional? Evidence from an exploratory study in the Costa Rican software industry. *Journal of International Business Studies, 40*: 1228-1238.

Lu, J. W., & Beamish, P. W. 2001. The internationalization and performance of SMEs. *Strategic management journal*, *22*(6-7), 565-586.

Lu, J. W., & Beamish, P. W. 2004. International diversification and firm performance: The S-curve hypothesis. *Academy of management journal*, *47*(4), 598-609.

Melnikas, B. 2011. High technologies sector: scientific research, studies and perspective of networking. (Lithuanian). *Public Administration (16484541)*, *1*(29): 37-51.

Mooi, E., and Sarstedt, M. 2011. *A concise guide to market research: Cluster analysis*, 237-284. Springer-Verlag, Berlin, Heidelberg 2011.

Nag, B., Han, C., and Yao, D. 2014. Mapping supply chain strategy: an industry analysis. *Journal Of Manufacturing Technology Management, 25*(3): 351-370. doi:10.1108/JMTM-06-2012-0062

Naudé, C. W., and Luiz, J. M. 2013. An industry analysis of pharmaceutical production in South Africa. *South African Journal Of Business Management, 44*(1): 33-46.

Paul, J. and Gupta, P. 2014. Process and intensity of internationalization of IT firms – Evidence from India. *International Business Review, 23*(3), 594-603 , http://dx.doi.org/10.1016/j.ibusrev.2013.10.002

Rajasekar, J., and Raee, M. 2013. An analysis of the telecommunication industry in the Sultanate of Oman using Michael Porter's competitive strategy model. *Competitiveness Review*, *23*(3): 234-259. doi:10.1108/10595421311319825

Ruiner, C., Wilkens, U., and Küpper, M. 2013. Patterns of Organizational Flexibility in Knowledge-intensive Firms - Going Beyond Existing Concepts. *Management Revue*, *24*(3): 162-178. doi:10.1688/1861-9908_mrev_2013_03_Ruiner

Sample Size Calculator 2013. Creative Research Systems. Petaluma, CA: *The survey System*. Retrieved November, 2013, from http://www.surveysystem.com/sscalc.htm

Schwab, K. and Sala-i-Martín, X. 2013. The Global Competitiveness Report 2013-2014. *World Economic Forum, 2013*, 15. Retrieved November 16, 2013, from www.weforum.org/gcr

Shirley, G. V. 1998. Chapter 7: Jamaica and Free Trade in the Western Hemisphere: A Competitive Analysis of Selected Manufacturing and Service Industries. In, *Jamaica After Nafta: Trade Options and Sectoral Strategies* (pp. 92-127). Ian Randle Publishers.

Starbuck, W. H. 1992. 'Learning by knowledge-intensive firms'. *Journal of Management Studies, 29*: 713–40.

Suárez, F. F., Cusumano, M. A., and Kahl, S. J. 2013. Services and the business models of product firms: An empirical analysis of the software industry. *Management Science, 59*(2): 420-435.

UCLA Academic Technology Services 2014. What does Cronbach's alpha mean? UCLA: Statistical Consulting Group. Retrieved on http://www.ats.ucla.edu/stat/spss/faq/alpha.html (July 1, 2014).

Vasilchenko, E., and Morrish, S. 2011. The Role of Entrepreneurial Networks in the Exploration and Exploitation of Internationalization Opportunities by Information and Communication Technology Firms. *Journal Of International Marketing*, *19*(4): 88-105. doi:10.1509/jim.10.0134

Vega, J. C. 2013. *Métodos no paramétricos en la investigación usando R*. University of Puerto Rico, Río Piedras Campus.

Verma, J. P. 2013. *Data analysis in management with SPSS Software: Cluster analysis: For segmenting the population*, 317-358. Springer Link India 2013.

Zucchella, A., and Kabbara, D. 2013. The Role of Partnerships in the Internationalization Process of Small Knowledge Intensive Firms (SKIFs). *Management International / International Management / Gestión Internacional*, *18*(1): 104-116.

APPENDIX

Table 1: In-depth annual revenue subdivision[1].

