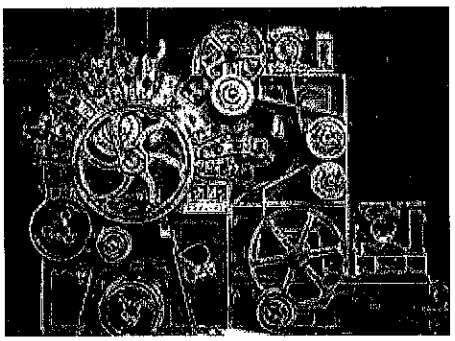
Competitiveness: Business Models, Innovations, and Systems



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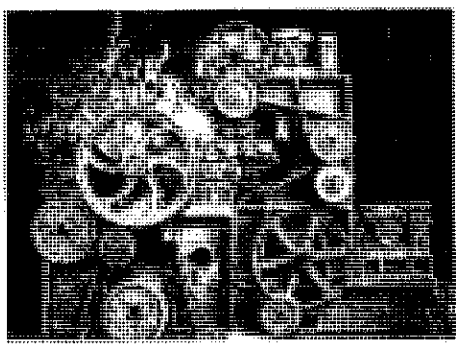

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Introduction

Jose Sanchez-Gutierrez

In a world where innovation and change are the standard, new ways of competitiveness are constantly being explored and applied in order to achieve success in the global market. This book provides a variety of research and models of competitiveness examining ways to avoid failure to succeed. We open the book with a proposal for a conceptual process of competitiveness, dealing with a business model that takes into consideration consumer needs and innovation management.

The US/Mexico border has become a strategic point of economic growth for both nations, so developing intercultural workers who possess the necessary knowledge, skills and experience with which to compete is a key issue. "Global Competences of Employees in Hispanic Enterprises on the U.S./Mexico Border" measures global competences for knowledge, skills, attitudes and experiences in Hispanic-owned enterprises in order to find a dynamic between the two cultures.

In a world dominated by brands, global competition can be harsh, so the importance of being different is a key factor to success. Hence, customer service and how it is perceived becomes a "must" for any company dealing in an international or global context. Identifying proper leadership complemented with a transactional style is a topic explored in the chapter, "The Role of Leadership at a Telephone Call Center in an Enterprise That Markets and Distributes Electric Power in the Northwestern Part of Mexico."

The maquiladora program has been a way to spur economic and industrial growth in Mexico, as Tijuana is one of the largest cities in the world where electronics are produced. "Methodology of the Fifth Systemic Helix for the Development of Public Sector Policies" identifies which factors could increase the competitiveness of this zone and lead to better decision making and initiatives and increase development of the area.

Keeping low costs and reliability is also a fundamental factor when competing in global markets, so the next work deals with the lean design of six sigma quality implementation. "Lean Design for Six Sigma: An Integrated Approach to Achieving Product Reliability and Low-Cost Manufacturing' discusses new product developments based on a traditional stage-gate process.

To effectively compete, some manufacturing companies are focusing on marketing knowledge, as they try to attract more business in the face of competition from Asian countries. A major factor of improvement is related to two resources available to companies: organizational knowledge and marketing. The chapter, "Marketing Knowledge as a Competitive Tool For Manufacturing Companies in the Electronics

Industry in the Guadalajara Metropolitan Area," discusses the necessity to find a model for more intelligent marketing and, as a result, gain a larger share of foreign investment. The rise of new emerging markets, known as BRICS, is a challenge for Mexico in its effort to be part of a first world economy. A potential factor for Mexican success is logistical, where the efficiency of the clearance process by border control agencies must be competitive and done effectively. The following work, "Logistics Competitiveness in Mexico vs. Brics 2012," deals with these elements.

Finally, to find qualified employees and to reduce recruitment uncertainty is also an important element of competitiveness. The chapter, "Selection Criteria Used for Personnel Recruitment in an Environment of Uncertainty," focuses on decision making within the company in an environment of uncertainty, particularly with regard to the management of human resources (HR). Using quantitative and qualitative criteria to facilitate decision-making will place companies in a competitive position hy having outstanding intellectual capital.

The chapters in this book offer new and innovative ways with which to address the issue of competitiveness. They elaborate on the use of models in industries in other countries and may provide inspiration for present and future businesses in Mexico.

1 Business models, customer needs and innovation management: Proposal of a conceptual process for competitive improvement

Juan Mejia-Trejo, Jose Sanchez-Gutierrez, Guillermo Vazquez-Avila, and Elsa Georgina Gonzalez-Uribe

INTRODUCTION

The purpose of this paper is to describe, through a documented study, the elements that drive the relationship between a business model and customer needs, taking into account innovation, as well as the way they are managed, with the objective to provide organizations with a differentiation tool for improving their competitive position. This study is divided into three sections: 1) approach of the issue, objectives, hypothesis, research questions and a justification, by which one evaluates the scope of the research; 2) theoretical framework, which summarizes a business model concepts, needs and stimuli for customers' purchases with innovation management, as well as a proposal for a conceptual process model; 3) and a discussion and a summary of obtained results.

CONTEXTUAL REFERENCE

The Oslo Manual (OCDE, 2005) in paragraph 12 refers to the importance of marketing (selling) methods that have a significant role in a company. They are an important factor in the success of new products. Market studies and customer contact play a critical role in the development of products and processes through the innovation introduced by the demand. The Global Innovation Index report (INSEAD, 2012, p. xix) places Mexico in 79th place out of 141. Although the country has great growth aspirations for becoming the 7th worldwide economy in 2020 (Milenio website, 2012), it has not managed to hold a sustainable position in the index (vs. rank 81/125, INSEAD, 2011, p. xix; rank 69/132 INSEAD, 2010, p.14; rank 62/130, INSEAD, 2009, p.13; place 37/107, INSEAD 2007, p. 27). This circumstance is reflected in its competitiveness level which is ranked 58/142, according to *The Global Competitiveness Report 2011-2012* (World Economic Forum website, 2012). Based on the above, the problem is expressed through a general question (GQ): What is the process proposal that relates a business model, customer needs and innovation management to improve business competitiveness?

OBJECTIVES

General Objective (GO): To determine a process proposal that relates the business model, customer needs and innovation management to improve business competitiveness.

Specific Objective 1 (SO1): To describe the main elements that are involved in the proposal that relates the business model, customer needs and innovation management to improve business competitiveness.
Specific Objective 2 (SO2): To determine a general conceptual model *ex ante* of the process that entails a relationship with the business model, customer needs and innovation management to improve business competitiveness.

HYPOTHESIS

General Hypothesis (GH): Based on a documented study, it is possible to determine a general conceptual model *ex ante* of a process that relates a business model, customer needs and innovation management to improve business competitiveness.

RESEARCH QUESTIONS

Question 1 (Q1): What is the description of the main elements that are involved in the process that relates a business model, customer needs and innovation management to improve business competitiveness?
Question 2 (Q2): What is the general conceptual model *ex ante* of the main elements that are involved in the process that relates a business model, customer needs and innovation management to improve business competitiveness?

RATIONALE

OCDE (2009, p.25) indicates that inventions or development of products and/or processes, which are protected by patents, increase the dynamic efficiency of the economy by fostering innovation and, at the same time, growth and value creation. The WIPO report (2012, p.17) shows that Mexico, up to 2010, has contributed 0.7% of all worldwide patents (US: 24.8%; China: 19.8%; Japan: 17.4%; European Union: 7.6%; Germany: 3.0%; Brazil: 1.1%, among others). Requests for patents, trademarks and utility models (OMPI website, 2012) generated in 2010 in the U.S. number 420,815; 710,601; 80,454. In comparison, Mexico had 1,591; 78,999; 2,154, respectively. Therefore, this study is needed, since our country shows very low levels of systematic use of innovation. Refer to Table 1.1.

The social relevance of this study is based on the fact that the industry lacks a systematic process that allows aligning a value proposal of a business model with customer needs and product features based on the IMT.[1] The theoretical value of the study is based on the documented review of state of the art knowledge in relation to a business model, value proposal, customer needs and purchase stimuli with the product's features in order to apply IMT. Additionally, it proposes actions related to product-market matrices, as well as its competitive positioning based on environmental

[1] Innovation Management Tools (IMT)

considerations, yielding a comprehensive proposal for a wide enhancement of a general model, thus becoming a platform for generating additional lines of study. The employed methodology approach aims to identify, organize and combine data to obtain a practical tool that can be used by management and/or directors.

Table 1.1 Large-Scale Establishments, by Sector which Develop and/or Implement Actions Related to New Product Creation by Establishment Size, 2003

Sector	The establishment has a department, which is, totally or partially, dedicated to the design or creation of new products or processes		It invests in the creation of new products, materials, devices or components		It registers products and other works of intellectual creation with the intellectual property institutions		It has full-time qualified staff dedicated to innovation of products, materials, devices, components or processes		Total
	Yes	No	Yes	No	Yes	No	Yes	No	
Manufacturing	6 155	13 111	6 600	12 666	1 738	17 528	6 686	12 580	19 266
Business	14 093	64 491	11 052	67 532	3 660	74 924	0	0	75 584
Services	7 826	32 816	7 334	33 308	1 946	38 696	0	0	40 642

Source: INEGI website, 2003

THEORETICAL FRAMEWORK

The study analyzes concepts like competitiveness, marketing and customer behavior, as well as innovation for the purpose of finding common points which would allow determination and description of the main variables, thus proposing a general conceptual model *ex ante* of their involvement in innovation management.

Business Model

In order to create, deliver and capture value, Osterwalder and Pigneur (2010) propose a model called *Business Model Generation*, which consists of 9 units: (1) customer follow-up with target, niche, segmented, diversified and multi-platform; (2) added value proposal with innovation, performance, personalization, design, brand status, price, cost and risk reduction, accessibility, convenience, usability; (3) channels, such as own, partner, direct, indirect; (4) customer relationships, with personal assistance or customized support, staff support, self-service, automated services, communities, value co-creation, (5) income stream, with asset sales, subscription fees, loans, rent, advertising; (6) key resources based on the physical, intellectual, human, financial aspects; (7) key activities, such as production, problem resolution, platform/network; (8) key partners, with optimization/economies of scale, reduction of risk and uncertainty,

acquisition of key resources and activities; (9) and cost structure, with cost and value drivers, fixed costs, variable costs. On the other hand, special emphasis is made on focusing the business on the customer and not on the market, thus defining the mission (what does the company do) around the business: What does it do?; Who does it serve?; And how does it serve? (Hill & Jones, 2011, p.14); the vision (future state of desired business); and the values (behavior of management and employees), which suggests that they are subject to continuous review as they are considered a source of competitive advantage (Hill & Jones, 2011, p.16).

Proposal of Added Value

Bonel et al. (2003) define value as a set of goods of economic or any other nature (power or prestige) sought after by the owners and managers of an organization, as well as the products, services and solutions offered by an organization to its customers at any given moment and all elements that allow an organization to continue evolving and adjusting to the needs of its environment and its customers, identifying different agents that are benefiting from it. Refer to Table 1.2.

Table 1.2 Beneficiaries of Value Creation

Value Creation for:	Description
The Customers	This is a process of value creation process through marketing strategies, supported by the quality assurance policies, aimed to capture and to maintain customers, creating high expectations of value and providing a high satisfaction level. This type of customer-oriented value creation should be focused on increasing short to medium term shareholder value.
The Shareholders	A final and a crucial approach to company evaluation. It is carried out through the distribution of dividends among the shareholders or by increasing the value of shares or invested capital. Any other approach to value creation must be aimed at creation of value for the shareholders.
The Organization and/or the Company	A planned adjustment of internal processes of the organization (technical and human resources). The capacity to adjust is obtained for the sake of ongoing implementation of continuous improvement of processes, systems and policies. From the market perspective, the objective is to anticipate a change in the conditions before the competition, for the purposes of increasing the presence and intending to consolidate the leadership on the market. From the organization's perspective, the objective is to ensure that it is prepared to face the processes of change required by the market before the competition and to transform such capacity into a competitive advantage into strength.
The Sector	Organizations and companies are not isolated entities - they are grouped into economic activity sectors, the analysis of which may show the maturity level of corresponding markets and the underlying solutions.
The Society	Society is considered a new player in the value creation process. It is complementary to customer value creation and should be considered as a positive or negative feedback, depending on whether customer value creation is detrimental or beneficial for the rest of the society.

Source: Bonel et al. (2003) with our own adaptation

White and Bruton (2011) refer to value as a process in changing stages. Refer to Table 1.3.

The proposal of added value is one of the basic components in the creation of a business model and is a task attributable to the managers, since it is the conception of how to incorporate company strategies in a coherent way in order to achieve competitive advantages with profitability and generation of higher returns (Hill & Jones, 2011, p6).

Table 1.3 Value Processes

Value process	Driving Force	Operational Measurement	Financial Measurement
Creation	Innovation, New Venture, Risk-taking	Research and Development, Investment, New Markets	Sales and Profit Growth, Moderate Return
Adoption	Imitation, Reassignment - Acquisition of Resources	Products and Geographical Coverage	Growth, Increase and High Return
Protection	Barriers, Market Power	Market Participation, Efficiency	High and sStable Return
Destruction	Competition, Abandonment, Game	Investment Cuts, Loss of Participation, Extreme Action	Decline, Various Discharge Results

Source: White and Bruton (2011, p. 327)

Customer Needs

In order to determine customer needs, different criteria have been created in order to identify them, as well as the generated desires and purchase stimuli which affect customer behavior. A summary of principal models is provided in Table 1.4.

Table 1.4 Customer Behavior Models

Model	Description
Economical	Customers follow the maximum utility principle based on the marginal decrease of utility. The customer wants to spend as little as possible in order to obtain maximum benefits. This is based on the *Price Effect*: The lesser the price, the bigger will be the purchased amount. *Substitution Effect*: the lesser the price of a substitution product, the smaller will be the utility of the original purchased product. *Income Effect:* The greater generated income or amount of available money, the greater will be the purchased amount. According to behavior scientists, this model is not complete, since it assumes that the market is homogeneous, that buyers have similar behaviors and they are only focused on the product or the price. It doesn't take into account all other aspects, such as perception, motivation, learning, attitudes, personality and socio-cultural factors.
Psychological	This is based on A.H. Maslow's needs hierarchy model. At any specific moment, an individual's behavior is determined by the most urgent need at that moment. This also shows that there is a priority for needs. First, the basic needs are met and then the secondary ones. Motivational forces that stimulate the individuals to act govern the purchase and behavior process and commences with a need. It is a driving force and also a mental phenomenon. A need emerges when the individual is deprived of something and thus mental tension is created, driving the individual towards a goal-oriented behavior in order to cover the need. Once the need is satisfied, a new need appears and the process repeats. There are 5 types of needs: (1) Physiological: water, air, thirst, hunger, sex, protection, etc. (2) Safety: protection, order, stability, etc. (3) Social: friendship, sense of belonging, affection (4) Ego: prestige, status, success, respect (5) Self-realization
Pavlov's Learning	This is based on the conditioned response experiments conducted on a dog by the Russian physiologist Ivan Pavlov. Learning is defined as behavioral changes that occur in practice based on prior experience. The learning process is defined by 3 factors: (1) *Conditional stimuli* drive an action in order to fulfill a wish. (2) *Unconditional stimuli* are inherent and

	arise from physiological needs, such as hunger, thirst, pain, sex, cold, etc. It is a learned response, such as an effort to obtain status or social approval. There are small stimuli that provoke the purchase, such as: (a) discharge signals and (b) non-discharge signals for a purchase; the latter influence but do not activate the purchase. In turn, they are divided into (b1) product-related signals: color, packaging, size, price, etc. (b2) information-related signals: advertising, promotion, third-party recommendations, recommendation by sales people, etc. The response is: to buy or not to buy. (3) Reinforced strengthening of the association between the unconditional stimuli and the conditional one; when a person observes a satisfying factor, just as it proves convenient to make a purchase.
Entrance-Process-Exit	This is a simple customer behavior model, where the entrance for the customer is the product, due to company's marketing efforts and social environment (family, reference groups, culture, social class, etc.), which influence the decision-making process. Marketing and the social aspect are the factors that establish the entrance into the customer's mind. There are 5 stages: (1) *Need of Recognition.* When a desire emerges, tension is created and a product is chosen to satisfy the need. There is also a possibility that a person may be aware about the product prior to the recognition of the need. (2) *Product Awareness* is obtained through an advertisement or the exposure in different media or through the social circle. The awareness and the need drive to the creation of interest. In some cases, the interest can also be affected, and the decision-making process is stopped or could be postponed to another moment. (3) *Evaluation* consists of obtaining more information about the product, comparing it and contrasting it with other products. This can be carried out theoretically or by performing a test. Once the evaluation is completed, customer interest increases towards making purchase or decreases, leading to cancel or to postpone it. (4) *Intention,* at this phase, the customer carries on with actions aimed for product purchase. Once the product has been acquired, it is used to fulfill the need. While it is being used, the customer becomes aware about the positive and negative features of the product. (5) Post-purchase behavior in which, after having purchased and used the product, a satisfied customer returns and repeats the purchase process. The unsatisfied customer suspends the purchase. Therefore, a marketing specialist must pay attention to the recommendations and/or complaints in order to improve the product.
Sociological	This refers to society. A customer is a part of society and he or she can belong to many groups in a society. These groups influence customer purchase behavior. In the first place, friends and family can have a big influence on the decision to buy. For example, a customer may belong to a political group with a different dress code. As a member of an elite organization, he or she may face different dress code requirements, thus having to buy items to match the life style of different groups.
Howarth Sheth	This recognizes that customer behavior is a complex process that depends on various concepts, such as learning, perception and aptitudes and consists of 4 sets of variables: (1) Entrance: based on 3 types of stimuli: (1a) significant stimuli, which are tangible physical product characteristics, such as the price, quality, distinctive appearance, services provided and product availability. (1b) Symbolic stimuli, which include the perception of significant stimuli by the individual, for example, whether the price is high or low; that is, it is different from other products, the additional services that it may have, the post-sales services and quick availability. (1c) Social stimuli, which come from the family, friends, acquaintances, social groups, etc. They are considered to be of great importance, since a customer is a social entity that adjusts to the requirements of its environment, which creates habits and customs. (2) Perception and learning constructs, which are psychological variables, for example, motivating factors, attitudes, perceptions, which have an influence on the decision-making process of the customer, who receives the stimuli and interprets them. There are two factors that influence this interpretation: ambiguous stimuli and perceptual prejudice. The first one occurs when a customer cannot fully interpret or understand the significance of received stimuli and does not know how to respond. The second one occurs when an individual distorts the information in accordance with his or her needs and experiences. (3) Exits, where we refer to the decision to buy. After the purchase there can be satisfaction or dissatisfaction. Satisfaction brings a positive attitude and entails brand expansion. Dissatisfaction brings about a negative attitude. (4) Exogenous or external variables. They are not shown in the model and do not have a direct influence on the decision-making process; they influence the customer indirectly and vary

	from one customer to another; they depend on the traits of each individual, such as their personality, social class, the importance of acquisition and the financial situation.
Engel-Blackwell-Kollat	This consists of 4 components: (1) Information processing, which consists of exposition, attention, understanding and retention of marketing and non-selling stimuli. In order to obtain successful sales, the customer must be adequately selected and be repeatedly exposed to the message. Customer's attention must be captured, so that he or she understands and retains what is being transmitted. (2) Central Control Unit, where the stimuli are processed and interpreted by the individual. There are 4 psychological factors. (2a) stored information and past experience with the product, which serves as a standard for comparison with other products or brands. (2b) evaluation criteria, which are personal. (2c) attitudes or moods that change every once in a while and help with product selection. (2d) customer personality, which serves as a guideline for making a choice. (3) Decision-making, based on the approach to the issue, internal-external search, evaluation and purchase. Satisfactory and non-satisfactory experience is taken into account for future decisions. (4) Environmental factors consist of: income level, social class, family influence, physical influence and other considerations.
Family Decision	It is important to understand how family members interact among themselves when making a purchase decision. There are different roles, such as: (1) The *Influencer* participates in the decision to buy by means of providing information. (2) The *Observer* is a family member who controls the information flow about a product or a brand that they like, and withholds the information that is not of interest to them. (3) The *Decider* is the one with the power or money and the authority to purchase. (4) The *Purchaser* is the one who really makes a purchase. (5) The *Preparer* prepares the product for the final consumption. (6) The *Users* are those who use or consume the product, individually or jointly. The roles played by family members may differ depending on the product and the same family member can play various roles at the same time.
Nicosia	This is maintained through 4 fields and sub-fields: field 1 consists of sub-fields 1 and 2. Sub-field 2 is the *Customer Predisposition*, whose characteristics and attributes are affected by the messages and information from the environment, yielding an adoption of attitudes by the customer. Field 2 is the *Pre-action*, where the customer investigates, evaluates and gets motivated to buy the product. Field 3 is the *Decision to Buy*. Field 4 is *Post-purchase*, when the product is consumed, used or stored. Feedback from Field 4 goes towards Field 1 or *Company Attributes* where the experience can change the decision to buy and the attitude towards the consumption. This model is considered a comprehensive one, since it covers the build-up of attitudes, product purchase and use, as well as the post-sales behavior.
Industrial Purchase Behavior	This corresponds to a complex world of inter-relations at industrial level. There are 3 significant characteristics: (1) Different involved areas with various interests. (2) Conditions that lead to decision-making. (3) Differences in opinion and conflicts due to purchasing decisions. Therefore, various expectations related to product purchase arise, such as product quality, delivery time, quality of the offer, service, post-sales and price. These are known as the explicit objectives. There are other objectives, such as provider's reputation, credit conditions, provider location, relationship with the provider, technical competence and even the seller's personality, abilities and lifestyle. These are known as the implicit objectives. Thus, it shows the ability to resolve conflicts of different origin and intensity.