Statistical Analysis	Total Annual Revenue in USD	Annual Revenue from PR market in USD	Annual Revenue from US market in USD	Annual Revenue from International markets in USD	Annual Revenue from Abroad (US and International markets) in USD
Mean	$3,354,761.90	$2,417,817.46	$466,904.76	$470,039.68	$936,944.44
Median	$1,000,000.00	$1,000,000.00	$0.00	$0.00	$0.00
Min	$50,000.00	$10,000.00	$0.00	$0.00	$0.00
Max	$10,000,000.00	$7,500,000.00	$7,500,000.00	$3,750,000.00	$8,750,000.00

Table 2: Frequencies for Total Number of Employees per cluster

Cluster number	Mean	Minimum	Maximum	Median
Cluster 1	32.08	1	750	10
Cluster 2	128.80	7.50	250	128
Cluster 3	232.60	18.75	1,000	56.25

[1] **Source: Estimated by the authors using survey data.**

Figure 1: Primary Industry of Service (n=63)

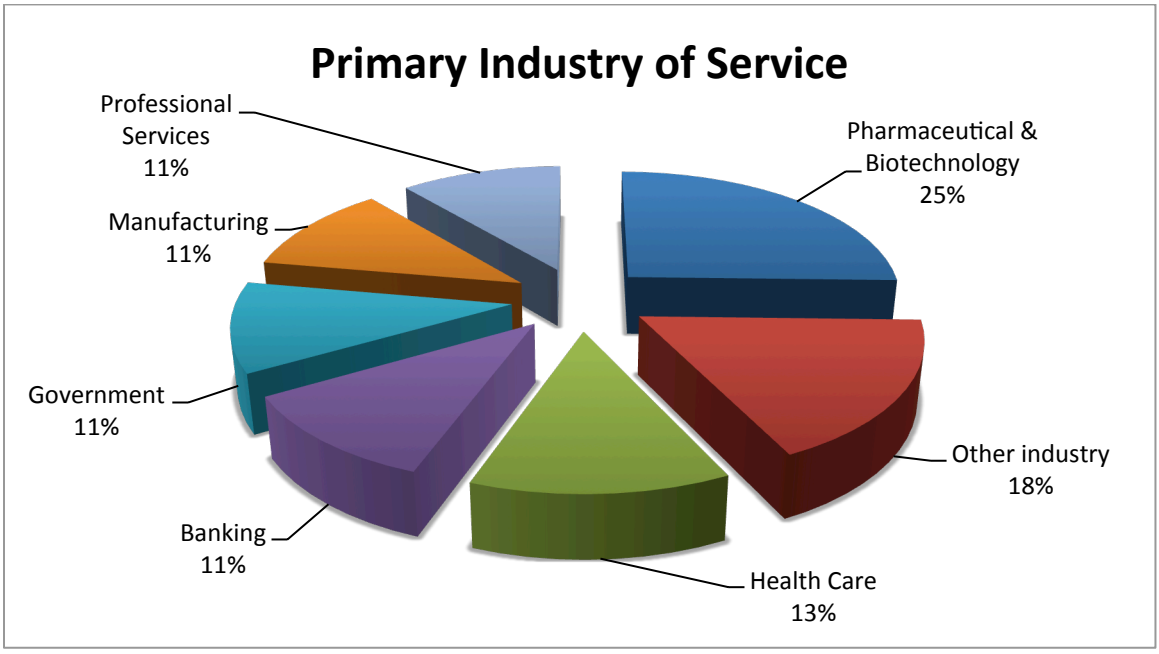


Figure 2: Services to private and public sectors for the Puerto Rican IT firms (n=63)