Source: Khan (2006, pp.174-187)

Market Analysis

The website of the Spanish Royal Academy Dictionary (DRAE, 2012) contains the following information about the word market: from the Latin, *mercātus*: 1. m. Public procurement in a location specified for these purposes on the agreed-upon days. Main practices of market identification are provided in Table 1.5.

Once the market segment is identified, demand size is measured by (Loudon et al., 2005, pp. 50-54): (1) market factors, which explain the reasons for the product-consumption relationship and its future. Their impact depends on the analysis of correlation or arbitrary judgment; (2) potential segment market, which appears after the following factors have been determined: segments, customer characteristics and market factors, market size, that is, expected sales in this segment, both in absolute terms (units, dollars, etc.), as well as in relative terms (percentage).

Table 1.5 Methods for Market Segment Identification

Method Type	Description
Research-based	Studies with multivariate statistical analysis are conducted in order to define customer behavior, attitudes, motivating factors and preferences.
Services of Database Systems with Existing Segmentation	Marketing experts use business and government information. This includes *Consumer Markets* (identified through Geo-demographic systems, such as Claritas PRIZM, VALS of SRI Consulting Business Intelligence of the US) and the *Business Markets* (such as NAICS or North American Industry Classification System of the US).
Expert Evaluation	Marketing knowledge and experience is applied to discover new characteristics of the existing or new markets (which have not been taken into account before due to their nature). Study criteria are established as follows: Geography, Demography, Psychographics, Purchase Behavior, Style, Culture, Customer Profile, etc. Matrices are often created to compare different data, such as Customer Profile vs. Geography, etc.

Source: Loudon et al., 2005 (pp. 27-54)

Absolute terms are calculated by using techniques, such as measurement of relative potential sales index, market factor method, regression analysis method, focusing mainly on the existing products and services. For new products and services, the following techniques are used: expert estimations and customer surveys through a substitution method. With regards to market research, the Spanish word for Marketing (Mercadotecnia) is not registered in the DRAE (2012). The definition that is provided below has a similar structure: derivative of "market (Mercado) and technique (técnica), which means 1. f. A set of principles and practices aimed for the increase of sales, especially of the demand. 2. f. Study of procedures and resources available for these purposes. Kotler and Keller (2012, p. 5) define it simply as: satisfaction of customer needs in a profitable manner. Based on appeal and profitability, Loudon et al. (2005, p.168) describe market segmentation in terms of mass, personalized mass, a single segment, multiple segments and niche, also including those based on different market conditions describing emerging, growing, mature and declining markets. It is suggested that the latter can be exploited by means of market change, product change, strategy and marketing mix change. Given that growth is the main objective of companies, two strategies are named for achieving it: (1) product/market expansion (Loudon et al., 2005, p.132), creating the matrix shown in Table 1.6 and (2) the integration strategies, which are put into practice as: (a) forward integration (b) backward integration (c) horizontal integration. Thus, a product/market study should contain: expected demand, end user

characteristics, awareness about industry practices and trends, identification of key competitors, market size, identification of growth factors, market stability or decline (Loudon et al., 2005, p. 154). Once the segment's detail is expanded, customer studies can be undertaken to discover general profiles, socio-economic, behavioral and psychological traits (Loudon et al., 2005, p.156).

Table 1.6 Product/Market Growth Matrix

MARKETS		PRODUCTS	
		EXISTING	NEW
	EXISTING	**Market Penetration** is carried out through the Adjustment of Current Purchasing Behavior, Attraction of Non-Customers, Attraction of Competitor's Customers	**Product Development:** New characteristics - Different levels of quality - Different Product Sizes
	NEW	**Market Development:** New Foreign Markets - New segments which do not use the product	**Diversification:** New products to new markets or acquisition of other companies that already operate in this area. It is done through: Product-Technology Relation, Market Relations, No Product No Market Relation

Source: Loudon et al., 2005 (p.133), our own adaptation

Product/Service Attributes

The result of detecting customer needs and purchase stimuli is reflected in the design of attributes delivered to a customer by the product, such as form, characteristics, performance, duration, trustworthiness, style, and by the service, such as ease of placing an order, delivery, installation, customer's training and consulting, repair and maintenance, along with the desired personnel qualities, such as competence, courtesy, credibility, trustworthiness, response capacity, communication, amongst others (Hill & Jones, 2011, p.129).

Competitiveness

According to the DRAE (2012), the word "competitiveness" has the following meaning: 1. f. A capacity to compete 2. f. Rivalry for the purposes of reaching a goal. Therefore, it is important that a company generates a sustained competitive advantage (Hill & Jones, 2011, p.74) when it manages to obtain an above-average profitability during several years. Company success or failure is determined by the competition (Porter, 2005, p.1). Therefore, target market and objective are the main factors in the competitive analysis aimed to determine whether an innovation proposal has commercially viable tendencies.

Strategic Competitive Market Analysis

In order to create a tool that is capable of identifying a company's competitive position, as well as its competitors on the market, it is suggested that the techniques named by David (2009), Hill and Jones (2011), Rowe et al. (1982), Lancaster and Massingham (2011), Gallardo (2012) and Hernández and Sánchez (2005) are used, as summarized in Table 1.7.

	focused on improving the weaknesses in order to take advantage of the opportunities offered by the environment. At times, despite the fact that opportunities exist, weaknesses of the company preclude it from taking advantage of them. ST use company's strengths for avoiding or reducing the impact of the weaknesses from the environment. Companies that copy ideas, innovations and patented products are a big threat in any industry. WT use defensive tactics aimed at reducing weaknesses and avoiding external threats.
Internal External Matrix (IEM)	Based on prior matrices: IFE (X axis) and EFE (Y axis). It is carried out in 4 steps: (1) take the weighted totals from IFE; (2) take the weighted totals from IFE; (3) identify the square where the company belongs; (4) identify the square where the company belongs Within the IE matrix, the weighted total, from IFE or EFE, must be analyzed in the following way: between 1.0 and 1.99 it represents a weak internal position. A rating between 2.0 and 2.99 can be considered an intermediate position, and the rating between 3.0 and 4.0 is a strong position. Create 9 squares with different types of strategic action, such as: cell I, II and IV Growing and Building with intensive strategies (market penetration, market development or product development); integrative strategies (backward integration, forward integration and horizontal integration); cells III, V and VII Preserving and maintaining with penetration strategies in the market, product development; cells VI, VIII and IX reaping and withdrawing with entrenchment, disposal or investment withdrawal strategies.
Grand Strategy Matrix (GSM)	This serves as an alternative strategy formulation, it has 4 squares: X axis has the company's competitive position; Y axis has the market growth speed. Strategies proposed for the companies in Square I (strong competitive position vs. rapid market growth) are as follows: market development, market penetration, product development, forward / backward / horizontal integration and concentric diversification. Strategies proposed for the companies in Square II (weak competitive position vs. rapid market growth) are as follows: market development, market penetration, product development, horizontal integration, investment withdrawal and liquidation. Strategies proposed for the companies in Square III (weak competitive position vs. slow market growth) are as follows: entrenchment; concentric diversification/ horizontal/ in conglomerate; investment withdrawal and liquidation. Strategies proposed for the companies in Square IV (strong competitive position vs. slow market growth) are as follows: concentric /horizontal/conglomerate diversification, shared-risk companies.
Strategic Position and Action Evaluation (SPACE).	Indicates if a strategy is to be adopted, such as aggressive, conservative, defensive or competitive; the axes represent internal and external factors. Internal factors that have to be taken into consideration are as follows: company's financial strength or fortitude, which is labeled FS in the matrix; company's competitive advantage (CA), external factors that have to be taken into consideration are as follows: the stability of the environment surrounding the company (ES), strength or fortitude of the industry, represented in the matrix by SI. It is carried out in 5 steps: selecting variables; rating variables; obtaining totals; defining axes points; charting a vector. A set of variables should be selected, including: Financial strength (FS), competitive advantage (CA), environment stability (ES) and strength of the industry (SI). Rowe et al. (1982, pp. 155-156) suggest considering for FS: investment performance, leverage, liquidity, working capital, cash flow, easy market exit, implicit business risks; for ES: technological changes, inflation rate, variability of demand, competitors price scale, market entrance barriers, competitive pressure, demand elasticity; for CA: market participation, product quality, product life cycle, customer loyalty, use of competitors' capacity, technological knowledge, control over providers and distributors. Lastly, for FI: growth potential, utility potential, financial stability, technical knowledge, taking advantage of resources, capital intensity, ease of market entry, productivity and capacity utilization. Subsequently a numeric value should be assigned to each variable in the FS and SI dimensions, ranging from +1(the worst) to +6 (the best.) Afterwards, a numeric value should be assigned to each variable in the CA and ES dimensions, ranging from -1(the best) to -6 (the worst). A weighted average value of FS, CA, ES and SI is then calculated. Values assigned to the variables at each dimension are added, and they are divided by the number of variables included in the dimension. Average value is obtained for each dimension. The point on the X axis equals to the results obtained by adding FS and EA. The point on the Y axis equals to the results obtained by adding SI and CA. ES and CA results are usually negative. Draw a directional vector from the origin of SPACE vector through a new point of the intersection. This vector reveals the type of

	recommended strategy for the organization: aggressive, competitive, defensive or conservative. Aggressive strategy square: market penetration or development, product development, backwards, forward, horizontal integration, diversifications in conglomerates, horizontal or combined strategies are recommendable. Defensive strategy square: it suggests that a company must focus on getting over its weaknesses and avoiding the threats: entrenchment, withdrawal of investments, liquidation and concentric diversification. Competitive strategy square: backward, forward and horizontal integration, penetration, market development, product development and shared-risk companies. It has 4 squares: Square I industrial strength vs. financial strength (FS), suggests the action type: aggressive; Square II competitive advantage vs. financial Strength (FS), suggests the action type: Conservative. If Square III is used, competitive advantage vs. environmental stability, the strategic profile is defensive strategy. If Square IV is used, industrial strength vs. environmental stability, the action is: competitive.
Quantitative Strategic Planning Matrix (QSPM)	Allows the objective evaluation of alternative strategies. It is carried out in 6 steps: listing factors, defining weights, indicating the strategies to review, grading appeals, calculating totals, prioritizing strategies. This is done in the following manner: Consider the strengths, weaknesses, opportunities and threats defined in SWOT. Assign to each factor the weights defined in IFE and EFE. Review the strategies defined in SWOT and evaluate them in comparison with the results of verified matrices. Select a number between 4 and 5 strategies that have a synergy with SPACE, IE and GSM. These should be listed in the upper part of the matrix. Next, the relative appeal of each strategy must be checked against each strength, weakness, threat and opportunity. Assign a rating from 1 to 4: 1= not attractive, 2= somewhat attractive, 3= quite attractive and 4= very attractive. Grading should respond to the question: "Does this factor affect strategy selection?" If the answer is "yes," then pertinent values should be assigned. If the answer is "no," then it should be left blank. Add weighted grades obtained for each alternative strategy. The bigger the grade obtained by a strategy, the more attractive it will be for the company. This approach allows prioritizing the strategies selected for the implementation.

Source: David (2009), Hill and Jones (2011), Rowe et al. (1982), Gallardo (2012) and Hernández and Sánchez (2005) with our own adaptation

Creativity and Innovation

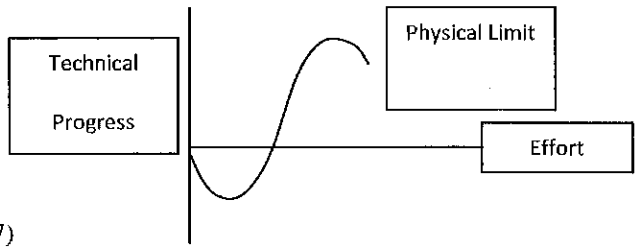
The former arises from the Latin word *creare* which means "produce," "procure." Crea Business Idea (2011, p.8) defines it as the ability for easy generation of ideas, alternatives and solutions to a certain problem. Thus, creativity represents an idea generation process and ceases to do so when such ideas are implemented into practice through innovation. According to the DRAE (2012), it stems from the Latin word *innovatĭo, -ōnis* which means: 1. f. Action and effect of innovating, and 2. f. Product creation or modification. Hill and Jones (2011, p.130) suggest that innovation is the most important source of competitive advantage, since it allows the company to: a) differentiate its products, establishing higher prices and b) reduce its cost structure more than competitors, and its market introduction. Thus, successful launches of new products and services are the principal driving factors of greater profitability (Hill & Jones, 2011, p.130) Cooper (1999) studied over 200 launches of new products and found that out of those that were considered successful, 50% had achieved over 33% return on investment, half of them had an investment recovery period of two years or less and half of them had attained a 35% market share. On the other hand, it should be taken into consideration that the majority of works on innovation are mainly based on the products, while services remain a completely different point of reference due to their particular characteristics, such as intangibility, simultaneity, expiration and homogeneity (Lovelock et al., 2004). Services have managed to dominate the economy of the 21st century, since they create three-

fourths of total wealth and over 85% of employment positions in the US and UK. Nonetheless, little is known about innovation management in this sector (Tidd & Hull, 2003). Elche (2004, p.34) argues that innovation of services is more of a social achievement attributable to teamwork than a technological one. Moreover, services contribute the most to the worldwide Gross Domestic Product (GDP) and in Mexico they correspond to 67%, according to the *World Bank*: *Global Economic Prospects and Developing Countries* (cited by Lovelock et al., 2004, p. 6).

Innovation Types

In the Oslo Manual (OCDE, 2005, p. 56), innovation is defined as the introduction of a new or a significantly improved product (good/service), a process involving a new marketing approach or a new organizational approach, in the internal practices of the company, workplace organization or in external relations, therefore, it does not only include the area of technology, products or services. Likewise, the Oslo Manual (OCDE, 2005, p. 377) recognizes the process of creative destruction, stated by Schumpeter, which mentions two types of innovations: radical - contributing to the significant changes in the world and progressive, which provide a constant feedback to the change process. Our attention has been brought to the model called Foster's S-curve with regard to the innovation life cycle, which explains how the results of a technology-related effort decrease as they draw closer to their limits. The limits of a given technology can be predicted if its physical limits are known by following an S-curve. Refer to Figure 1.1.

Figure 1.1 Foster's S-curve



Source: Afuah (1997)

Technical progress commences slowly, then accelerates quickly and lastly it slows down depending on the physical limits of the technology. The model's added value lies in how to predict the end of an existing technology and the arrival of technological discontinuity.

Innovation Management and Tools

This concept has been defined in various ways, being interpreted as a way of making administration braver and heterodox. The DRAE (2012) defines an administration thusly: a) Administrator in English or "administration" in Spanish (from the Latin word: *administrare*) with an ad-prefix that includes the direction, trends, proximity, contact and

ministrare which means "to govern," "to order"; b) Management in English or "gestión" in Spanish (from the Latin: *gestio, onis*), which means "action" and an effect of managing, in a courageous way. Thus, management applied to innovation can be defined by one of three activity types (Morales, 2002, cited by Ortiz & Pedroza, 2006): 1) Sporadic, with few actions or procedures which resolve a problem, usually with involvement of a single person; 2) Intermittent or those that resolve problems by using the same method or procedure or mechanic, but this can be very specialized; 3) Systemic, such as activities which stimulate pro-activeness, creativity and teamwork on a regular basis in order to obtain a new culture that encompasses a new approach of continuous improvement. The first two types are usually reactive, so under this circumstance, in light of a constantly changing environment, some action opportunities may be lost in the process. Nonetheless, systemic management does not necessarily require a problematic condition, but can be detonated from a condition that is potentially subject to analysis and improvement giving rise to its proactive character (foreseeing a better future). This concept will be used hereinafter in the study, due to its connection to innovation, for observation purposes. Refer to Table 1.8.

Table 1.8 Selected Innovation Management Tools

IMT	Description
Benchmarking (Creativity Technique CT)	A process of improvement by continuous identification, understanding and adjustment to the most appraised practices and processes within and outside of an organization.
Brainstorming (Creativity Technique CT)	Created by Alex F. Osborne (1941). It is divided into: (1) *Brainstorming* with a key word, writing the topic at the top part of the page. All generated ideas are written down, setting the imagination flow in regard to a specific subject. Ideas have to be written down quickly as a list, not worrying about the orthography or the choice of words, etc. The goal is to record the biggest number of ideas-concepts during the least possible time. (2) *Mental maps*, which thoroughly examine the ideas with different graphs associated with the ideas, (3) *Box of Ideas*, where an idea is shown with a number of attributes for the implementation of a combination of such, (4) *Galaxy* starts by writing a topic in the middle of the page/board. Ideas are written down in a circle around it and they are linked to the center with a line. The next idea is written in a circle. If it refers to the first, idea, it is linked through a line, otherwise, it is linked with the center. Each idea is a star, stars may have planets, and planets may have satellites. Thus, a galaxy of ideas is obtained.
Re-Engineering Process (RP)	A radical re-design of processes through 7 steps: (1) Organization around the results, not around tasks. (2) The process must be carried out by those who will use its results. (3) Mixing information processing tasks with the actual production of information. (4) Treating geographically dispersed results as if they were centralized. (5) Relating parallel activities in the place where their results will be integrated. (6) Making decisions at the place where the work will be carried out and establishing controls over this process (7) Registering the information only once and at the source.
Change Management	This is a process used to align company's staff members and culture with system changes, business strategy and organizational structure. It consists of 3 phases: (1) Preparation for a need to change at the entire organization, with a wide evaluation of the situation in order to quickly identify main opportunities and chances for

	success. It divides the organization in smaller groups. (2) Planning and problem resolution based on the creation of a model; development of evaluation of ideas; selection of ideas, implementation and communication. (3) Implementation with continuous monitoring of improvements.
Concurrent Engineering (CE)	It consists of a simultaneous implementation of market research, design, development and production planning for new or improved products. It consists of 7 phases: (1) Project identification. (2) Project scope. (3) Needs and analysis. (4) System design. (5) Development planning. (6) Construction. (7) Installation and evaluation.
Continuous Improvement	It considers a production process as a situation of *continuous work improvement.* It consists of 7 phases: (1) Identification of the improvement area. (2) Process evaluation (3) Analysis. (4) Action. (5) Study of the results. (6) Standardization of the solution. (7) Future planning.
Design for Manufacturing and Assembly (DFMA)	This is a design tool for *function X* (DFX). This is a systematic procedure aimed at helping the companies to take greater advantage of the existing manufacturing processes and to keep a minimum number of assembly pieces. It consists of 7 phases: (1) Design concept. (2) Assembly design. (3) Selection of materials and low cost process. (4) Concept of the Best Design. (5) Design for manufacturing. (6) Prototype. (7) Production.
Design for "X" Function (DFX)	This is one of the most effective approaches that can be put into practice for Concurrent Engineering. It consists of 7 steps: (1) Product analysis (2) Process analysis. (3) Performance measurement. (4) Comparative Benchmarking. (5) Diagnosis for improvement. (6) Advice for the introduction of change. (7) Prioritizing.
Failure Mode and Effects Analysis (FMEA)	A strong discipline of quality assurance used to identify and minimize the effects of potential problems in the design of products or processes. This technique was formalized at NASA in mid-1970s, and it was used for the first time by Ford North America in 1972. There can be various types of FMEA - related to design, processes, means or systems; its number of phases depends on the insertion type.
Rapid Prototyping (RP)	A set of sophisticated techniques, which quickly allow obtaining a prototype of physical products. Advantages: it provides techniques that substitute artesian labor. Direct connection with CAD/CAE systems. Dramatic reduction of the *time to market.* Main techniques: Stereo Lithography (SL). Selective Laser Syntering (SLS). Laminated Object Manufacturing (LOM). Fused Deposition Modeling (FDM)
Computer Aided Design (CAD)	Graphic design and computer simulation techniques, which allow for studying the behavior of products or pieces and their automated handling. They allow object modeling by means of 2-dimensional images (2D) in the horizontal plane, or 3-dimensional images (3D) by means of surface modeling (threads) or solids. This technique allows performing simulations of mechanical, thermal, dynamic and structural behavior of modeled objects (by means of analysis by the finite elements method.) Various software packages are available (AutoCAD, Pro-Engineer, CATIA) They allow subsequent connections with special machinery equipped with numeric control production tools.
Value Analysis (VA)	Organized and creative method that employs a process of functional and ergonomic design with the objective of increasing product of process value. Value concept: Need --> Function --> Product. The value is defined as: V=F/C. It is a quotient between product benefits or functions (F) with respect to its cost (C). It consists of 7 steps: (1) Preparation. (2) Information. (3) Analysis. (4) Innovation. (6) Evaluation. (7) Implementation.
Functional Analysis of	Identifying product functions and evaluating the benefits to be obtained. It distinguishes between user-related functions (URF) and product-related functions

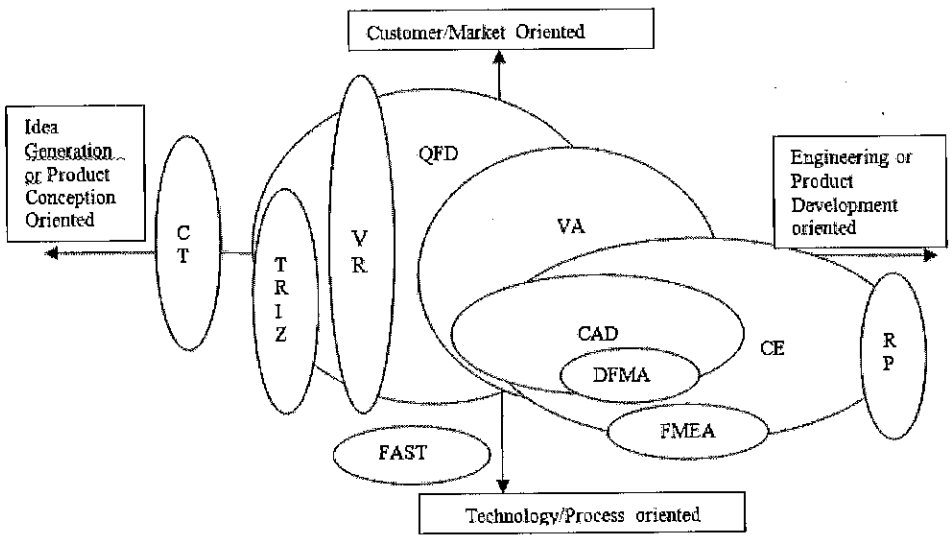
Systemic Technique (FAST)	(PRF). Functional analysis is performed in 5 phases: (1) List of functions. (2) Organization. (3) Description. (4) Hierarchic order (5) Evaluation. (6) Representation of the functional diagram (FAST) of the product or the process.
Quality Function Deployment (QFD)	This technique allows a systemic and structured introduction of the *Customer's voice* during the process of product design and development. Inter-relates the *What* (customer requirements) with the *How* (technical solutions for the satisfaction of such requirements.) Based on the use of different matrices starting off with *Quality House.*
TRIZ	Created by the Russian scientist Genrich Altshuller in 1946 in order to generate ideas and solutions for product creation by means of a so-called contradiction matrix, which consists of 39 physical phenomena which, when combined, can be resolved through 40 empirically valid technical proposals.