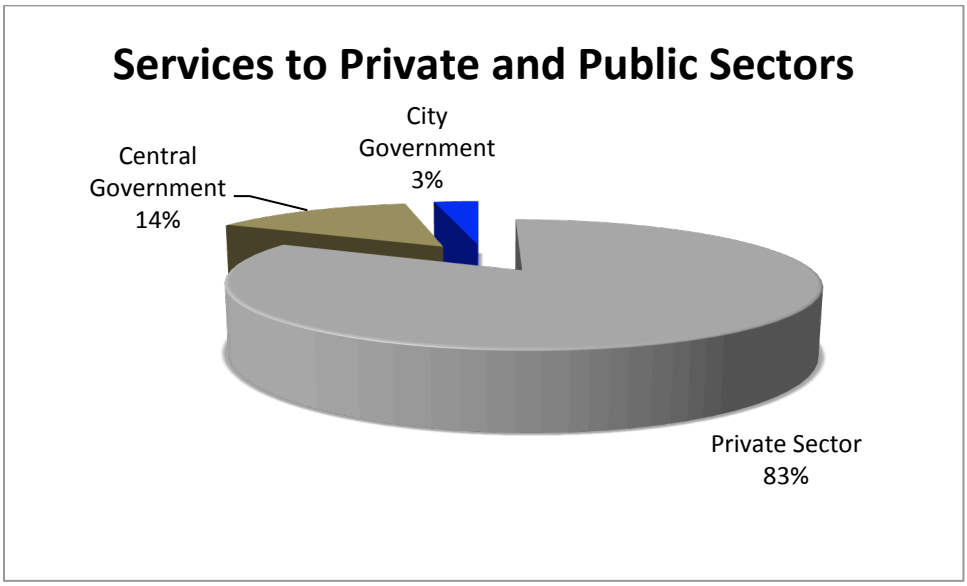
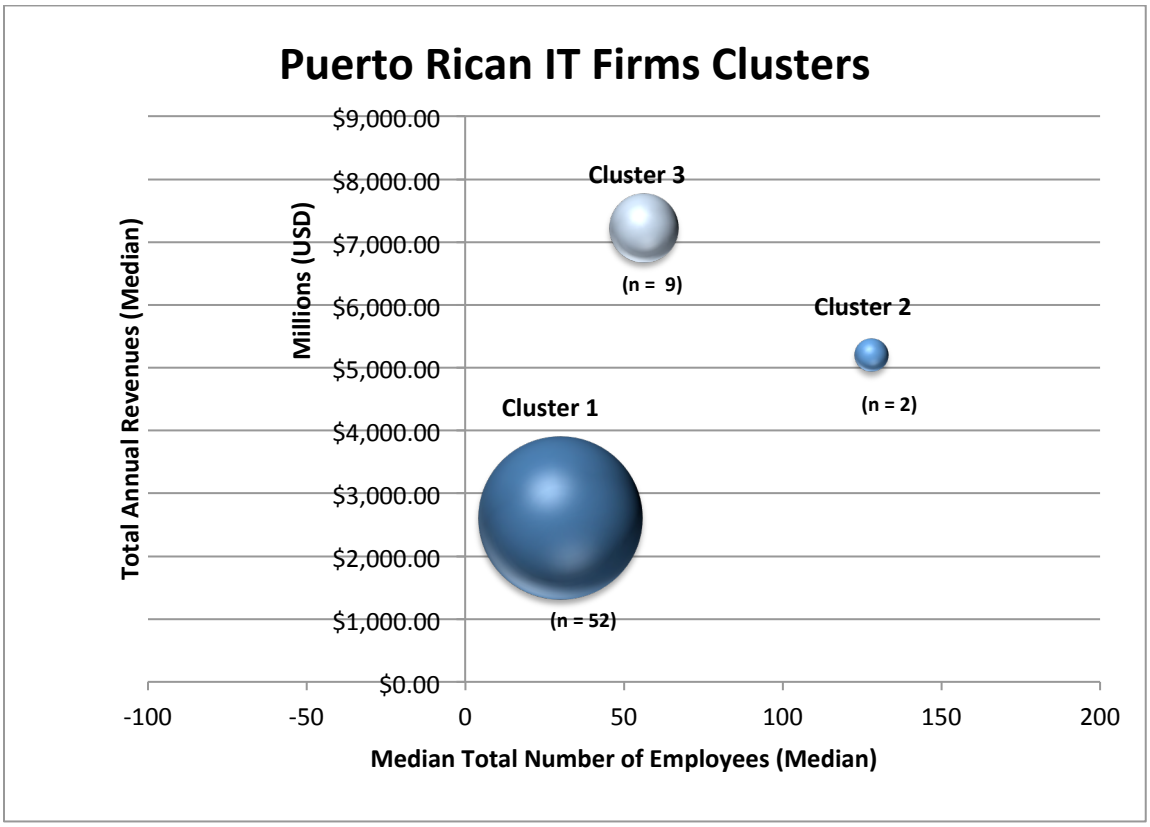


Figure 3: Cluster Analysis Results[2]



[2] The size of the bubbles represents the number of firms in each cluster.

Figure 4: CPP Model for Internationalization and Firm Growth