Source: Bakouros and Demetriadou (2004) and Mañá (2000) with our own adjustment.

Mañá (2000) allocated the main IMT for the strategy. See Figure 1.2

Based on the below, a proposal of a General Conceptual Model is created. Refer to Figure 1.3.

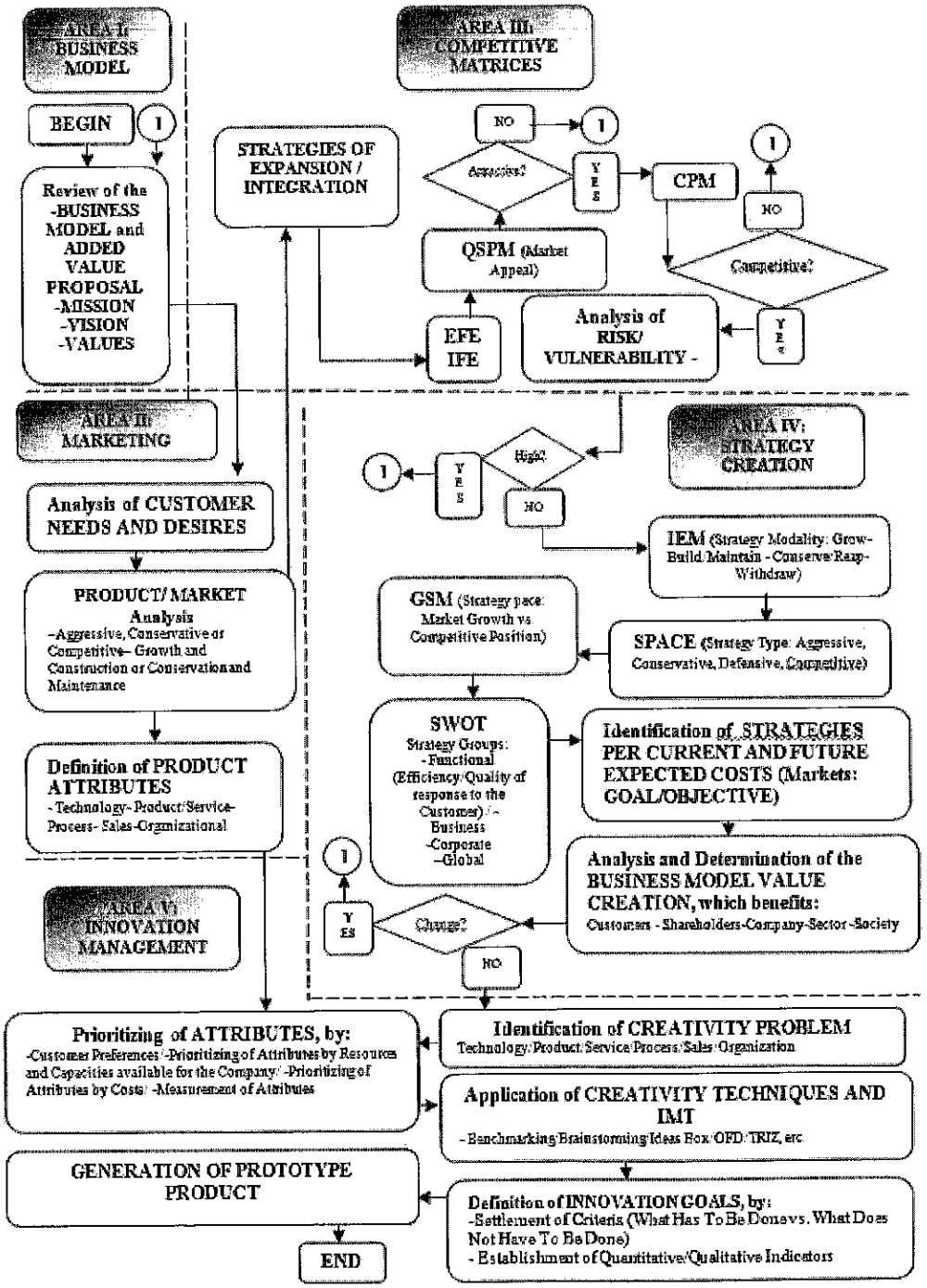
Figure 1.2 Positioning of the Main IMT in the Chain of Value



Source: Mañá (2000) with our own adaptation

RESULTS

Figure 1.3 - General Conceptual Model *ex ante* of the Process that Relates the Business Model, Customer Needs and Innovation Management for the Improvement of Business Competitiveness



DISCUSSION

The conceptual model shows specific areas of analysis and application initiated in ***Area I: Business Model*** (Osterwalder & Pigneur, 2010), which is subject to continuous review based on the proposal for added value, mission, vision and values. Once confirmed, ***Area II: Marketing*** discovers customer's needs, wishes and purchase stimuli (Khan, 2006; Table 1.4) establishing a relationship between the markets, products and actions that satisfy them, both currently and in the near future (Loudon et al., 2005; See Tables 1.5 and 1.6). Criteria are established for attributes of products and services involving tangible and intangible aspects, considered a delivery of satisfying factors (Hill & Jones, 2011) yielding a double result: the definition of a target/objective market to be analyzed, as well as customer satisfaction attributes listed in greater detail. Based on the above, we obtain the input information we need for **Area III: *Competitive Matrices***, which includes *Expansion/Integration* strategies (Loudon et al., 2005) and a strategic matrix is performed (David, 2009; Hill & Jones, 2011; Rowe et al., 1982; Gallardo, 2012; Hernández & Sánchez, 2005; See Table 1.7). Such a matrix reports the external conditions of the market (EFE), its internal conditions (IFE), competitive position (MPC) and appeal (MCPE), a risk/vulnerability analysis, which provides the management with decisive elements for continuing into ***Area IV: Strategy Creation***. Here, difference is made based on the main internal and external factors, defining the modality (IE) and type (SP&AE), as well as the strategy's pace (MGE). The aforementioned elements define the base for the performance of the SWOT analysis. At this level, cost analysis of current strategies and proposals must be carried out both in terms of the target market as our goal, as well as a review of the added-value proposal based on value beneficiaries (Bonel et al., 2003; see Table 1.2) and the value process (White & Bruton, 2011; See Table 1.3). If there are any signs of deviations, actions should be adjusted to match the business model and/or the added value proposal. As a result, the following is obtained: identification of innovation problem per type: technology, product/service, process, sales and organization (OCDE, 2005) with the creation of objectives and goals resulting from the SWOT. Lastly, we can advance into **Area V: Innovation management**, which by pointing out a creativity problem is subject to the application of techniques and other innovation management tools (Bakouros & Demetriadou, 2004; Mañá, 2000; See Table 1.8) prioritizing them depending on the attributes.

CONCLUSIONS

GO, as well as SO1 and SO2, were reached 100% in response to GQ, Q1 and Q2, as well as the GH. It has to be pointed out that the elements that were discovered along the process are immersed into a generalizing model, which covers solutions at a conceptual level that are to be detailed at a deeper level: technology, products, services, processes, sales and organization that are not a part of this study's scope but that contribute to the improvement of the director/manager decision-making process in order to improve competitiveness, based on the market and on the Innovation Management Tools that are available.

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2 Global competences of employees in Hispanic enterprises on the U.S./Mexico border

Monica Blanco-Jimenez, Juan Rositas-Martinez and Francisco Javier Jardines-Garza

INTRODUCTION

Institutions of higher education in the United States face many challenges in preparing students to become interculturally competent in the global marketplace. These institutions have the task of remaining intellectually and culturally relevant in a rapidly changing world. Some researchers suggest that universities should make a deeper commitment to preparing graduates worldwide, but the burden of providing an international education falls on both universities and government agencies. They must increase the number of international student and teacher exchanges and create and integrate transnational educational consortia.

If students have better international preparation, they can develop their global competences in multinational or Hispanic enterprises and companies will therefore perform at a higher level and be more competitive. Multinational companies in the United States, for obvious reasons, have a greater need for global employees. This is especially true in the case of companies located on the U.S./Mexico border where there are geographical market dynamics between the two countries. For this reason, the objective of this research is to determine whether employees who work in the Hispanic businesses located on a border region, such as in the city of Tucson, Arizona, have the appropriate level of global competences necessary to work effectively in these international companies and if American universities in this area adequately prepare their students to be competitive.

But what exactly is global competence? This is currently a very widely discussed topic. In our research, we found definitions that include elements such as having the ability to speak other languages, having knowledge of other cultures, as well as possessing components of flexibility, empathy and adaptability to other cultural, political and business environments (Lambert, 1996; Olson & Koege, 2001; Curran, 2002; Brustein, 2003; Deardorff & Hunter, 2004; Blanco, Fasci, & Valdez, 2009).

We agree that global cross-cultural competence includes knowledge, skills, attitudes and experiences that enable a person to have effective interaction with people from other cultures. In our study, we adopt the definition created by William Hunter (2004) in his research on global competence. Hunter proposed, in his study on strategies to internationalize American institutions, some elements necessary to becoming globally

competent: Knowledge of others and one's self; the skills to interpret, interact and discover; and the ability to value the beliefs, values, and behaviors of others.

By analyzing the existing need to have a more international education in order to create employees with greater global competence, our research question focused on asking if employees of Hispanic businesses in the Tucson metropolitan area (on the United States-Mexico border) have global levels of knowledge, skills, attitudes and experiences to be considered globally competent, thereby enabling them to perform more competitively. This work will present a review of the literature, a discussion of the methodology for the examination of the research question, our findings and some conclusions.

LITERATURE REVIEW

International Education

To offer an international education, institutions of higher learning should be preparing students in a global environment, which would facilitate their learning about other cultures. This, in turn, would increase sales or allow them to provide services to other foreign companies. Employees should also speak other languages in order to communicate freely and work multilaterally. They also must learn to interact with people from other countries in order to improve the competitiveness of these businesses, especially in the case of multinational corporations. It is equally important that employees have strong knowledge of the geography and history of other countries.

At present, most countries should work toward offering an international education to students, which would award them greater global competence for when they begin working in international companies. In the case of the United States, the lack of global competency in the educational system became evident in the 1950s. The National Defense Education Act noted in 1958 that only 15% of all college students were studying a foreign language at that time. They acknowledged America's need to confront serious deficiencies in many fields, including the inability to communicate with foreign audiences. To rectify this problem, the Educational Act helped create the establishment of foreign language learning centers at universities around the country.

The lack of global competence, 50 years later, is still an issue. In 2002, other problems emerged in the American international educational system. For example, the very low rate of participation in student exchange and study abroad programs, estimated at 3%, is a scandal as Godbey and Turlington (2002) have pointed out. The problems extend into secondary and primary education, according to research undertaken by the *National Geographic Society* on the knowledge of school-aged students from a variety of countries regarding world geography where the American school children ranked in the bottom third (*National Geographic Society*, 1998).

To have an international education, the American system needs to expand globalization in teacher education programs in order to prepare globally minded teachers. Only a few

colleges and universities have organized international field experiences that truly meet intercultural competences, international collaboration and global awareness to teach from a global perspective. Merryfield's (1995) research demonstrated that many employers are discontented with American colleges and universities because they do not prepare their graduates to become part of the global workforce. Maxwell, in *Business-Higher Education Forum 2004*, concurred, saying, "The U.S. higher education system is doing a terrible job of preparing globally competent students" (p. 29).

These studies emphasize the need to increase global education in universities. In order to achieve a truly international education, the educational system also needs to expand the level of globalization in teacher education programs in order to prepare globally-minded teachers who will impart global knowledge to their students. Colleges and universities need to increase international field experiences for the teachers themselves in order to truly create intercultural competencies, international collaboration and global awareness to teach from a global perspective.

The importance of global education is also supported by Cendant Mobility, a global relocation management firm. They have shown the need to impart global education in order to improve the competitiveness of businesses. In a survey conducted in 2002 that polled 180 human resource managers on six continents who collectively managed 200,000 people, they found that global competence is critical to the success of cross-border workers (Cendant Mobility, 2002). Also, a study by Green (2000) suggests that before becoming globally competent students must be globally literate and possess a high degree of international understanding and intercultural competence.

Similarity, Broad (1998) argues the necessity for increasing international education, as research shows that mid-level managers, chief executive officers and human resource professionals consistently state a need for college graduates who are "knowledgeable about the global environment in which they must function and be facile in the cultural diversity it entails" (p. vi). For this reason, colleges and universities must make a deeper commitment to prepare global-ready graduates.

Global Competences

The need for employees to gain global competence through international education is very important because we are currently working in a globalized world with fewer and fewer business or geographical barriers. As Godbey and Turlington (2002) argue, globalization *is arguably the central social, cultural, political and economic phenomenon of our times.* Work, in both the non-profit and for-profit sectors, is increasingly geographically distributed, technologically mediated, team-based, international collaborative and multicultural. It is a phenomenon that represents an emerging world-wide interdependence of individuals and countries. Colleges and universities must plan their futures in the context of a globalizing world where not only economic production but leisure, social and welfare policies are now subject to external influences.

This phenomenon of globalization has impacted nearly all national and multinational companies. Firms compete daily with other companies in the world; their products can be sold anywhere on the globe. With the advancement of telecommunications and transportation comes a more competitive international market, so companies have to make a greater effort to compete successfully in a global market. For this reason, companies require international employees who have the knowledge, skills, attitudes and experiences (global competence) that enable them to penetrate the world market more easily.

Many authors have worked to define what a person needs in order to claim global competence. Olson and Koeger (2001) surveyed staff and faculty at New Jersey City University to assess the relationship between international experiences, intercultural sensitivity and global competence. Their results led them to define a globally competent person as "one who has enough substantial knowledge, perceptual understanding and intercultural communication and skills to interact effectively in our globally interdependent world" (p.116). Lambert (1996) identifies a globally competent person as someone who has knowledge of current affairs, empathizes with others, maintains a positive attitude, has an unspecified level of foreign language competence and values differences between people and cultures. In the private sector, the Swiss Consulting Group, a transnational management firm, identifies, in its *Global Competency Report 2002*, five essential global skills: Intercultural facility, effective two-way communication, diverse leadership, systematic best-practice sharing and a truly global design process strategy.

In the U.S. educational system, William Brustein (2003), Director of the University Center for International Studies at the University of Pittsburgh, defines global competence as "the ability to communicate effectively across cultural and linguistic boundaries and to focus on issues that transcend cultures and continents." For Brustein, the different aspects of global competence include the ability to work effectively in different international settings; an awareness of the major currents of global change and the issues arising from such changes; knowledge of global organizations and business activities; the capacity for effective communication across cultural and linguistic boundaries; and a personal adaptability to diverse cultures.

The social researcher William Hunter (2004) established in his thesis a definition of the term "Global Competence." Using the Delphi Technique (Group Techniques for Program Planning), he asked a panel composed of 17 experts who were either international educators or human resources managers/directors for transnational corporations and 42 human resources managers to define the term "global competence." The panel defined global competence as "Having an open mind while actively seeking to understand cultural norms and expectations of others, leveraging this gained knowledge to interact, communicate and work effectively outside one's environment" (p.1).

In all of these definitions we can find common aspects, such as knowledge, skills, attitude and experience with respect to the outside world. If we review the basic concept of competencies, we find these topics are closely related. A competency is a set of defined behaviors that provide a structured guide enabling the identification, evaluation and development of the behaviors in individual employees. Some scholars see "competence" as a combination of knowledge, skills and behavior used to improve performance or as the state or quality of being adequately or well qualified, having the ability to perform a specific role.

In this paper, we consider it necessary to include the experience one has with the outside world in order to have global competence Not only are knowledge, skills and behavior (attitude) important, but so is the experience with the outside world as it can help further develop global competences of employees. For this reason, we adopt the outline that Hunter presents in his thesis where he integrates an instrument of 22 questions or a "Global Competency Checklist" to measure the knowledge, skills, attitudes and experiences necessary to becoming globally competent.

The following are some concepts that Hunter defines in each of the elements of global competence of employees:

- **Knowledge:** Understanding cultural norms and expectations, globalization terms and supranational entities, knowledge of world events and world history.
- **Skills:** Ability to speak English and at least one other language, be linguistically and culturally competent, have the ability to live outside one's own country, collaborate across cultures, participate in projects with people from other cultures and traditions.
- **Attitudes:** Recognition of other cultures, a non-judgmental attitude, openness to new experiences, ability to cope with different cultures.
- **Experiences:** Foreign trips of a long or short duration, experience of culture shock, regular interaction with people of other cultures, study abroad.

METHODOLOGY

Having studied the theoretical framework that allows us to analyze the elements of global competence that require employees to be internationally competitive and based on the objective of our research, we propose the following hypothesis: Most of the employees working in Hispanic businesses on the southern border of the United States have the necessary skills to be considered globally competent. The employees have a good level of global competence (knowledge, skills, attitudes and experiences) represented by an agreement that *the population mean* for each Likert statement is ≥ 4 (Likert scale level = 4: Agree). An alternate hypothesis is *that the population* mean is less than 4. Hence, the null and alternate hypotheses are as follows:

Hypothesis: H_o: $\mu \geq 4$ (agree), H_1: $\mu < 4$

To prove our hypothesis, we conducted a survey using the Likert scale choices (1=Strongly disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly agree). Our survey instrument was based on Hunter's (2004) consensus definition of the term "global competence," as devised by the Delphi panel and a review of the relevant literature. We integrated 15 questions based on the 22 question survey of William Hunter's "Global Competency Checklist," which measures global competencies.

We decided to use Hunter's instrument as a base. Several important reasons influenced the decision to work with the Hunter questionnaire. The first was because the questionnaire was integrated and validated based on the results of work sessions he had with several leaders in the field, including experts on international education and human resources managers and directors of transnational corporations who understand the subject of global competence.

The second reason we used Hunter's instrument is that the questionnaire was sent to 133 international educators at higher educational institutions from universities that self-nominated for inclusion in the "Profiles of Success at College and Universities Internationalizing the Campus 2003," and to 42 human resource directors representing transnational corporations, in order to measure the global competencies of employees. We believe that these aspects validate the use of his survey to measure global competence.

The third reason is due to the fact that, in our study, we wanted to measure the global competence of employees in Hispanic enterprises located on the U.S./Mexico Border, which makes them transnational corporations.

Our survey is divided into three sections. The first section is designed to extract general information about the characteristics of Hispanic enterprises located in Tucson, Arizona; the second section measures the global competence of the employees; and the third section defines management style of employee's organization in order to characterize the degree of employee participation found in the workplace. In this paper, we analyze only the second section of the questionnaire to measure the knowledge, skills, attitudes and experiences of the employees.

The instrument was pilot-tested to ensure that respondents understood the questions, the terms used in the survey and the potential uses for the data collected. There were some changes. We decided to alter some of Hunter's questions to make them more comprehensible and eliminated others. We also included two more questions to assess whether universities in the U.S. provide global education to their students.

Procedures

The data used in this paper were collected from the Tucson Hispanic Chamber of Commerce. It has 643 members including both Hispanic and non-Hispanic-owned businesses. Reviewing the database, we were able to determine an approximate of 67

small and medium Hispanic-owned businesses. In 1989, the Tucson Hispanic Chamber of Commerce (THCC) was incorporated in the State of Arizona. The purpose of the Chamber is to provide, promote and advance, on a nonprofit basis, the general welfare and prosperity of the Tucson area. We selected small and medium Hispanic-owned businesses only because we believe that these companies, due to their proximity to the border with Mexico and the dynamic lifestyle in Tucson, Arizona, may require even more employees who have global competence in order to successfully run their businesses and increase their competitiveness.

The questionnaire and cover letter were sent electronically to the 67 owners of the Hispanic enterprises. The e-mail invitation to complete the questionnaire assured the anonymity of the respondents, who were sent to a website accessible to the authors via hyperlink. Additional information was gathered in direct interviews with managers of the Hispanic Chamber enterprises during several luncheons with the support of the Chair of the Business Education Committee of the Chamber.

In this research project, we decided to apply the survey to managers or owners of Hispanic businesses located in Tucson based on the size of their businesses. Most of the selected companies are small to medium Hispanic businesses. Some of them only consist of a business owner, in some cases Mexican-American entrepreneurs. The managers of these companies, due to the small number of employees, usually know more about their employees therefore enabling them to estimate the knowledge, skills, attitudes and experiences that their employees may have in the international arena. We chose to survey managers, rather than the employees themselves, because it was more difficult to draw a sample of all the employees of all 67 companies and very difficult to survey each one.

The number of total responses was 40. We sent 67 questionnaires by e-mail and had 13 returned (a 19% response rate). From personal interviews with members of the Tucson Hispanic Chamber of Commerce, 27 more were collected (67% response rate). The final sample size for our research was 40 respondents. We believe that this sample is representative, especially if we rely on studies conducted by Iacobucci and Duhacheck (2003) for confidence and reliability measurement of instruments, where it is shown statistically that the minimum sample size for research in management science can be 30 surveys.

RESULTS

In order to test the internal consistency of our instrument, we calculated Cronbach's alpha coefficient for each competency indicator group and contrasted our values with the following values required by standard convention. An alpha value of 0.60 is acceptable for exploratory research. It should be at least 0.70 to be considered adequate and a minimum criteria of 0.80 is required to be considered a good instrument.

According to Nunnaly and Bernstein (1994), an alpha reliability value of 0.70 could be considered satisfactory for exploratory research, but for other scenarios these researchers state that a value of 0.80 or even 0.90 should be required (pp. 264-265). The reliability of our instrument (Table 2.1) is good, considering these minimum levels.

With an alpha value of 0.80 as the cutoff point for adequate consistency, we found adequate Cronbach alpha levels for four groups: Knowledge (0.862), skills (0.870), attitudes (0.849) and education (0.800). The remaining group, experience (0.673), did not reach an adequate level, but it could be considered acceptable for exploratory research.

Table 2.1 Instrument Reliability

	Cronbach's alpha	Confidence interval	
		Lower Bound	Upper Bound
Knowledge	0.862	0.774	0.921
Skills	0.870	0.788	0.926
Attitudes	0.849	0.742	0.849
Experience	0.673	0.417	0.827
Education	0.800	0.655	0.890

After analyzing the reliability of our instrument, we analyzed the results of each of the elements of our hypothesis (Table 2.2) based on the Likert type levels: 1= Strongly disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly agree. We thought that an adequate level for a globally competent employee should start at 4 and we tested our hypothesis for each indicator. The results for the hypothesis were: H_o: $\mu \geq 4$ (agree), H_1: μ □ < 4. Our null hypothesis for each indicator was Ho: μ =4 and our alternate hypothesis was $\mu \leq 4$ at a 0.01 significance level.

The critical value for a 0.01 significance level, where the sample size equals 40, is $t_{□ = 0.01, n-1} = -2.43$. The decision rule was: Accept H_o if $t > -2.43$, reject otherwise. In Table 2.2, most of the statements of our hypothesis related to intercultural global competencies were not supported. Only two of our 17 questions on global competency hypothesis were supported or accepted, which refers to the following: "Most employees have an understanding of cultural norms and expectations of his or her own culture" (Var 9) and "Most employees have the ability to work with people from other cultures and traditions" (Var 13).

Table 2.2. Hypothesis Testing for Global Competences in Hispanic Enterprises

Hypothesis: H_o: $\mu = 4$ (agree), H^{1}: $\mu < 4$				$t_{\alpha=.01, n-1}$ -2.43		
Var	**Description**	**Mean**	**St. Dev**	**t value**	**Decision**	**p-value**
KGlob06	**Most employees have an understanding of the concept of "globalization"**	3.15	1.09	-4.85	not supported	0.000
KWorld07	**Most employees have knowledge of current world events**	3.41	0.99	-3.71	not supported	0.000
KOCul09	**Most employees have an understanding of cultural norms and expectations of people from other cultures**	3.31	0.95	-4.55	not supported	0.000
OwCul09	**Most employees have an understanding of his or her own culture**	4.05	0.69	0.47	**accepted**	0.322
SpLang10	**Most employees speak at least one other language in addition to English**	3.26	1.14	-4.07	not supported	0.000
OthCu11	**Most employees have successfully participated in projects with people from other cultures and traditions**	3.46	1.07	-3.14	not supported	0.002
LivOth12	**Most employees have the ability to live outside his or her culture**	3.31	1.13	-3.83	not supported	0.000
WkOth13	**Most employees have the ability to work with people from other cultures and traditions**	3.69	0.98	-1.97	**accepted**	0.028
NoUniv14	**Most employees recognize that his or her own world view is not universal**	3.45	1.06	-3.22	not supported	0.001
NotJud15	**Most employees have a non-judgmental reaction to cultural differences of other cultures and traditions**	3.36	1.11	-3.6	not supported	0.000
CrCul16	**Most employees are willing to take risks in pursuit of cross-cultural learning and personal development**	3.41	0.99	-3.71	not supported	0.000
IntAct17	**Most employees interact regularly with at least one foreign business culture**	3.41	1.04	-3.53	not supported	0.001
SpWk18	**Most employees speak another language more than 25% of the time at work**	3.13	1.24	-4.39	not supported	0.000
KTrip19	**Most employees have knowledge and experience gained from multiple short-term trips abroad to a variety of countries**	3.27	0.8	-5.21	not supported	0.000
Bach120	**Most employees hold a Bachelor's degree or its equivalent**	2.97	1.14	-5.47	not supported	0.000
EmpGE21	**Do you think your employees have received formal education in "Global Competences?"**	2.51	1.04	-8.66	not supported	0.000

UnGlEd22	**Do you think that, in general, colleges and universities in the U.S. currently provide "Global Education" for their students?**	2.97	0.93	-6.74	not supported	0.000

Likert scale: 1= Strongly disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly agree

DISCUSSION

It is interesting to analyze the results of each global competency:

-With regard to knowledge: Employees seem to have knowledge of their own culture but not of other cultures and their knowledge of current world events is low. This is evidenced by the lack of understanding of the concept of globalization.

-With regard to skills: Even though employees have the ability to work with people from other cultures, the managers report that they have less successful participation when they are working on projects together. Most of them do not speak a second language and the managers indicate that they have problems living outside their own culture.

-With regard to attitude: The respondents showed a good international attitude reflected in risk-taking in pursuit of cross-cultural learning development. They recognize their own world view is not universal, but some had a judgmental reaction to cultural differences between their own and other cultures and traditions.

-With regard to international experiences: Though all respondents reported having taken multiple short-term trips, only a few engaged in cross-cultural business interactions and not all of them spoke a foreign language at work.

-With regard to international education: Even though half of the respondents held a Bachelor's degree, they needed additional international competences to work effectively in the Hispanic enterprises where they were employed.

Finally, our general results show that Hispanic business entrepreneurs, located on the U.S.-Mexico border, think their employees are missing a formal higher education in global competence to make them internationally competitive and they believe colleges and universities in the U.S. need to increase global education.

CONCLUSION

Our conclusion is that there is not enough evidence showing that employees of Hispanic-owned businesses have adequate levels of knowledge, skills, attitudes and experiences to be considered globally competent. Even though some of them have international experiences and attitudes, they need to increase their international competency in the area of knowledge and especially international skills.

If the employees that we interviewed seem like the most likely individuals to be globally competent, since they work for Hispanic enterprises in a predominantly Anglo country on the border with Mexico, and since they almost necessarily have to speak

Spanish and English, these results seem surprising in that the owners of these companies consider their employees have such low levels of global competence.

Another lesson learned worth mentioning is that living on/near the border with a foot in two different worlds does not guarantee global competence. This adds important insight into the study of the nature of global competence and it strengthens the suggestion that universities need to add or increase the global component in their education in order to bolster students' knowledge and international skills (the two areas most lacking in employees of Hispanic-owned business

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3 The role of leadership at a telephone call center in an enterprise that markets and distributes electric power in the northwestern part of Mexico

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INTRODUCTION

As organizations aim to enhance high productivity standards, they must establish strategies that allow them to provide quality services to their customers. When developing such strategies, call centers are considered to be important service and contact factors between organizations and their customers.

Call centers, since the 1990s, have been the most important form of contact with customers within information economies. They have become creators of employment for millions of people in the United States and for hundreds of thousands in different countries in Europe, Australia and recently in India. Although the literature in regards to this topic is not very abundant, Russell (2008) offers an interesting analysis relative to his research on call centers. Regarding human resource management, the author emphasizes different perspectives regarding management of human resources. Some interesting relationships are offered, such as those by Kinnie et al. (2000a) who studied the paradoxical relationship between surveillance exercised by supervisors at call centers and the attempt to include entertaining activities as "shock-absorbers" (or activities to *soften* interactions). In this context, deliberate efforts are focused on creating idiosyncratic cultures through the participation of personnel in construction games and other activities provided by the management to promote social activities, trying to improve the most oppressive aspects of the working process at call centers. Some authors (Russell, 2002) have studied manufacturing sociability (*maquila* style) that has characterized call centers, while Townsend (2004) and van der Broek (2002) have emphasized how important it is to work on the construction and development of team work. Other researchers (Batt, 1999, 2000, 2002; Hutchison et al., 2000), have emphasized the possibility of using systems of practices that tend to develop High Performance Working Systems (HPWS), while other approaches have tried it through what we know as TQM — total quality management — and re-engineering processes at call centers (Knights & McCabe 1997, 1998). It is quite interesting to observe the evidence found in the case studies of Kinnie et al. (2000b) and Hutchison et al. (2000). They found that practices known as high commitment management, in which there is an identification with the promotion of team work practices (team-building) whose activities are focused on the entertainment factor, the management carrying out a selective recruiting and selection process, focused training, two-way communication, performance connected with compensation and job

security, are meant not only to relieve control of functions of high electronic surveillance, but to generate a commitment with organizational objectives from the working force.

Leadership is a topic that influences personnel management of call centers in an important manner, especially when the number of transactions that take place between customers and the personnel of the organization on a daily basis can be a creator of stress (Coronado et al., 2010) and can influence personnel's commitment towards the goals of the organization (Ali et al., 2011). Any research on this topic undoubtedly becomes appealing to researchers and academics (Bateman & Snell, 2003) since, directly or indirectly, consciously or unconsciously, they participate or are influenced by leadership.

Robbins (2000) defines leadership as a process of having an influence over a group, in order to achieve goals, and a leader as someone who can influence others and who has managerial authority. Managers are considered successful when they can adjust their behavior according to the organization's requirements, depending on the demand of the prevailing situation. These managers can adopt a leadership pattern according to the needs at the time.

The leadership that is required in order to direct the changes within organizations, according to Bass and Avolio (1990), is transformational leadership. Transformational leadership is added to transactional leadership effectiveness; transactional leadership does not substitute transformational leadership. Empirical studies in regards to this topic (Waldman, Bass, & Yammarino, 1990) support Bass's supposition. The best leaders are those who have both styles, transactional and transformational, although the tendency of the main researchers of the subject shows a preference for the transformational leadership style (Bass, 1999).

PROBLEM STATEMENT

The Northwestern Distribution Division of the Federal Bureau of Electric Power (C.F.E.) is responsible for distributing and marketing electric power. Therefore, it has focused its quality and competitiveness processes on satisfying the needs and expectations of its customers, which by December 2011 were about 1,797,443 users whose demands by that period was a total of 3,395 megawatts. The C.F.E. call center in the northwestern division was created in 2003 with the aim of forming a connection between customers and the company through highly qualified personnel (call center executives) who, by means of the phone number 071, provide service to enquiries that originate in the state of Sonora (with an area of 184,934 km) and Sinaloa (58,488 km), thus representing a total of 243,422 km, as well as calls that are re-directed from other states. There are 161 employees at this call center. During the year 2011, they serviced an average of 65 telephone calls a day per employee, thus providing, among other services, consulting services to their low, medium and high tension customers, attending problems related to the collection of power consumption rates, home and entrepreneurial outlets, interruption of electric power due to suspension, re-connections or contingencies, signature of new

agreements and solving problems involving special services (relocation of poles, feasibility studies for special projects, increases in electric charge, etc.). Aiming to contribute to the productivity and social responsibility of the company, the profile of the human team required to achieve the strategic objectives must be based on solid leadership that encourages principles, ethical values and a culture of results achieved through highly qualified personnel to solve the problems presented by the customer based on a wide knowledge of the business, service quality, quick response and kind treatment.

RELEVANCE OF THE STUDY

In any enterprise, leadership is a very important pillar for success or for failure and has an influence on the establishment or the creation of a determined organizational environment and culture (Bass, 1999, p. 16). Additionally, leadership performance has a very important influence on the actions of individuals, as well as the high quality results that they must achieve for the growth and sustainability of the organization and its image in society.

Call center leaders at the enterprise being studied, through their Telephone Service Executives, are required to fulfill some productivity indicators, whether as a group – index of total serviced calls, index of serviced calls without disconnection; whether considering productivity of their work force – occupation percentage, availability percentage, average time spent on each call, daily average of calls served by each executive; or whether through the fulfillment of indicators to identify quality offered to the customer – call monitoring, surveys related to the phone service; or whether through the efficiency of the processes – cancellation percentage, rejection percentage, percentage of unsuitable situations and operation indicators. Leadership, as a consequence, has a great influence on many of the organizational results. It determines every aspect of the company, for human capital and for the customer. Thus, the relevance of measuring leadership variables in a call center aims to achieve effective results and expected satisfaction through leadership (Ahmad & Musarrat, 2010), as well as getting the extra effort demanded both by the enterprise and by society from their members by committing to the vision of good leaders who abide by the organization's mission.

OBJECTIVES

General Objective

In our study, we determine if, according to the dimensions of the theoretical model of Multifactorial Leadership (Bass & Avolio, 1995), leadership perceived by the employees of a regional call center of a Mexican public enterprise that markets and distributes electric power in the northwestern part of Mexico can be measured.

Specific Objectives

1. Determining if there is a positive relationship between the indicators: idealized influence (tribute), idealized influence (behavior), motivational inspiration,

intellectual stimulation, individualized consideration and the transformational leadership dimension.
2. Determining if there is a positive relationship between the indicators: contingent reward (prize), management by active exception and the transactional leadership dimension.
3. Determining if there is a positive relationship between leadership measured as transformational and transactional, with the dimensions of the results presented in the theoretical model of Multifactorial Leadership (Bass & Avolio, 1995).
4. Determining if transformational leadership is co-related with transactional leadership.

RESEARCH QUESTIONS

In order to achieve the aforementioned objectives, the following questions have been proposed:

1. Can the transformational leadership dimension be measured with the indicators: idealized influence (tribute), idealized influence (behavior), motivational inspiration, intellectual stimulation and individualized consideration?
2. Can the transactional leadership dimension be measured with the indicators: contingent reward (prize) and management by active exception?
3. Is there a positive relationship between leadership measured as transformational and transactional, with the dimensions of the results presented in the theoretical model of Multifactorial Leadership (Bass & Avolio, 1995)?
4. Is transformational leadership co-related with transactional leadership?

LITERATURE REVIEW

Transformational and Transactional Leadership

Several authors (Bass & Avolio, 1985; Bass, 1990; Bass & Avolio, 1994) have developed the theory of transformational leadership, which is the culmination and extension of work that has been provided by Bennis and Nanus (1985), Burns (1978) and Tichy and Devanna (1986), among others.

Bass and Avolio (1994) suggest that leaders who are charismatic and who encourage their employees, inspire them, consider them individually and stimulate their intellectual needs are transformational leaders. The authors propose that transformational leadership is comprised of four dimensions. The first dimension is idealized influence. Leaders receive admiration, respect and a high degree of confidence. Their followers tend to acknowledge their leaders and they feel proud to be like them. Leaders are appreciated by their subordinates, because they have an additional level of capacities, a greater degree of persistence and true determination. These leaders can be trusted and relied upon, because they tend to do things right and show a high level of ethics and moral conduct.

The second dimension is motivational inspiration. This dimension is reflected by behavior that provides significance and a challenge to the labor of their followers. This includes behavior that articulates clear expectations and that shows commitment to several goals of the organization. To summarize, the spirit of the team is lifted through their enthusiasm and optimism.

The third dimension is intellectual stimulation. Leaders who show this kind of transformational leadership promote new ideas and creative solutions for the problems of their followers and they encourage original approaches for the development of their labor.

The fourth dimension is individualized consideration. It is reflected by leaders who listen to their followers in an attentive manner, and who pay special attention to their achievements and needs for growth (Tracy & Hinkin, 1998, 221-222).

Transformational leaders become responsible for performance beyond the ordinary expectations. They communicate a sense of mission, stimulate learning and awaken new ways of thinking; they encourage their followers to do more than what was originally expected. This is how transformation can be achieved: a) by re-birth of a consciousness of relevance and valuing the interests of each person, b) by getting followers to transcend their own individual interests, or c) alternating or expanding the needs of the followers according to Maslow's hierarchy of needs (Bass, 1985).

Transactional Leadership

Hater and Bass (1998) define two dimensions of this kind of leadership:

> a) Contingent reward: the leader provides rewards if the performance of the follower is in accordance to the agreed terms, if the effort is necessary.
> b) Administration-by-exception: the leader avoids giving directions if the old ways are working and he/she allows his/her followers to keep on doing their jobs as usual, as long as the performance goals are known (Hater & Bass, 1998, p. 695-696).

Dan Hartong, Van Muijen and Koopman (1997) mention that all of the transactional leadership theories are profiled based on the idea that leader-collaborator relationships are grounded in a series of exchanges or implicit negotiations between leaders and collaborators. Transactional leaders are there to clarify the requirement of the roles and the tasks of the collaborators (Bass & Avolio, 1990, p. 237).

There is a contrast between transactional leadership and transformational leadership but that does not mean that they are not related. Transformational leadership can be seen as a special case of transactional leadership; both approaches are connected to the achievement of a goal or objective.

Some authors, such as Avolio and Gibbons (1998) and Tichy and Devanna (1986), mention that transformational leaders differ from transactional leaders because the latter simply do not acknowledge the needs of their collaborators. However, they also try to elevate their needs, from smaller to greater development and maturity levels. Changes based on transactions with the collaborators represent small but significant improvements, both in effort and yield, while changes based on transformation are generally greater and of a higher order in terms of their effort, development and yield (Bass & Avolio, 1990, p. 241).

As Waldman, Bass and Yammarino demonstrated in 1990, transformational leadership does not replace transactional leadership, but it increases transactional leadership by achieving the goals of leader, collaborator, working team and organization.

Proposed Research Model

For over 30 years, leadership models took into consideration approaches focused on aspects related to personality characteristics, to the leaders' behaviors and situational and contingency aspects. The latest approaches to leadership take into consideration aspects that are related to the transformation of both individuals and organizations. The model for this work (Figure 3.1) takes into consideration the following variables:

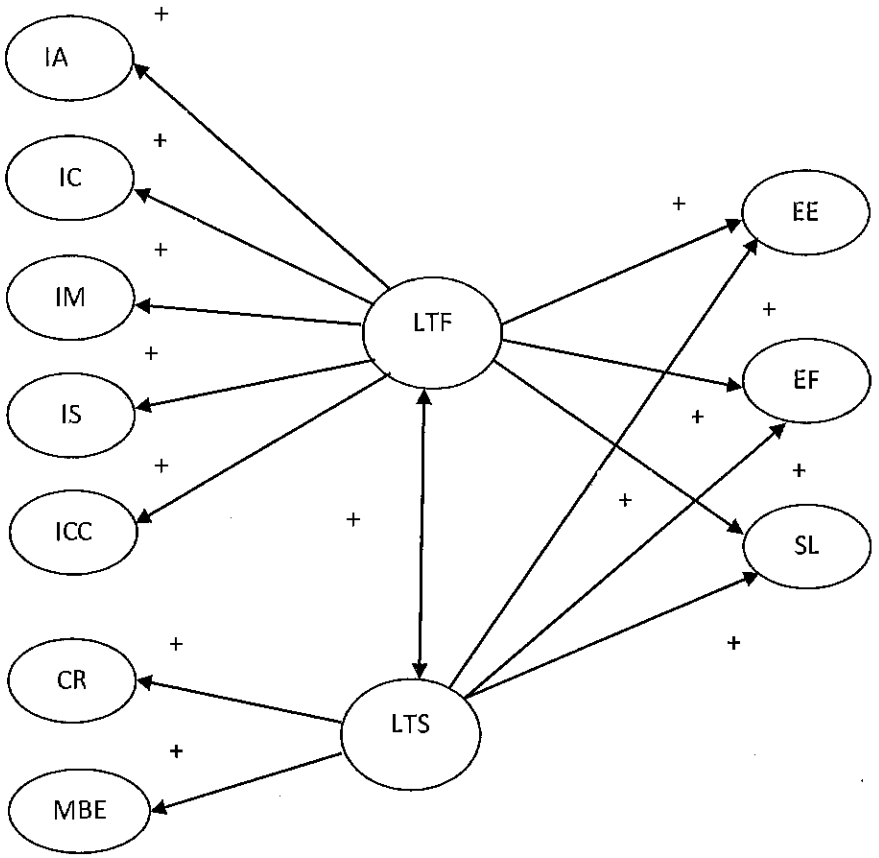
Transformational Leadership dimensions (LTF) in the research model are:

Idealized Influence (IA): They are leadership characteristics related to the charismatic attributes of influence over followers, by making them feel good, by making them feel proud of being close to the leader, because his/her achievement has built a feeling of respect for him/her. These leaders show themselves to be confident and assured people (Mendoza, 2005).

Idealized Influence (IC): The way in which the leader acts encourages a feeling of respect and pride among his/her followers. His/her behavior becomes a role model. It refers to behavioral aspects of the leader; they provide sense and guidance to followers. Leaders project through values and, most importantly, beliefs (Mendoza, 2005).

Motivational Inspiration (IM): In this dimension, leaders articulate clear expectations and show a commitment to the goals of the organization. To summarize, the spirit of the team is lifted by means of enthusiasm and optimism (Bass & Avolio, 1990). It is understood as the leaders' abilities to act as role models for their subordinates, to communicate a vision and to use symbols to focus efforts (Hartog et al., 1997). Leaders have a great capacity to express a clear vision of what they want to achieve with optimism and they invite their followers to share such vision; they are able to encourage with their words and use symbols and images. They express their expectations in a simple way (Mendoza, 2005).

Figure 3.1. Proposed Research Model to Measure Leadership in Accordance with the Theoretical Model of Multifactorial Leadership



Source: Bass & Avolio, 1995

Intellectual Stimulation (IS): For this dimension, leaders stimulate; they provide their subordinates with a flow of new challenging ideas, which are proposed to stimulate analysis of the old way of doing things (Bass, 1985; Bass & Avolio, 1990). This creates an awareness of potential problems, their own thoughts and imagination and there is an acknowledgement of their subordinates' beliefs and values. Intellectual stimuli are evidenced by conceptualization, comprehension and analysis from subordinates about the problems they face and about the generation of solutions (Yammarino & Bass, 1988). Leaders allow their subordinates to re-think the ways in which they do things (Bycio et al., 1995). In general terms, they encourage intelligence, rationality and problem solving (Mendoza, 2005).

Individualized Consideration (ICC): The use of individualized consideration by leaders noticeably influences individual subordinates who achieve their maximum capacity (Yammarino & Bass, 1988). Individual consideration is on the trainer or on the mentor –

he/she foresees continuous regeneration and connects the individual with the needs of the organization's mission (Bass, 1985; Bass & Avolio, 1990). Individualized consideration is similar to the one found by Ohio's study (Bryman, 1992). In general terms, leaders pay personal attention, treat each employee individually, direct and advise (Bycio, Hacket, & Allen, 1995). Leaders take into consideration specific needs of each of their followers, paying them personalized attention (Mendoza, 2005).

Next, we discuss the dimensions of Transactional Leadership (LTS) included in the research model:

Contingent Reward (CR): In this dimension, leaders describe an agreement in which labor is exchanged for payment (Bass, 1985). Leaders reward their followers in order to achieve specified functioning levels. Rewards are contingent on effort and in the achieved functioning level (Hater & Bass, 1988). It contrasts the exchange of rewards for effort; it promises rewards in exchange for good yield; it acknowledges achievements.

Management by Exception Active (MBEA): In this dimension, leaders look for deviations of procedures and they actively take action when irregularities arise (Hater & Bas, 1988). Leaders are constantly watching and supervising working conditions in order to detect flaws and to be able to make corrective measures (Mendoza, 2005).

The dependent variables that were included in the model are:

Leadership Satisfaction (SL): This dimension is related to leadership methods used by leaders, according to the perception of satisfaction of their subordinates (Yammarino & Bass, 1988).

Extra Effort (EE): Leaders' actions promote greater participation from their followers in regards to the effort in their daily labors. Followers are stimulated to actively participate whenever their leaders need their collaboration.

Effectiveness (EF): Leaders' actions encourage the achievement of goals and objectives from their followers. Jointly, working teams participate in a harmonic way in order to achieve scheduled goals.

HYPOTHESES

For this study, the following hypotheses were outlined:

H_1: There is a positive relationship between the indicators of idealized influence (attribute), idealized influence (conduct), motivational inspiration, intellectual inspiration and individualized consideration with the transformational leadership dimension.

H_2: There is a positive relationship between the contingent reward indicator (prize) and management by active exception and the transactional leadership dimension.

H_3: There is a positive relationship between leadership that has been measured as transformational and transactional, with the dimensions of the results.

H_4: Transformational leadership is complementary to transactional leadership.

RESEARCH METHODS

Participants

161 employees were included in the sample. They represented 100% of the call center's telephone service executives of a public service enterprise that distributes and markets electric power in the northwestern part of the Mexican Republic. Those participants (59% men and 41% women) averaged 29 years of age (S.D. = 5.16). 54% of them were single, 42.2% married and 3.7% divorced. 60.9% had a permanent unionized agreement and 2.5% had a permanent non-unionized agreement (known in Spanish as *Contrato de confianza*). 36% of the persons who answered the survey said they had a temporary unionized agreement and only 0.6% were working under a temporary non-unionized agreement.

Materials

In order to get to know the self-perception of the employees of the call center, the questionnaire designed by Bass and Avolio (1990) was used. The questionnaire, known as the Multifactor Leadership Questionnaire (MLQ-5 Short), includes 45 questions with sufficient validity and confidence to measure transformational and transactional leadership, as well as performance indicators such as extra effort, effectiveness and leadership satisfaction. For the Likert-scale, the following answers were considered: 1: Never, 2: Rarely, 3: Sometimes, 4: Frequently and 5: Always. With the objective of determining the internal consistency of the measurement instrument, internal consistency was calculated (Cronbach's alpha coefficients) for each of the dimensions that were included in the model. In order to evaluate the aforementioned internal consistency, it was determined that the dimension should be > .60 (Nunally, 1967).

Procedure

161 questionnaires were provided to call center employees (telephone service executives) hired by the Northwestern Distribution Division of C.F.E. who worked during that period on any of the three shifts. The personnel members were contacted thanks to the administrator and to the coordinator of the Health and Hygiene Division of the company. The leaders of the working center being studied also agreed to the study. Personnel were specifically trained to provide directions for the application of the surveys. Answers resulting from the surveys were respected as confidential, as was the anonymity of the employees.

Scope

In order to demonstrate the hypotheses, quantitative research – with a co-relational scope – was carried out. This study included an analysis to confirm date (SPSS, version 19 and Amos, version 19) by means of Structural Equations models (Hair, Anderson, Tatham, & Black, 1999).

RESULTS

Average, standard deviation, correlations and Cronbach's alpha coefficients for each one of the dimensions that were included in the leadership model (transformational and transactional) are shown in Table 3.1, as well as the scores from the variables of the results of the leaders' performance (satisfaction, extra effort and leadership satisfaction).

As can be observed in Table 3.1, the dimensions of transformational leadership that had a higher average score were: Idealized Influence (IA) attribute and Idealized Influence (IC) behavior, with an average of 3.14 and 3.12 respectively, whereas 2.79 was the lowest average for Individualized Consideration (ICC). For the dimensions of transactional leadership, those related to Management by Exception (MBEA) provided a better average score (3.39) in regards to the ones related to Contingent Reward (CR). Standard deviations reflected variability with values that ranged from 0.90 and 1.17. Regarding the leader's performance dimensions, telephone service managers gave a better average score to the Leader's Effectiveness dimension (3.16) and a lower average score to Leadership Satisfaction (2.73) and a lower standard deviation was found in relationship to answers related to Extra Effort (0.97).

Analyzing the correlations –Table 3.1 – we can observe that every assessed dimension provided results with statistical significance (α=0.01). Those dimensions that related to Transformational Leadership were well related to each other, with high scores. Those related to Transactional Leadership, the ones corresponding to Contingent Reward (CR) got high scores in their relationship to all other dimensions of transformational leadership, although it was not the same with MBEA and such dimensions, since MBEA had low correlations (between 0.33 and 0.45). On the other hand, the association between Contingent Reward and Management by Exception Active (MBEA) received low scores (0.45). Regarding the dimensions of performance, we can observe that Leader Satisfaction (SL) received high co-relations for the dimensions of Transformational Leadership and Contingent Reward (CR), however, it received a low score for MBEA (0.357). For Extra Effort (EE), the telephone service executives granted high correlations for ICC (r=0.62) and for CR (r=0.66). Effectiveness of Leadership only received a high score when related to (SL), Leader Satisfaction=0.61.

Table 3.1 Average Scores, Standard Deviations, Correlograms and Reliability by Dimension for the Variables of Leadership and Those Related to the Leader's Performance Result

	Average	Typ. Dev.	Variance	Co-relations	Cronbach's Alpha									
					IA	IC	IM	IS	ICC	CR	MBEA	SL	EE	EF
IA	3.14	0.99	0.97	Pearson co-relation	0.860									
				Sig. (bilateral)										
IC	3.12	0.92	0.84	Pearson co-relation	.832**	0.880								
				Sig. (bilateral)	0.000									
IM	3.08	1.07	1.15	Pearson co-relation	.742**	.803**	0.890							
				Sig. (bilateral)	0.000	0.000								
IS	2.83	1.06	1.13	Pearson co-relation	.756**	.817**	.722**	0.910						
				Sig. (bilateral)	0.000	0.000	0.000							
ICC	2.79	1.05	1.1	Pearson co-relation	.790**	.789**	.774**	.801**	0.910					
				Sig. (bilateral)	0.000	0.000	0.000	0.000						
CR	2.97	0.99	0.99	Pearson co-relation	.757**	.777**	.783**	.722**	.818**	0.920				
				Sig. (bilateral)	0.000	0.000	0.000	0.000	0.000					
MBEA	3.39	0.9	0.81	Pearson co-relation	.391**	.370**	.334**	.396**	.381**	.452**	0.700			
				Sig. (bilateral)	0.000	0.000	0.000	0.000	0.000	0.000				
SL	2.73	1.15	1.34	Pearson co-relation	.767**	.790**	.742**	.748**	.776**	.758**	.357**	0.800		
				Sig. (bilateral)	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
EE	2.94	0.97	0.95	Pearson co-relation	.564**	.578**	.549**	.575**	.624**	.664**	.412**	.607**	0.690	
				Sig. (bilateral)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		
EF	3.16	1.17	1.38	Pearson co-relation	.504**	.521**	.455**	.483**	.521**	.495**	.275**	.612**	.483**	0.900
				Sig. (bilateral)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	

Note: ** The co-relation is significant at the 0,01 level (bilateral.) N=161

In regards to Internal Consistency, the tool for each one of the dimensions of transformational and transactional leadership styles and performance, we could observe that the highest coefficient (alpha =0.92) was achieved for Contingent Reward and the lowest alpha ($\alpha = 0.69$) for Effectiveness. For the rest of the dimensions, Cronbach's alpha scores were around the minimum acceptable levels. With these values, it was shown that, in general terms, the self-evaluation instrument behaved in a consistent manner, thus indicating a high internal reliability (Nunally, 1967).

Structural Equations Model (MEE)

For the model, some of the goodness of fit estimates cited by Arbuckle (1995, pp. 589-605) were taken as references in accordance to the following rules: accepting the adjustment hypothesis when $\chi^2/gl \leq 2$, for χ^2 when the value of p is >.05, the average error of quadratic approximation is RMSEA $\leq$ .08. Likewise, when the indicators: CFI (Comparison Index of Adjustment) the Tucker-Lewis coefficient (TLI) and the normal adjustment indicator (NFI) are larger than 0.95.

When using these indicators to evaluate the model, the selection achieved the following results: Chi-square with a value of 51.256, the level of probability turned out to be 0.012 the CMIN/DF=1.653, the normal adjustment indicator (NFI) had a value of 0.96, Tucker-Lewis coefficient (TLI) had a result of 0.98, the average error of quadratic approximation (RMSEA) =0.064 and the comparison adjustment index (CFI) showed a value of 0.99. As can be observed, those data reflected an adequate adjustment of the model.

Regression Analysis of the MEE

In Table 3.2, we can observe the results of the regression analysis of MEE and see evidence that shows that every dimension of transformational and transactional leadership significantly contributed to explaining the variation. It is worth noting that there is a relationship between the dimensions of leadership and performance, which presented a positive relationship as was foreseen in our theoretical proposal.

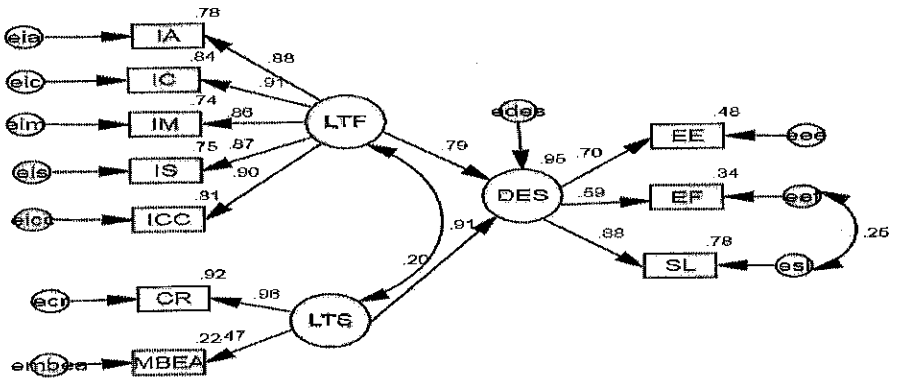
Table 3.2 Results of the Regression Analysis of the Structural Equations Model between the Variables of the Result and the Leadership Variables

Dimension		Dim	Weights	S.E.	C.R.	P	Standardized Weight of the regression.
DES	<---	LTF	.562	.125	4.484	***	.785
DES	<---	LTS	.325	.262	1.237	.216	.204
ICC	<---	LTF	1.000				.900
IS	<---	LTF	.978	.060	16.414	***	.868
IM	<---	LTF	.978	.061	16.109	***	.861
IC	<---	LTF	.887	.048	18.679	***	.914
IA	<---	LTF	.920	.054	17.064	***	.882

MBEA	<---	LTS	1.000				.471
CR	<---	LTS	2.252	.376	5.981	***	.960
EF	<---	DES	1.015	.144	7.030	***	.586
SL	<---	DES	1.507	.145	10.420	***	.882
EE	<---	DES	1.000				.696

When the weights were analyzed, (standardized coefficients) – refer to Figure 3.2 – we could observe that transformational and transactional leadership styles (standardized coefficient =0.79 and 0.91, respectively) have a positive and strong effect on performance indicators, such as extra effort (0.70), effectiveness (0.59) and leadership satisfaction (0.88). On the other hand, transformational leadership was related to transactional leadership (covariance with weight=0.363, S.E.= .075, C.R.= 4.837, p=***).

Figure 3.2 Result of the Structural Equations Model with Standardized Coefficients to Measure Leadership Measuring the Dimensions of Transformational Leadership, Transactional Leadership and Results of Performance Using the Theoretical Model of Multifactorial Leadership



Source: Bass & Avolio, 1995

DISCUSSIONS, CONCLUSIONS and IMPLICATIONS

Regarding hypotheses 1 and 2, the dimensions that were found in this study are similar to the dimensions of Mendoza's (2005), especially in the transformational and transactional leadership constructs. As was established in the hypotheses, at the call center that was being studied, we could observe that the transformational leadership dimensions were consistent with the findings reported by Bass and Avolio (1990). Such authors worked with the charisma dimension, while in this study this dimension was divided into idealized influence as an attribute and as behavior, according to the co-relation of the two scales found by Bass (1999). In the same manner, results were coincidental with the results obtained by Hartog et al. (1997) who co-related, in a positive manner, the indicators being used with the transformational leadership construct. In their study, these authors also used the charisma indicator and an additional one: inspiration (inspirational motivation). According to their results, shown in the graphic representation of the research model (Figure 3.2), the indicators that confirmed the transactional leadership construct were positively related, in agreement with Bass (1985). Two of the factors, Management by Exception and Contingent Reward (CR), were charged as transactional variables -- mainly Contingent Reward (CR). The results were also consistent with the results of Bass and Avolio (1990) and of Yammarino and Bass (1988). To summarize, we can point out that the five sub-dimensions of transformational leadership and the two sub-dimensions of transactional leadership resulted in adjusting the theoretical model with the perception expressed by the telephone service executives (call center) of the company being studied. In the third hypothesis that was originally proposed (H_3), we were looking for the existence of a positive relationship between transformational and transactional leadership regarding the result/performance dimension. As could be observed in Figure 3.2 of the Structural Equations Model, in this study we expressed such a relationship just as was specified in the theory and by the evidence referred by Bass (1985), Bass and Avolio (1990), Hartong et al. (1997), Hater and Bass (1988), Yammarino and Bass (1988) and Mendoza (2005). In the fourth hypothesis (H_4), we were looking to relate, in a positive manner, transformational and transactional leadership and to demonstrate whether the latter was a mediating variable between transformational leadership and the performance indicators. The results supported the research hypothesis in that the telephone service executives of the call center considered transformational leadership a style that was co-related to transactional leadership. The results of this study allow for the establishment of the following general conclusions; it is a reliable measurement of the dimensions that confirm transformational and transactional leadership and performance of leadership. According to the theory of leadership styles, the aforementioned result is reflected in the expected signs. In this specific case, with the telephone service executives at the working center being studied, they related the transformational leadership style with the three dimensions of result/performance. Therefore, we can observe that at the call center of the company being studied the number of transactions and services that the telephone service executives service on a daily basis at the Northwestern Division of Distribution of C.F.E. require not only transactional forms of leadership, such as receiving payment for what they do, fulfilling or accomplishing productivity standards or monitoring the activities of subordinates, but also to keep strengthening the human part by means

of leaders who inspire, encourage, intellectually stimulate and see other persons as individuals, while respecting and abiding with the institutional mission/vision.

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4 Methodology of the fifth systemic helix for the development of public sector policies

Martinez Gutierrez

INTRODUCTION

In the last thirty years, Baja California, Mexico has become one of the most dynamic regions on Mexico's northern border (World Bank, 2009) for the manufacturing of electronic products. This dynamism is based on the fact that the region has reached high levels of competitiveness in comparison to other regions in the country, as well as on an international level.

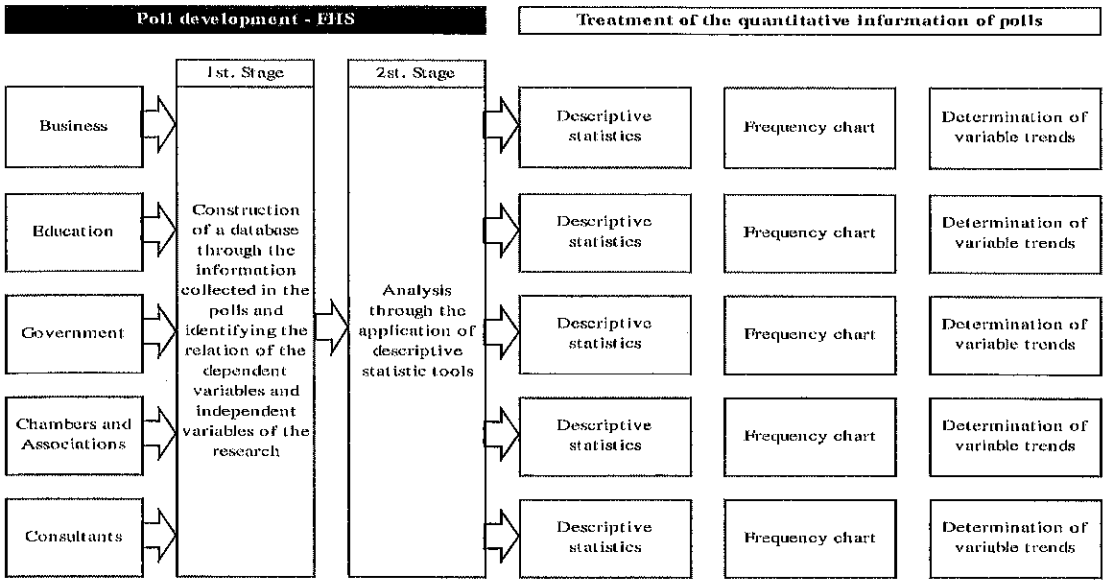
The records of the National Institute of Statistics and Information (INEGI, 2005) show that export *maquiladora* companies at the national level employ up to 1,115,230 persons, i. e., 3% of the economically active population in the country. There are 2,811 *maquiladoras* registered all over Mexico. The state of Baja California holds the first national spot with 882, which represents the national 32% within its five municipalities.

The Directory of the Maquiladora Industry of Baja California (2010) records that 65% of the electronics sector industry at the state level is located in Tijuana. The Secretary of Economic Development of Tijuana (SEDETI, 2010) indicates that the global companies are constantly assuming the challenges of international competitiveness, identifying operational practices through innovation training and technological research toward a stronger culture of continuous improvement and customer satisfaction. Therefore, government institutions need to know and update the legal framework where public policies provide incentives for practices that are profitable in a competitive environment.

Educational institutions, through their relations with the business sector, oversee study programs that are aimed toward the development of necessary human resource skills at the technical and professional level which can be integrated into the business sector. The education must be focused on fulfilling the skills, competences and proactive cultural attitudes for optimum performance. The general structure of the research work is displayed in Figure 4.1.

The characterization of the *maquiladora* industry is closely linked to the development of the City of Tijuana, as well as to the economic impact from the development of the State of Baja California, industrial escalation and new generations of companies within the last thirty years. According to the Directory of the Baja California (2010), the city of Tijuana holds the first spot as regards attracting the electronics industry sector, based on the number of companies located there compared to those located at the national level in the same sector.

Figure 4.1 General Structure of the Research[2]



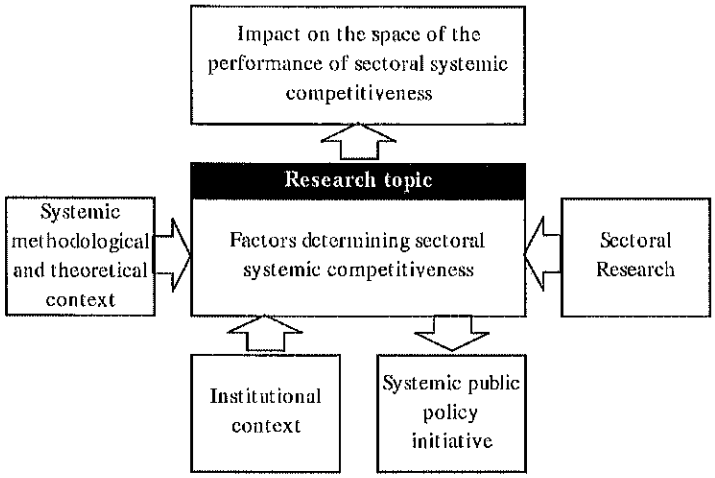
METHODOLOGY

The strategy followed in this research started from the data collection stage and went through to the design of instruments validated by scientific research methods. Within these stages, methodological references were provided based upon the works of INEGI (2010), CEPAL (2006), OIT (2003) and the World Development Bank (2010). The foregoing was the basis for the construction of instruments that were validated through a multidisciplinary review, including specialists in the fields of economics, management and engineering and specialized interviews that provided information on factors and actions related to the competitiveness of the *maquiladora* industry of the electronics sector, thus creating a methodology using the triple helix approach of Etzkowitz and Leydesforff (2000), but with an evolution toward a methodology adapted to contemporary reality called the Fifth Systemic Helix.

This is similar to Shinn's (2002) approach, where government public officers intervene in business development or where academic specialists and researchers provide their perspectives and validation of research work. They are the strategically selected informants and representatives of the research subjects needed to carry out the identification of the factors that determine the competitiveness of the *maquiladora* industry in the electronics sector. We decided to employ mixed research, specifically with directors and managers from different sectors, business, education, government, business consultants, who provided information through face to face interviews (focus groups), and obtained findings in an microeconomic context for interpretation later on. In Figure 4.2, the mind map of the research is displayed that considers the micro, meso, macro and goal-related aspects of the context of economic development.

[2] Following the eclectic vision of the LART research model (Rivas, 2006), which presents a schematic representation to follow an organized and sequential research structure, a research model with a systematic focus, with a quantitative and qualitative focus, was developed.

Figure 4.2 Mind Map of Scientific Research



The participants selected in the research participated in an in-depth interview process so that we could obtain opinions that were complementary information based on international, national and regional competitiveness models, on the basis of which factors were taken to build axes and parameters of competitiveness that influence productivity and business development.

The research focused on the development of mixed research, based on the analysis of factors of systemic competitiveness of the *maquiladora* industry of the electronics sector of Tijuana, Baja California, Mexico and on an intentional systemic selection of expert specialists per sectors, thus forming five axes of systemic sectors that interact in the business environment. They are the following: 1) Business Sector, 2) Education Sector, 3) Government Sector, 4) Business Chamber Sector and 5) Company Consultant Sector. According to Contreras, Carrillo, García and Olea (2006), the *maquiladora* industry, has become the industrial development model in the northern region of Mexico. It is characterized by the Official Journal of the Federation (1998) as providing the following: a) sources of employment, b) strengthening the business scale through greater contribution of net currency, c) contributing to a greater interindustrial integration and elevating international competitiveness of the national industry and d) raising the training of workers and promoting technology development and transferring to the country.

When carrying out research, the target population has specific characteristics made up of an indefinite number of individuals, things or organizations, sometimes with precise information and sometimes with unknown data or inaccessible databases, which is why when research is carried out the goal is to infer or generalize results of a sample of the population, which is normally categorized in sample types.

The sample is a minor group of individuals or organizations, also known as sub-groups, and is thus limited. Per the foregoing, the focus of the sample is on third generation companies in the *maquiladora* industry of the electronics sector of the city of Tijuana, Baja California, Mexico. Studies are done on the basis of samples and not full populations in order to save time and to maximize the results that are expected from the research work, logically, because of the resources invested and also to avoid getting lost in the research, for there is the risk of changing

the research hypotheses and goals.[3] By delimiting the sample of the research, the quality of the results is also raised, as specific samples allow one to reduce the heterogeneity of a population by indicating the inclusion and/or exclusion criteria, just as was done when developing the categories of the population of the *maquiladora* industry of the electronics sector in the city of Tijuana, based on the studies of Carrillo and Gomis (2005).

The sample representation for each sector is seen in Table 4.1. The questionnaire was applied to different sectors: *maquiladora* companies of the third generation electronics sector (Carrillo & Redi, 2004), as well as schools, government, business chambers and consultants linked to the *maquiladora* industry sector.

Table 4.1 Sample Distribution Throughout Research Sectors

Sector	Frequency	Percentage	Valid Percentage	Accumulated age
Business	12	16.2	16.2	16.2
Educational	29	39.2	39.2	55.4
Government	7	9.5	9.5	64.9
Chambers	13	17.6	17.6	82.4
Consultants	13	17.6	17.6	100.0

The sampling type used was not probabilistic,[4] which allowed for the selection and direction of the research process toward typical elements of the population, i.e., selecting a reasoned sample (Giroux & Tremblay, 2002) but watching over representativeness by applying reasonable shares to ensure the representativeness of each sector: educational, government, business chambers and consultants.

In order to carry out this stage, it was necessary to determine the characteristics of the target companies of the research. Within the total *maquiladora* companies of the electronics sector, their business categorization was based on their development levels, in accordance with the study carried out by Carrillo and Gomis (2005) which set forth generations in the level of sophistication of *maquiladora* companies. For this research, we focused on third generation[5] companies that are characterized by the development of clusters, supply chains and a competitive production system.

Companies with third-generation criteria were invited to participate and an intentional sample was created with leading companies; the data was handled confidentially. The basis of the information was the Directory of the Maquiladora Industry of Baja California.[6] An exploration of

[3] Rivas (2006) suggests a very detailed work in the delimitation of the subject matter and specifically in the sample size in order to maximize the efficiency of the research and research methodology to be developed.

[4] The characteristics of the research sample type were not random, which implied the participation of experts (Rivas, 2010).

[5] Description of the evolution of the *maquiladora* industry of the electronics sector called "generations" by Carrillo and Gomis (2005).

[6] The Board of Directors of the Maquiladora Industry of Baja California (2010) includes considerable information divided into specific sectors about the *maquiladora* industry, such as the following: company name, years in the business, manufactured products, certifications, number of employees and above all the identification of the corresponding production sector (electronics, aerospace, medical, plastics, wood, among other sectors).

the characteristics of the companies of the electronics sector and their historical statistical context through information gained from business agencies and the Council for Economic Development and the Investinbaja[7] website of the Government of Baja California served to determine a group of 12 leading companies deemed to be third-generation ones due to their dynamism.

Table 4.2 displays the statistics developed in the *maquiladora* industry of the electronics sector of the city of Tijuana categorized on the basis of its growth and sophistication profiles, in accordance with Carrillo and Gomis (2005), as well as the growth and development data of that sector as a result of interviews done with experts on this industry.

In order to determine the size of the sample statistically, the following formula was used when the population was known. Table 4.3 displays how the number of companies to be interviewed was determined, although in this research the sample was selected intentionally.

Table 4.2 Characteristics of the Sample of *Maquiladoras* of the Electronics Sector

Generation	Number of Companies[8]	Main characteristics of companies per generation type[9]
First	68	Low technology level, based on manual labor.
Second	43	Local providers considered; it has qualified workers through training and skill certification.
Third	**12**	Considers cluster and supply chain development; competitive production system.
Total	123	Companies located in the Industrial Parks of the city of Tijuana, Baja California.

Table 4.3 Sample Size Determination

$$n = \frac{Z^2 pqN}{NE^2 + Z^2 pq}$$

$n =$	Sample size	**11.64**
$Z =$	Confidence level	1.96
$p =$	Positive variability	0.5
$q =$	Negative variability	0.5
$N =$	Population size	12
$E =$	Precision or error	0.05

The amount of companies as a result was n= **11.64**. This was rounded to 12, forming 12 focus groups, followed by 12 representatives from each systemic focus sector.[10] The variables included in the quantitative study are the acceptance scales of the participants under a variable categorization and their respective independent variables, each of them associated with the

[7] Investinbaja (2010) sets forth the leading companies of the *maquiladora* industry of the electronics sector in Tijuana.

[8] Updated information, in accordance with the Tijuana Strategic Plan 2003-2025, of the electronics cluster and its companies.

[9] Characteristics of the companies per generation level in accordance with the study by Carrillo and Gomis (2005).

[10] The systemic participants were the following: 1) Third-generation *maquiladora* companies, 2) Technical Schools and Colleges, 3) Government institution representatives, 4) Business chamber representatives and 5) Representatives of companies offering specialized Business Consultancy services.

systemic sectors, as is the case with representatives of the following sectors: 1) Business, 2) Education, 3) Government, 4) Business chambers and 5) Business consultants. The variables of the quantitative instruments in turn were classified into 6 question categories, with five or seven of them, respectively.

The answer scale in the case of the category of variables of general questions of systemic competition only meant the order of the sectors and to what degree of significance they contribute directly to the competitiveness of the *maquiladora* industry of the electronics sector in Tijuana.

In the case of variables of specific questions, seven answers were assigned within a significance scale. The predetermined answers were arranged on a scale from 1 to 7: number 1 representing the most direct level or significance or higher level of response to the instrument's question; the answers 5 or 7, respectively, represented the least direct answer to the question; the measurement of the variables were of a scale type. After each of the representatives filled out the instruments, values were generated that allowed for the design of a database to develop information treatment and analyze descriptive statistical data. Nominal scales were developed from the data per systemic sector. This allowed for the observation and identification of variable trends in the valuation of scales for each variable where the results obtained were analyzed and commented on using charts that display the percentage frequencies of each scale of the variables of each sector, as well as the hierarchies of the variables identified with the greatest value, where each participant provided its valuation for each independent variable against the dependent variables of each systemic sector.

The Fifth Systemic Helix methodological structure describes the research work process, which consists of identifying the factors that determine the competitiveness of the *maquiladora* industry, in this case, the electronics sector of the city of Tijuana, Baja California. For this purpose, an instrument with factors and components of Integral Systemic Business Competitiveness was built, which served as a reference for carrying out the pilot test of the final research instruments.

In the methodological stage of the development of the research, global questions were developed as a result of the participation of several countries through each sector of the Fifth Systemic Helix, displayed in Table 4.4, and served as a reference to facilitate the feedback of the interest of each sector and to segment the topics that were useful to identify the independent variables of each sector.

Table 4.4 Global Questions Raised for Each Systemic Sector

H1. Business	What are the problems of Tijuana, seen at an international level? What do they need to integrate themselves to business agencies? What are the obstacles that direct financial investment faces in Mexico? What do local companies need to attract new foreign investments? Have business consultants contributed to the success of your business? What do companies need in order to open up to the educational link? In what way may companies of all sectors be linked or connected? What is the business perception of the other sectors? Do companies consider the profiles of the graduates in B. C. to be the ideal ones?

	What do local suppliers need to do to be selected by maquiladora companies? What type of help do companies need to develop local technology with the support of schools and the government? What is the profile of a global professional? In what way may companies of all sectors be linked or connected?
H2. Education	What are the competences provided to prepare them in the occupational context? What limits schools to not update their plans and programs in accordance with the technological advances of maquiladora companies? How do you update the training of your teachers in order to teach topical issues to students? How do you measure the effectiveness of your study programs? In what way is the link or connection with the productive sector promoted?
H3. Government	What are the commitments to the health and education of the workers in the maquiladora industry? How may the government commit itself to actions that contribute to the development of local supplies through entrepreneurship of local professionals? What do the government levels need in order to develop public policies that promote and protect maquiladora companies? What initiatives is the government developing in terms of the prevention of public safety and that do not affect foreign and business development? What strategic actions is the government developing in the short, medium, and long term for industrial development in Tijuana? Why does the government not open up to the consultancy and advisory of IMMEX[11] so that it may become aware of its needs and develop programs and initiatives of work and investment protection? What errors does the government recognize it has made to cause the local and national supplies to lack development and contribution to the competitiveness of IMMEX? Would the government be open to build a development agenda that would imply developing it, notwithstanding the changes there may be on a political level?
H4. Chambers	What are the strategies to help the local and national supply departments to be inserted into the IMMEX in Tijuana? What attraction programs of the IED have been developed and what has been their effectiveness? What reforms, laws, and business regulations have been proposed, and what has been their impact? What are the strategies to support the IMMEX companies and the benefits of being a member of a business chamber or agency?
H5. Consultants	What is lacking in the educational institutions for their graduates to be more competitive in IMMEX? What actions do you recommend to the government sector in order to strengthen the IMMEX company sector and supply chain through the local and national supply departments? What initiatives do you consider that the business agencies and chambers must carry out so that they may be a key performer in the business development of the IMMEX sector in Tijuana? What are the professional services that you consider that must be provided by the business consultants to the companies in order to help them raise their competitiveness?

Source: Research called: "Fifth Systemic Helix – FSH (Quinta Hélice Sistémica - QHS)"

Two types of information processing were developed. The first one was quantitative processing with predetermined questions and response options per relevance scale, as was stated above. The second was oriented toward a qualitative research carried out through focus groups, which contained the same variables but did not contain predetermined answers, with three stages to be developed:

1. Recognition of each sector from the perspective and experience of the manner in which each systemic sector has contributed to the competitiveness of the electronics sector in Tijuana.

[11] IMMEX: Manufacturing, Maquila and Export Service Industry

2. Constructive criticism for each sector, from the perception of each participant who provided their opinion about areas of opportunity that they believe each sector should strengthen or develop to improve the performance of the systemic sector and during the final stage.
3. The perception that each sector acquired by setting forth the possibility of externalizing the commitments that they deemed necessary to develop sector interaction dynamics in order to contribute as a group and in harmony to create the synergies and conditions that could improve systemic competitiveness.

Although the study model may be applied to any type of company by contextualizing the variables, in this research *maquiladora* companies of the electronics sector received guidance through in-depth interviews with company directors. With the answers obtained, it was possible to explain the behavior and systemic context of the *maquiladora* industries of the electronics sector.

From the analysis of information, factors were derived which in the opinion of the participants influence the competitiveness of the *maquiladora* industry of the electronics sector. These include the relation they have as regards their dynamics with the other four systemic helixes, generating several information indicators and forming tendencies of independent variables that determine the factors that influence competitiveness. In Figure 4.3, the structure and stages of qualitative research are set forth.

Therefore, this design of focus groups allowed for the identification of the symbols and meanings contained between representatives of companies, universities, the government, business agencies, and consultants. The focus groups were developed on the basis of Fifth Systemic Helix interviews. The research was adapted to the model of the OCDE and variables of the FEW, IMD, and ISO models. A series of interviews with the systemic sectors was carried out through twelve focus groups with a representative from each of the aforementioned sectors, forming groups of 5 participants.

Figure 4.3 Structure of the Qualitative Research of Focus Groups

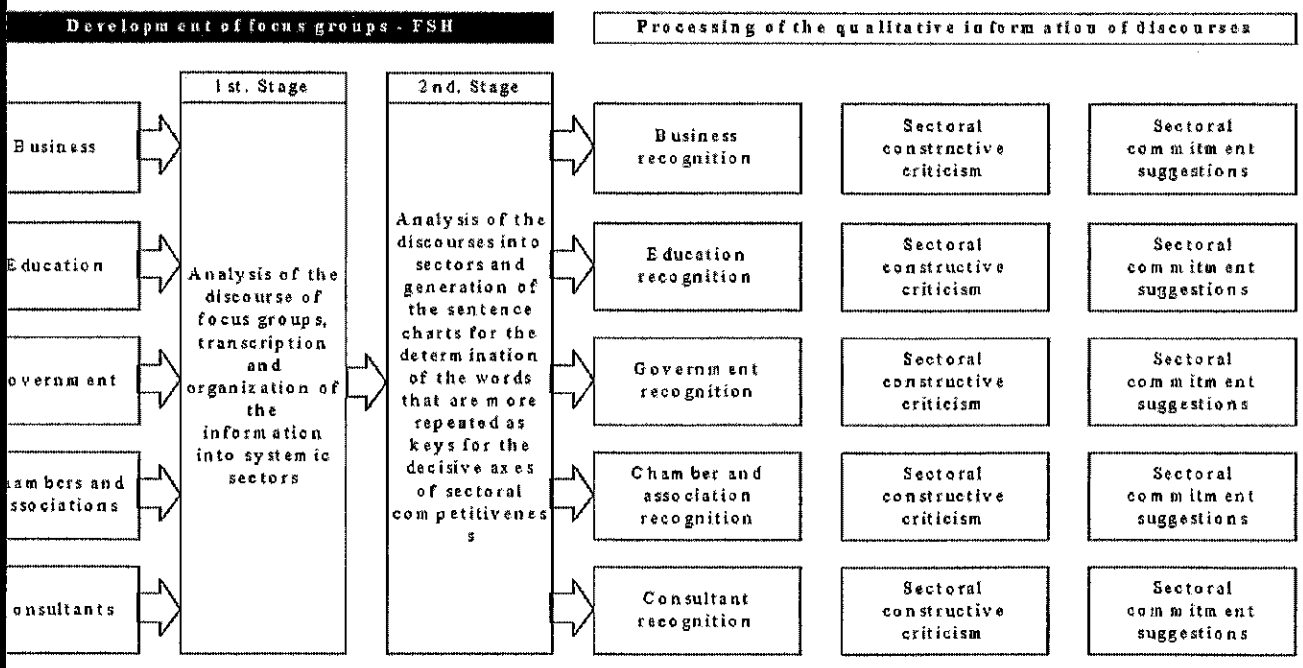
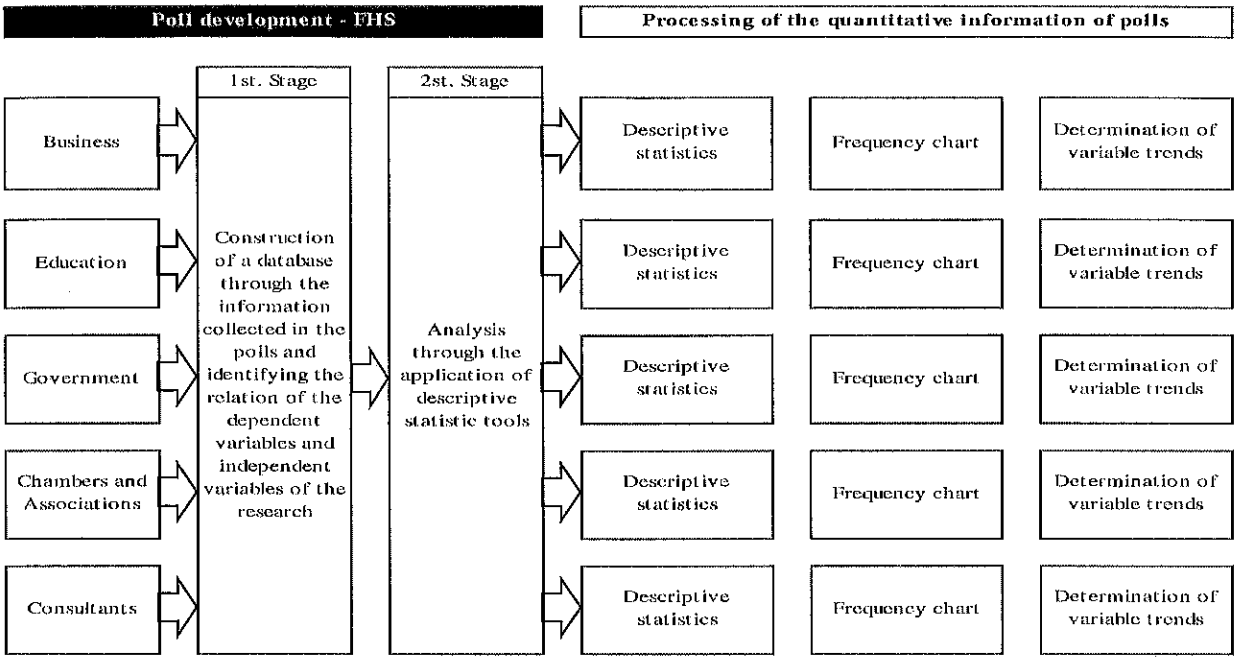


Figure 4.4 presents the structure of the quantitative structure by means of the application of polls with the Regnier scale, following the systemic approach.

Figure 4.4 Structure of the Quantitative Research of Polls

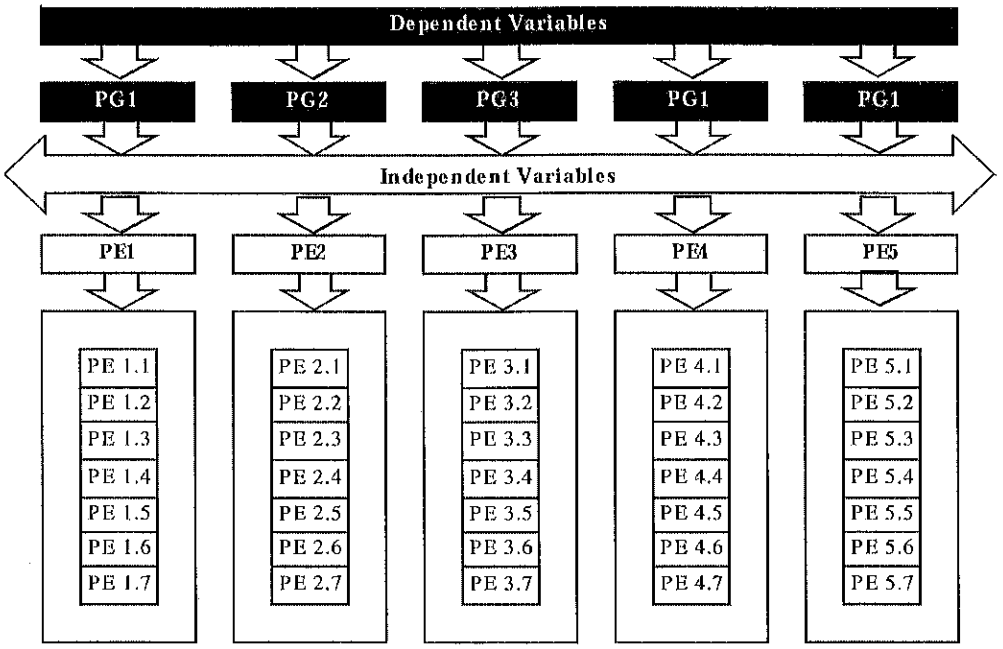


RESULTS

The conclusions explain the findings obtained in the process of determining the competitiveness factors, on the basis of which a series of actions and initiatives are proposed in terms of the business, educational and government sectors, as well as for the business agencies and specialized business consultancy services. The answers to the dependent variables display five independent hierarchical variables, each one of them on seven levels in accordance with the importance that the respondents stated. The diagram of variable correlation is explained in Figure 4.5.

Per the foregoing, the relevant non-parametric test for this research project is Spearman's range correlation test, which consists of a test for the correlation between two variables when the observations for each variable may be assigned agreement ranges in accordance with their relative magnitudes. As well, Kendall's W concordance coefficient was used (Camacho, 2001). Kendall's W coefficient is a linear function of Spearman's bivariate correlation coefficient. It is employed to measure the degree of relation between several variables. What is verified is if k related samples come from the same population. In this research, it helped us determine the degree of agreement between the subjects interviewed, since they had to organize their responses based on their perception or opinion. Finally the coefficient indicates the degree of concordance between the subjects interviewed. The more different the average ranges are, the more concordance there will be among the subjects interviewed, and the more equal the average

Figure 4.5 Variable Correlation Diagram[12]



ranges, the less concordance there will be, according to Mendenhall's process of estimation of Spearman's coefficient[13] (Mendenhall, 1981) The correlation of ranges provides a measurement of the degree of linearity of the variables that are assigned ranges or a measurement of how monotonous the relation is between the variables observed. Therefore, the coefficient of range correlation is frequently called a concordance coefficient for preferential data. An estimator for the correlation of ordinal or range data, commonly used, is Spearman's coefficient, since its calculation is identical to that of the coefficient of sample correlation, Pearson r. The range correlation coefficient of Spearman r_s is calculated by using the ranges as pairs of observations of the two variables, which are called x and y in the formula, in order to obtain the following coefficient:

$$rs = \frac{SCxy}{\sqrt{SCxSCy}}$$

Where x_i and yi represent the ranges of the i-th pair of observations

[12] Joan Mateo Andrés in Bisquerra (2004) proposes that the correlation studies include those studies in which we are interested to describe or clarify existing relations between the most meaningful variables of a phenomenon and they do it through the use of correlation coefficients.

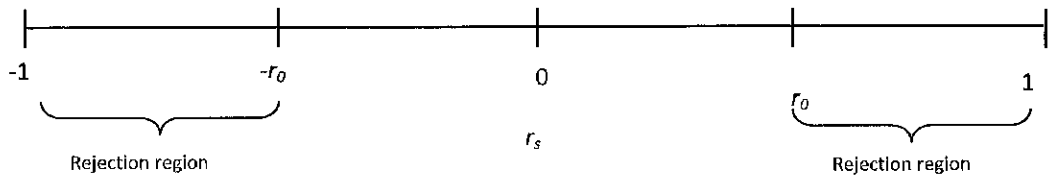
[13] Pérez (2009) and Levin and Levin (2001) indicate that in order to find the degree of association for data at ordinal measurement level, data which have been placed in ranges or organized in relation to the presence of a given characteristic, the appropriate coefficient is that of Spearman.

$$SCxy = \sum_{i=1}^{n} xiyi - \frac{\left(\sum_{i=1}^{n} xi\right)\left(\sum_{i=1}^{n} yi\right)}{n}$$

$$SCx = \sum_{i=1}^{n} x_i^2 - \frac{\left(\sum_{i=1}^{n} xi\right)^2}{n} \qquad SCy = \sum_{i=1}^{n} y_i^2 - \frac{\left(\sum_{i=1}^{n} yi\right)^2}{n}$$

Spearman's range coefficient was used as a test statistic to prove non-association hypotheses between two populations. It is assumed that the n observation pairs (x_i, y_i) were selected randomly and therefore the non-association hypothesis between populations implies a random assignment of the n ranges of each sample. Each random assignment (for both samples) represented a sample point associated with the experiment and a value of r_s may be calculated for each one. In Figure 4.6, the rejection region for a two-tailed test is displayed.

Figure 4.6 Rejection Region for Two-tailed Tests



If the alternative hypothesis (H_a) is that the correlation between x and y is positive, the null hypothesis (H_0) is rejected for big positive values of r_s, the higher tail. In a similar fashion, if one wants to prove that the correlation is a negative one, H_0 is rejected for big negative values of r_s, lower tail of Figure 4.7.

The critical values were considered by the SPSS program in order to determine the hypothesis tests, providing the results of significant correlation at bilateral level 0.01 and 0.05 (positive or negative), posing a null hypothesis of non-association between the ranges against the alternative of the existence of association between the ranges (two-tail test) or a positive (or negative) one. For a two-tail test, H_0 si $r_s \geq r_0$ o si $r_s \leq -r_0$ is rejected. These variables reflect the test statistics for a high or low tail, respectively. Table 4.5 displays the interpretation of the correlation coefficient.

Table 4.5 Interpretation of the Correlation Coefficient[14]

Coefficient	Interpretation
0 to 0.20	Practically null correlation
0.21 to 0.40	Low correlation
0.41 to 0.70	Moderate correlation
0.71 to 0.90	High correlation

[14] Mateo, J., in Bisquerra, R., (2004), for practical purposes, presents the interpretation of the correlation coefficient of what is normally used in correlation studies in Social Sciences.

0.91 to 1	Very high correlation

Result of the Spearman coefficient

A matrix was obtained of total correlations between the independent variables coded respectively as PE1.1, PE1.2, PE1.3., PE1.4., PE1.5, PE1.6, and PE1.7, for the business sector; PE2.1, PE2.2, PE2.3., PE2.4., PE2.5., PE2.6, and PE2.7, for the educational sector; PE3.1, PE3.2, PE3.3., PE3.4., PE3.5., PE3.6, and PE3.7, for the government sector; PE4.1, PE4.2, PE4.3., PE4.4., PE4.5., PE4.6, and PE4.7, for the business chamber sector; and for the case of the business consultant sector, PE5.1, PE5.2, PE5.3., PE5.4., PE5.5., PE5.6, and PE5.7. In the case of dependent variables, they were coded as PG1 for the business sector, PG2 for the educational sector, PG3 for the government sector, PG4 for the business chamber sector and PG5 for the business consultant sector. Negative correlations may be analyzed if they are statistically significant. Correlations that are not significant are discarded, since this signifies a null correlation.

Figure 4.6 presents a summary with the most significant correlations, either negative or positive, in general terms, according to Mateo's classification. It was found that they oscillate between *low* to *moderate correlations*. For their interpretation, a review was made of positive correlations, since they constitute the interest of the research, as the main findings in the relations between dependent and independent variables.

On the basis of the variables of the general questions, or rather dependent variables, interpretations were carried out for the positive associations with the specific questions, independent variables per sector, where the GQ (General Questions) are the dependent variables and the SQ (Specific Questions) are the independent variables. The following results were obtained:

1. Focusing on the degree of association between PG1 and its association with PE1, only a positive relation was found, the correlation between PG1.1 (The capacities installed and developed within the companies) and PE127 (having solid programs of supply chains [SCM], through certified providers, local and foreign ones) catalogued in the business sector is 0.347. The *p*-value associated to the statistical value to contrast the null hypothesis that variables are uncorrelated is very small (sig. (bilateral)=0.002), which is why this bypothesis may be rejected. That is to say, the correction between PG1.1 and PE127; the correlation between the scores obtained is statistically significant.

Figure 4.6. Results of Spearman Correlations in Dependent Variables

Dependent Variables				Independent Variables									
General Questions		Spearman's rho		PG2	PE123	PE127	PE232	PE234	PE235	PE237	PE451	PE453	PE563
	The capacities installed and developed within companies.	PG1	Correlation Coefficient	-,406**	-,306**	,347**	-,308**	,306**	-,314**	,306**	,252*	-,261*	,297*
			Sig. (2-tailed)	,000	,008	,002	,008	,008	,006	,008	,031	,025	,010
			N	74	74	74	74	74	74	74	74	74	74
		Spearman's rho		PG1	PG4	PE341	PE344	PE567					

The effectiveness of the staff formed in the local educational sectors.	PG2	Correlation Coefficient	-,406**	-,431**	-,270*	**,375****	**,301****				
		Sig. (2-tailed)	,000	,000	,020	**,001**	**,009**				
		N	74	74	74	**74**	**74**				
	Spearman's rho		PG4	PG5	PE123	PE125	PE235	PE237	PE347	PE452	PE561
The quality and management of government institutions	PG3	Correlation Coefficient	-,290*	-,690**	**,298****	-,293*	**,332****	-,236*	**,391****	-,278*	-,239*
		Sig. (2-tailed)	,012	,000	**,010**	,011	**,004**	,043	**,001**	,016	,040
		N	74	74	**74**	74	**74**	74	**74**	74	74
	Spearman's rho		PG2	PG3	PE121	PE123	PE235	PE237	PE341	PE344	PE345	PE347
The programs and initiatives of the business chambers that represent the maquiladora industrial sectors.	PG4	Correlation Coefficient	-,431**	-,290*	**,250***	-,258*	-,248*	**,331****	**,439****	-,276*	**,252***	-,235*
		Sig. (2-tailed)	,000	,012	**,032**	,026	,033	**,004**	**,000**	,017	**,031**	,044
		N	74	74	**74**	74	74	**74**	**74**	74	**74**	74
	Spearman's rho		PG3	PE125	PE342	PE344	PE347	PE561	PE563			
The specialized services provided by the consultancy companies in the region and at international level.	PG5	Correlation Coefficient	-,690**	**,380****	**,311****	**,230***	-,295*	**,396****	-,270*			
		Sig. (2-tailed)	,000	**,001**	**,007**	**,043**	,011	**,000**	,020			
		N	74	**74**	**74**	**74**	74	**74**	74			

Positive Correlations Negative Correlations

In the case of questions PG2 or PG1.2 (The effectiveness of the staff formed in the local educational sectors), no positive correlation was found with PE2, the educational sector, but a correlation was found with the government and consultant sectors, with independent variables PE 344 (Promoting an occupational culture in all the hierarchical levels of organizations and institutions) and PE 567 (Developing competences and attitudes on the importance of the quality and constant innovation in the work done), although the correlation was deemed to be low, 0.375 and 0.301, respectively. The p-value was very small, thus allowing one to reject the null hypothesis at a level of 0.01(bilateral sig.) in both cases.

2. The results of the correlation matrix for PG3 or PG1.3 (The quality and management of government institutions) and the degree of association with PE3 only provided a low positive correlation with PE347 (Tax incentives for foreign investment) of 0.391, where the null hypothesis was rejected with a level of 0.001. The foregoing is in relation to the government sector. But there were also positive correlations, although they were low, with the business and education sector with PE123 (Developing research and development of the product in Tijuana plants [research and development] and not just manufacturing) and PE235 (The existence of academic bodies that carry out research work in companies).

3. For the degree of association with other variables of PG4 or PG1.4 (The programs and initiatives of business chambers that represent the *maquiladora* industrial sectors), the results did not provide levels of association with PE4 of the Business chamber sector, but it did provide low positive correlations for the business, educational, and government sectors, with

PE121 (The adoption of Technological Innovation programs in all the departments [Example: Continuous improvement programs]), PE237 (Continuous education and professional training offered by local educational institutions), PE341(Relying on international treaties) and PE345 (The government policies that favor the export *maquiladora* industry).

4. The result of Spearman's correlations for variables PG5 or PG5.1 (specialized services provided by the consultancy companies in the region and at international level) shows a low positive association of 0.396 with PE561 (Outsourcing services of activities that do not generate added value for the *maquiladora* industry). A *p*-value was associated with the statistical value to contrast the null hypothesis that the variables are uncorrelated which is very small (bilateral) sig.=0.000), which is why this hypothesis may be rejected.

Moreover, three significant positive correlations were found with PE125 (Management of the operations through practices of Electronic Commerce, eCommerce and CRM, having Customer Service at Plants), of the business sector, PE342 (Having programs and policies that facilitate foreign investment) and PE344 (Promoting an occupational culture at all hierarchical levels of organizations and institutions) of the government sector.

CONCLUSIONS

The results of the mixed research work generated data that allowed for the identification of the factor perception trend that determine international systemic competitiveness in the *maquiladora* industry of the electronics sector of the city of Tijuana, Baja California, México and thus determines a weight level in regards to the impact of actions of the systemic sectors that participated in the research. This leaves us with the thought that there are still challenges and work to be done in the educational sector through following up on initiatives set forth in the agendas of business organizations, through synergies and team work structures between different actors in the environment that have formed the bases of economic development of the city of Tijuana, recognizing the advances of society and good practices within companies, capitalizing on the experience and performance models that have turned Tijuana into an attractive city for business and for direct foreign investment.

Business Sector Conclusions

International competitiveness demands that companies develop local capacities with global scope, capitalizing on the experience of their business callings, as well as establishing strategic alliances called clusters, which may facilitate the supply chain in the regions in order to strengthen their operations and challenges in terms of their customers' satisfaction.

Conclusions of the Educational Sector

Strengthening the link or connection with the production sector, as well as the quality of the study programs in universities that train qualified human resources required by the industry so that there are no obstacles when alumni are hired by companies in need of engineers or staff. Universities as well must provide the opportunity to learn specialized skills and abilities both in language and software.

Conclusions of the Government Sector
The government of the state of Baja California, from a systemic perspective, requires a local national plan, which includes national public policies adapted to local needs, decentralizing the programs and policies associated with business support and management by the forerunning sectors of economy and professional callings of the city.

Conclusions of the Business Chamber Sector
Business agencies must unite their efforts and synergies in order to develop a common agenda that may strengthen the business sectors through programs and agreements that may contribute to solving the needs of companies and the employees they represent; to provide business stability and economic development; promote a culture of value of work; and overcome technical and professional difficulties of society in general terms, in order to raise its quality and level of life.

Conclusions of the Consultant Sector
In turn, professionals who serve as consultants, in several cases as the result of having worked in the industry and therefore they representing the "Know How of Success" and the industrial development of Tijuana – need to provide standardized services per sectors and generate certifications for standards of occupational competence, since low operational cost strategies are not the only choice for organizations competing at the international level. Also the capacity to maximize business callings in the region and the local supply departments are to be considered.

The policy analysis process blends two critical issues. The first one is oriented towards the study of changes in scales and spaces of economic activity in the trans-border regions or cities as is the case of Tijuana which has economic dynamics that are very different to the national average, as well as leadership of foreign investment addressed in the *maquiladora* industry, not only in the northern Mexican border, but at a national level. Secondly, the analysis of three critical processes of public policies. Analyzing public policies has a strategy directing them to maximize their benefits and distributional potential to develop the globalization process in cities and their potential for society.[15]

The strategic plan for Tijuana 2003-2024, developed in 2003, implied a planning process of three dynamic stages. The first and second stages implied the following: 1. Organization, 2. External analysis, 3. Internal analysis, 4. Critical issues and breaches. The third stage centered on the development of: 5. Goals and objectives, 6. Strategies and projects, 7. Strategic actions and 8. Implementing actions. The region of Tijuana, Baja California, represents a reference for the sector integration model, for the integral development of the region, with the generation of sustained growth conditions and social progress, thus providing opportunities for national and international migrants.

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[15] Sassen (2007) acknowledges that cities and regions with a global economy widen their options of politics and government.

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5 Lean design for six sigma: An integrated approach to achieving product reliability and low-cost manufacturing

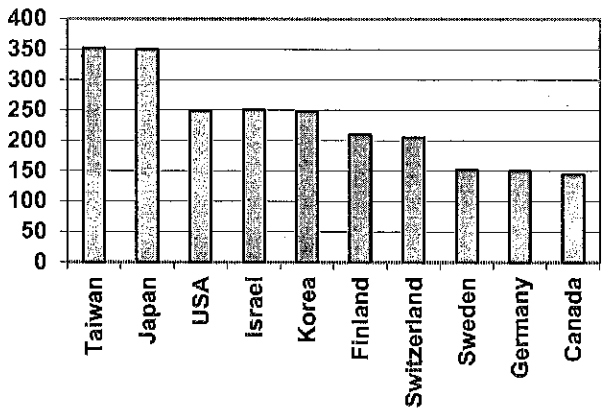
Jesus Gerardo Cruz-Alvarez and Berenice Mendez-Saenz

INTRODUCTION

In today's market and business environment, new product development is one of the key operations of a firm. Evolving market dynamics require new products to be innovative and competitively priced and to use sustainable technologies. Furthermore, firms require NPD to be cost-effective and to have an optimal time-to-market cycle.

NPD performance from a global perspective is most easily measured as the number of patents obtained per country and the amount of investments in R&D (research and development) (OCDE, 2012). The top ten economies in terms of the number of patents granted are almost identical to the top ten in terms of R&D investment (see Figures 5.1 and 5.2).

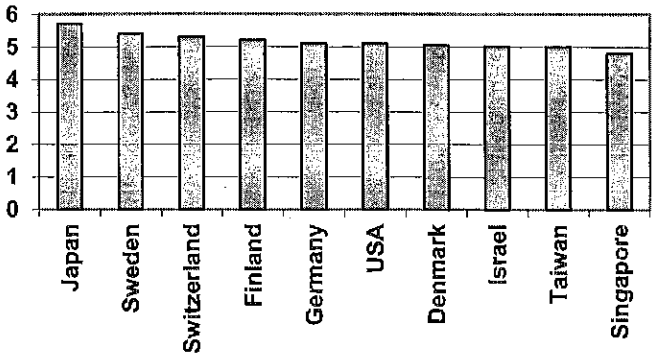
Figure 5.1 New Granted Patents



Source: OCDE, 2012

NPD follows a traditional approach that begins with identifying a new idea or concept for a new product and continues with design, industrialization, testing, validation and sales. However, due to increasing market competitiveness, firms must incorporate advanced processes for new product development, such as APQP (advanced product quality planning) and LDFSS (Lean Design for Six Sigma).

Figure 5.2 R&D Spending



Source: OCDE, 2012

METHODOLOGY

This research paper is based on the theoretical background presented in peer-reviewed scientific research papers during the period 1990–2012. In the second section of this study, the author provides examples of the proposed tools and of advanced techniques to show evidence that validates the hypothesis.

New Product Development Framework

In terms of its function and process, NPD represent a key strategic area for every firm. NPD is related to business intelligence, R&D, marketing, product phase in and phase out strategy and innovation, among other capabilities (see Figure 5.3).

Model Development and Hypothesis

The main goal of this study is to present practical evidence that LDFSS can be introduced into the NPD process to accelerate the achievement of its primary goals: reliable product quality and low-cost manufacturing (see Figure 5.4).

Theoretical Background

Some organizations have reported NPD to be one of the top three that have received the most attention, as proposed by Goetsch and Davis (2010), and have suggested that its success depends on design expertise and research and development capabilities in addition to the necessary input from different functional areas, as mentioned by Afonso et al. (2008), Handfield et al. (2008) and Plambeck (2011). Typically, different functional areas work simultaneously during this process.

In the early stages of new product development, a cross-functional team must provide feedback on the design and help the firm to achieve a cross-validated industrial design. The key parties involved in this step include suppliers, manufacturing and process, quality and design engineers, as discussed by Rasli Muslimen et al. (2012).

Figure 5.3 NPD Conceptual Diagram (by Cruz)

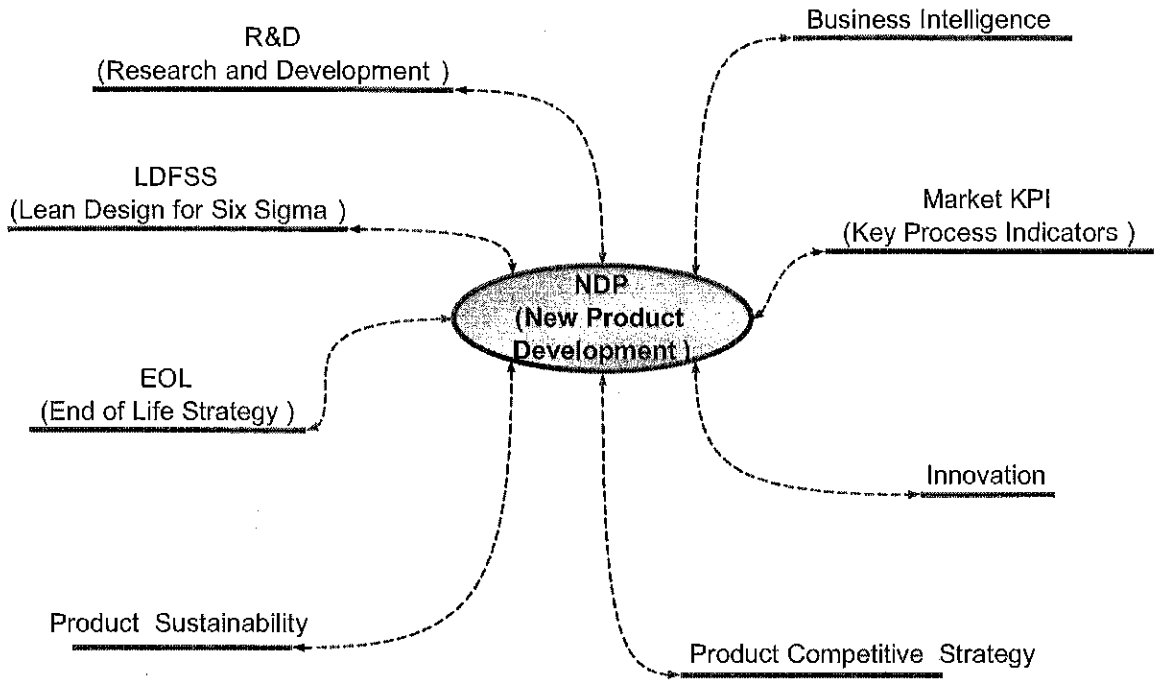
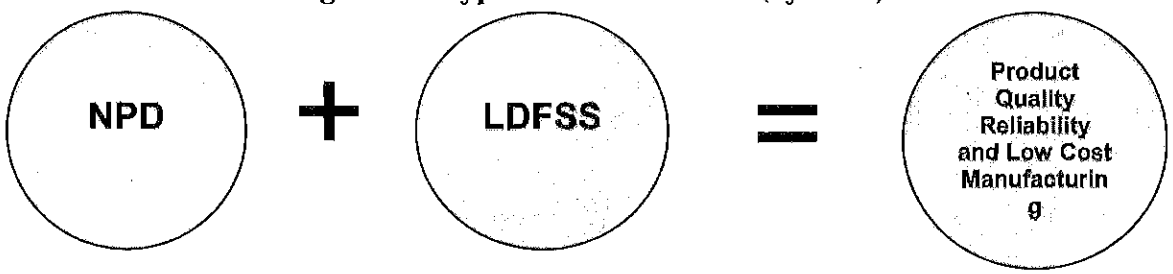


Figure 5.4 Hypothesis Framework (by Cruz)



Communication between R&D and marketing has a highly significant effect on the final conceptual design, as does the engineers' expertise in finalizing the industrial design, as confirmed in a previous study by Chang (2011) that examined 138 high-technology Taiwanese firms and found interaction between NPD teams. Similar theories and discussion are presented by Griffin (1996), Henderson et al. (2005) and Fernandez (2001).

There are some theoretical studies that describe the relationships and business synergies associated with well-designed, customer-oriented products, i.e., Kano (2001), Su (2006), Fornell (1987) and Cristiano et al. (2000). Firms can also use web-based technology as a powerful tool that can bring them closer to customers and determine their perceptions (both positive and negative) of a product. Pioneering web-based technology focused on consumer perceptions was developed by Park (2011).

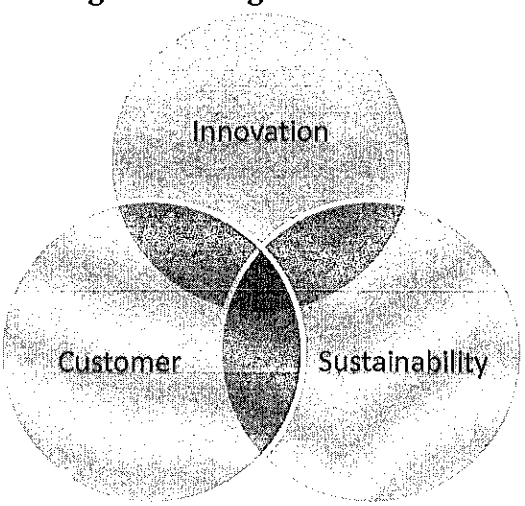
New product development requires customer input and this knowledge can be extracted and analyzed using a variety of marketing and customer-driven tools, such as QFD (Voice of Customer and House of Quality) and customer profile studies.

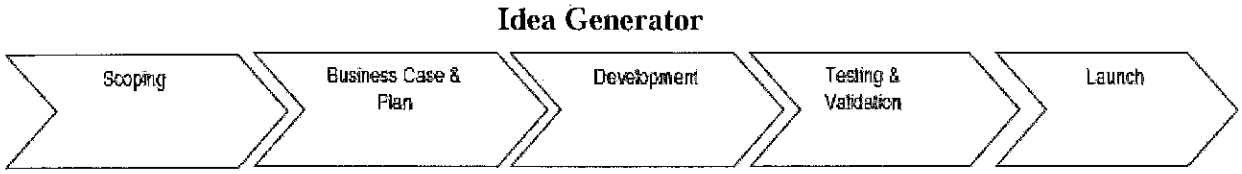
New product development should be considered a powerful strategy for meeting customer preferences through customer-focused products. QFD (Quality Function Deployment) is a customer-driven approach that transforms customer expectations into engineering requirements and manufacturing process parameters. According to Pang et al. (2011), QFD is extremely important during the product design stage. Working papers and empirical research proving the effectiveness of QFD during a design gate include Govindalruri and Cho (2007), Freiesleben (2010) and Sharma and Rawani (2007).

As indicated by Chan et al. (2011), new product development includes four major steps: 1) Opportunity identification, 2) Conceptualization, 3) Product design and development and 4) Product launch and commercialization. However, this approach is not aligned with new business dynamics (see Figure 5.5). The goal of this working paper is to propose that the APQP (Advanced Product Quality Planning) methodology allows a firm to face design issues at an early stage using different tools and lean design for Six Sigma. This approach should make it possible to ensure better design concepts and industrialization, while combining research and development with product and process reliability to create a lean product design process (see Figure 5.6).

Product design and lean product design are two different concepts. Product design is a traditional approach to new product development that involves obtaining an idea, making an industrial design, validating the design and launching the product. In contrast, lean design focuses on reducing the overall product development cost and time to design, as well as ensuring a cost effective product launch, as outlined by Azharul et al. (2011).

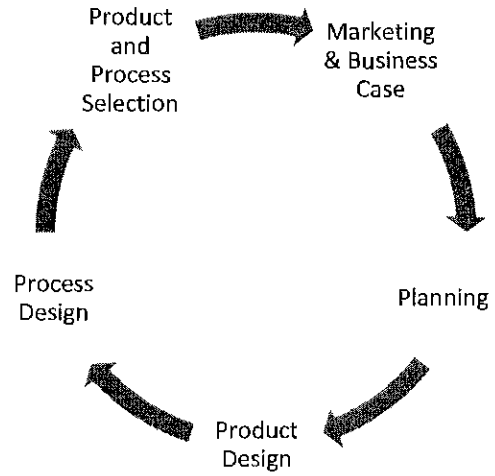
Figure 5.5 Stage-Gate Process





Source: Cooper, 2001

Figure 5.6 Advanced Product Quality Planning



Source: APQP, 2007

Previous discussions by Ulrich (1995), Karim et al. (2009) and Cloke (2000) focus on the idea that organizations compete with regard to product innovation, time-to-market and research and development. To remain on the cutting edge, companies must emphasize quality, cost, productivity and bringing the product to the market. Research and development, in addition to a focus on reliable product quality, can enable lean product design development. According to Cloke (2000), any type of investment made during the design stage will be lower than any type of improvement made during the product manufacturing phase.

Research and development, product quality and process reliability are not the only factors in new product development speed to market, product quality and cost are alternative priorities. Recent empirical research by Rodriguez et al. (2005) reveals that consumers are more influenced by product quality than speed to market. These results are consistent with previous research by Barker and Sinkula (2008) and Grinstein (2005). This customer perspective demands more from organizations, which must conceptualize, design and launch high-quality products with better process manufacturing reliability than those of their competitors, according to Kirca and Jayachandran et al. (1995) and Atuahene (2011).

According to Heinzen and Höflinge (2010), the competitiveness of successful firms is based on their ability to balance product quality and innovation with cost-effective NPD and reduced time-to-market cycle time. To achieve cost-effective NPD and short time-to-market, firms must implement concurrent LPD (Lean Product Design) strategies. According to Schulze et al. (2010), Womack and Jones (1996) and Walton (1999), LPD can be understood as integrating the

following steps: 1) specifying customer value; 2) identifying the value stream; 3) making the value flow; 4) letting the customer pull; and 5) ensuring continuous improvement.

Competing organizations facing these difficult business dynamics must identify their technological and human capabilities to determine and achieve key market objectives: increasing end-product quality and shortening the time-to-market cycle. Heinzen and Höflinge (2011) found that on-the-job training contributes significantly to the efficiency of NPD processes and enhances the motivation and skills of the new development team.

Another approach to the NPD process is explained by Grunert et al. (2011) who suggested that NPD involves key process activities, such as 1) consumer insight into the new product development process; 2) quality perception as a focal construct; 3) market opportunities and idea generation; 4) consumer acceptance of technology; 5) screening, concept development and concept testing; and 6) prototype testing. However, this approach does not consider process design or product and process validation to be part of an advanced focus on product quality planning.

NPD is mainly driven by cost-effective implementation and profitability. However, for optimal results, NPD must balance economics, design and ecology. The new eco-design approach impacts the overall concept of product design and the selection of manufacturing processes, as highlighted by Grunert et al. (2011).

An alternative to the traditional approach to NDP that is presented by Baril et al. (2011) and Breyfogle (1999) employs the concept of Six Sigma as a quality philosophy that involves the use of statistical tools within a structured methodology to obtain the knowledge needed to out-compete other firms in terms of quality, time-to-market and price of their products and services. In addition to the Six Sigma approach, Baril et al. (2011) present the key steps in the DFSS (Design for Six Sigma) process: 1) identify, 2) design, 3) optimize and 4) validate.

Design for Six Sigma uses tools such as CTQ (critical to quality) analysis, GD&T (geometrical design tolerance), FEA (finite element analysis) and process design simulation to 'poke-yoke' the planned design and promote a robust manufacturing process. In addition, previous studies by Yu and Ishii (1998), Taguchi (1993), Chen, Wiecek and Zhang (1999) and Eggert (1991) link the use of design for Six Sigma to increased product robustness.

CTQ is a common terminology that identifies a critical feature or component of quality. Once a component is defined as critical to quality, different process control activities must be conducted to ensure that the component meets the defined specifications; otherwise, the product may fail the customer.

GD&T is used to define the components' and features' required dimensions for perfect assembly; it also defines the allowable variation between components in terms of their linear dimensions or datum references.

FEA is an engineering approach used to develop robust engineering products and process configurations to design to fail-free or fail-safe specifications. According to Afazov (2012), FEA

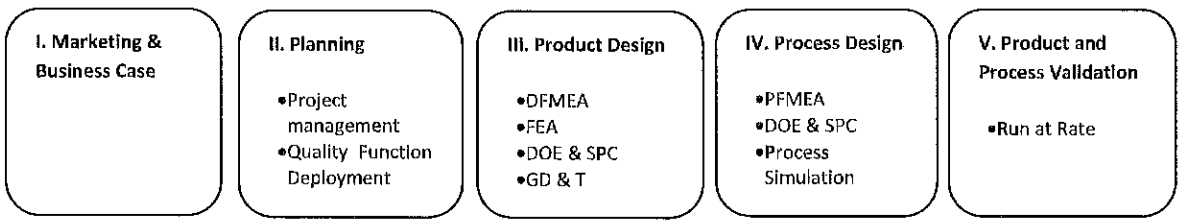
can be used to identify stressed and weakened areas and improve them accordingly based on the manufacturing process or customer use. The FEA methodology and its applications to new product development have been discussed by Pietrzyk et al. (2008) and Jahansson (2004).

The aim of the process design phase is to configure the manufacturing process to suit the new product design intent. As proposed by Zhenyuan et al. (2011), process design can be time - and cost - effective when the organization uses special tools and techniques to develop the manufacturing process, such as the following: layout simulation, experimental design, expert systems and the intelligent manufacturing approach, among others.

RESULTS: LDFSS TOOLS APPLIED TO THE APQP PROCESS FOR NPD

Based on the theoretical background presented in the earlier section, we can focus on key elements of lean design for Six Sigma tools that can be introduced into the advanced product quality planning process for new product development (see Figure 5.7).

Figure 5.7 Lean Design for Six Sigma Key Tool (by Cruz)



The full APQP process includes five stages or gates for the NPD process, with each step contributing to the main goal of increasing cost effectiveness and optimizing the length of the time-to-market cycle. Each step in the process includes specific tools, such as project management, quality function deployment, finite element analysis, design of experiments and failure mode and effect analysis. The aim of this APQP case study is to present evidence of the introduction of key tools from lean design for Six Sigma into NPD and indicate the influence of these tools on product quality and reliability.

The following figure (see Figure 5.8) contains a waterway for a commercial faucet or service sink that is composed of three main elements: a brass waterway, a water spout and an o-ring. To further analyze the potential failure modes, while making the product design gate a useful tool, failure mode and effect analysis can be used (see Table 5.1). The FMEA process can be nsed in the design gate to identify the RPN (risk priority number). In this example, the failure mode that triggers an RPN 240 occurs when the system begins leaking and may experience liability issues. This, in turn, occurs when the o-ring loses compression due to its proximity to a chamfer area.

Figure 5.8 Conceptual Design of a Waterway (by Cruz)

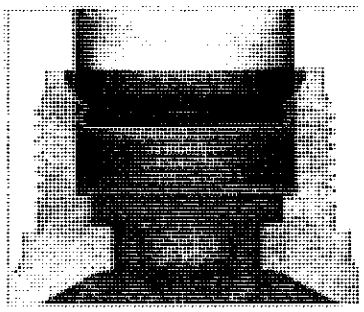


Table 5.1 Design Failure Mode and Effect Analysis

Description	Function	Potential Failure Mode	Potential Failure Effects	S	Potential Causes	O	Current Controls	D	RPN
O-Ring groove center line too close to lead in chamfer	Waterway	Inproper o-ring compression causes leakage issue	Leakage	8	Inproper o-ring compression	10	To analyze machine process capability and evaluate poke yoke by design	3	240

Industrial design will identify the overall dimensions of the components and the CTQ (critical-to-quality) features that may cause issues and that are related to high RPN (see Figures 5.9 and 5.10). The CTQ characteristic for this waterway is the x-x´ dimension of the o-ring's center line and the starting point of the chamfer. This would be the location of the water leak.

Figure 5.9 Critical Dimensions Related to Industrial Design (by Cruz)

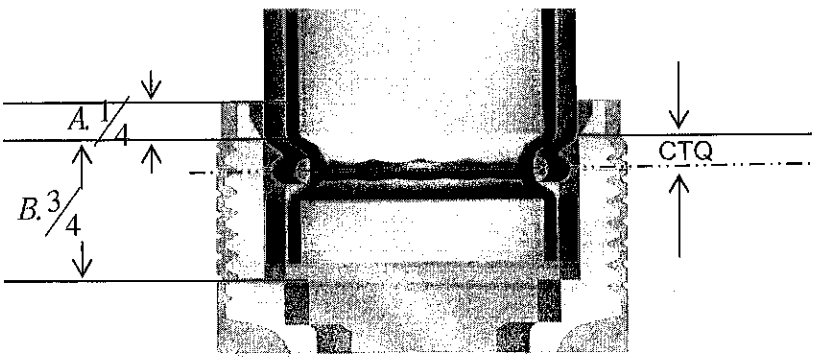
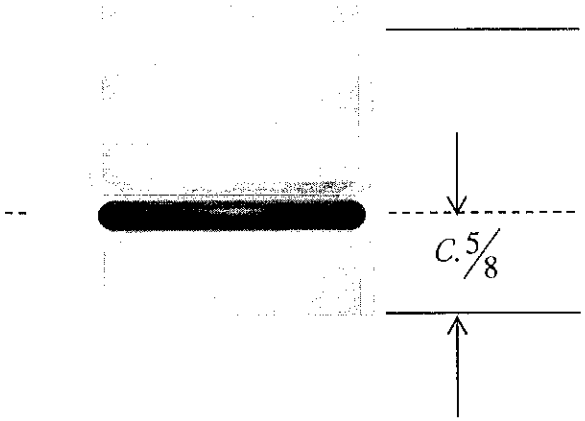


Figure 5.10 Spout Tube and O´Ring Leak Free Feature (by Cruz)



Industrial design based on GD&T (geometrical design and tolerance) and DFMEA can be used to determine the tolerance for each design reference (see Eq. 1). The following calculation produces the upper and lower limits for the key dimensions.

Equation No. 1. Design Specification for Key Variables A, B and C

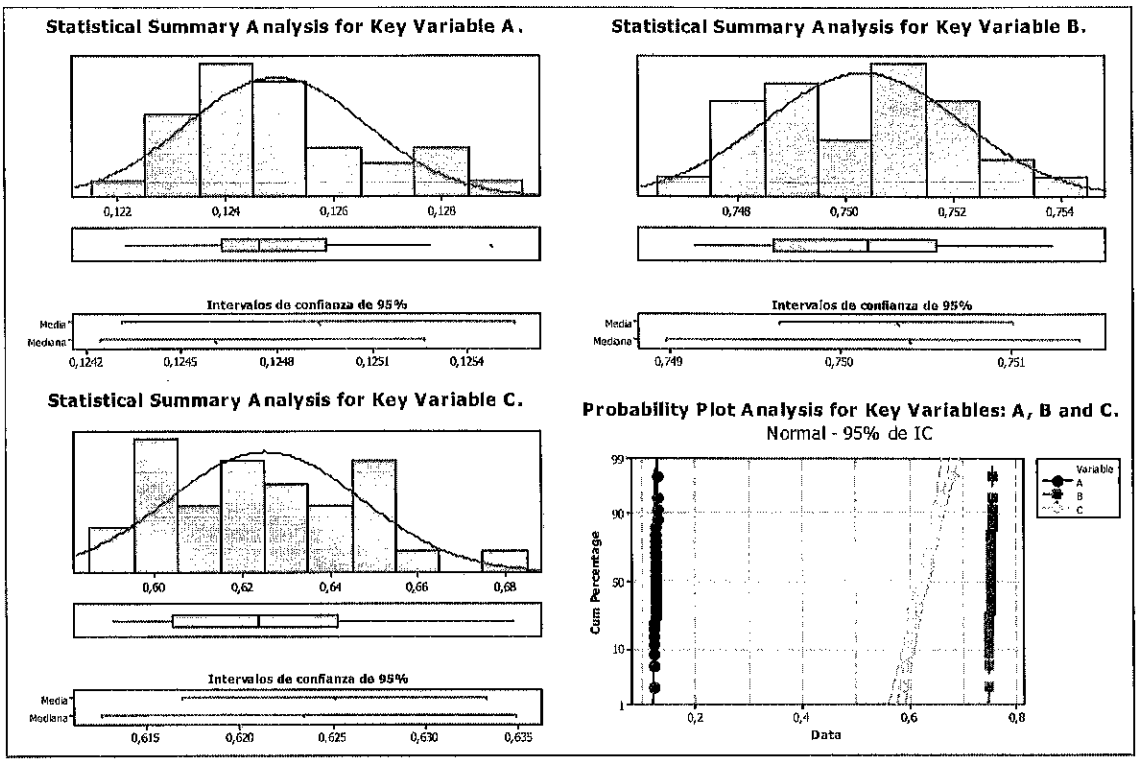
$A = 0.125 \pm 0.006$. (nominal value)	$B = 0.750 \pm 0.006$. (nominal value)	$C = 0.625 \pm 0.020$. (nominal value)
$USL = 0.131$.	$USL = 0.756$.	$USL = 0.645$.
$LSL = 0.119$.	$LSL = 0.744$.	$LSL = 0.605$.

DOE and SPC are state-of-the-art techniques for simulating product performance through manufacturing (see Figure 5.11). A process capability study shows evidence of the occurrence of failure when the system begins to leak. Statistical analysis yields sufficient evidence to confirm that the key dimension "c" is at a minimum according to the probability plot analysis, and 3D software can be used to recalculate the minimum "c" (see Figure 5.12). To calculate the delta, it is necessary to take the "c" mean sample value and the standard deviation (see Eq. 2) to calculate the natural upper limit and subtract from it the nominal "b" critical delta. The delta can also be shown in a normal histogram plot (see Figure 5.13).

Ouce the machine process capability is known, it can be input into a stack-up tolerance analysis to calculate the process drift in addition to a safety factor (see Figure 5.14 and Eq. 3). The process drift is 1.63. sigma in addition to a safety factor of 15% to create a larger space from the upper natural limit of "c" to the lower natural limit of "b."

This approach focuses on the downsizing strategy of RPN, while reducing the opportunity of failure occurrence. Following this approach, RPN decreases from 240 to 48 (see Table 5.2). The new "c" dimension can be calculated accordingly (see Eq. 4) and theoretical new cross section of "c." An illustrative histogram plot of the new redesigned "c" versus old "c" is shown in Figure 5.16.

Figure 5.11 Machine Process Capability Analysis (by Cruz)



Equation 2. Delta Calculation to Failure Based on Upper Natural Limit

$$UNL = 0.625 + 3(0.022) = 0.691.$$

$$\Delta = 0.750 - 0.691. = 0.059.$$

Figure 5.12 Waterway Leak Free Compromised - Failure Mode Occurrence (by Cruz)

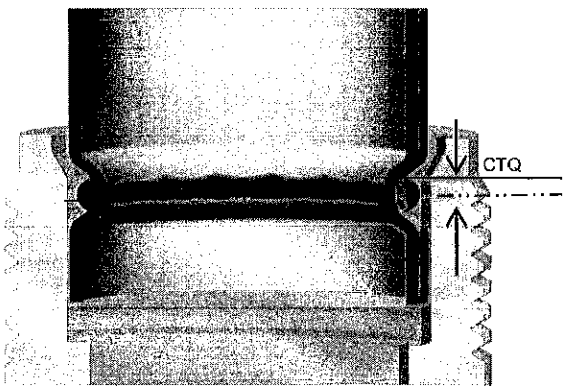


Figure 5.13 CTQ Condition Based on Random Sampling Analysis (by Cruz)

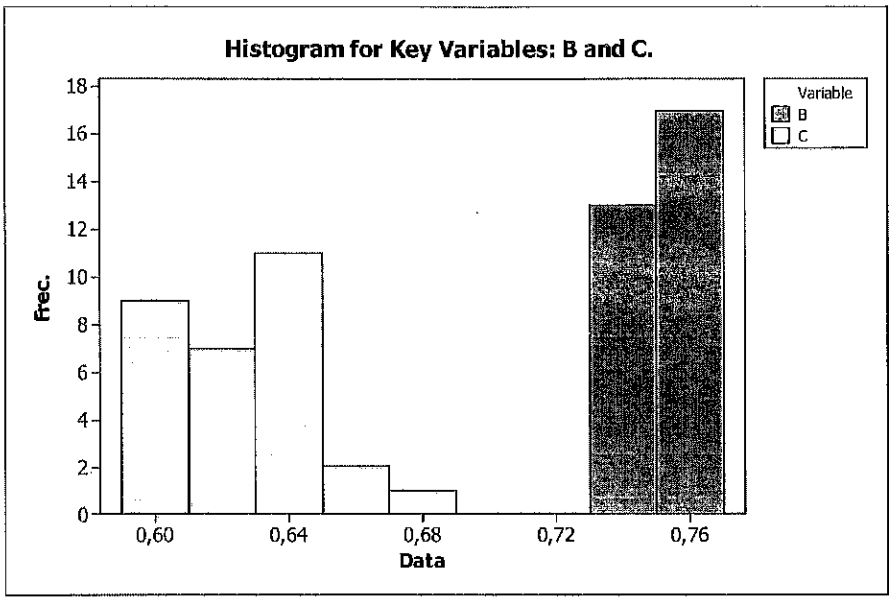
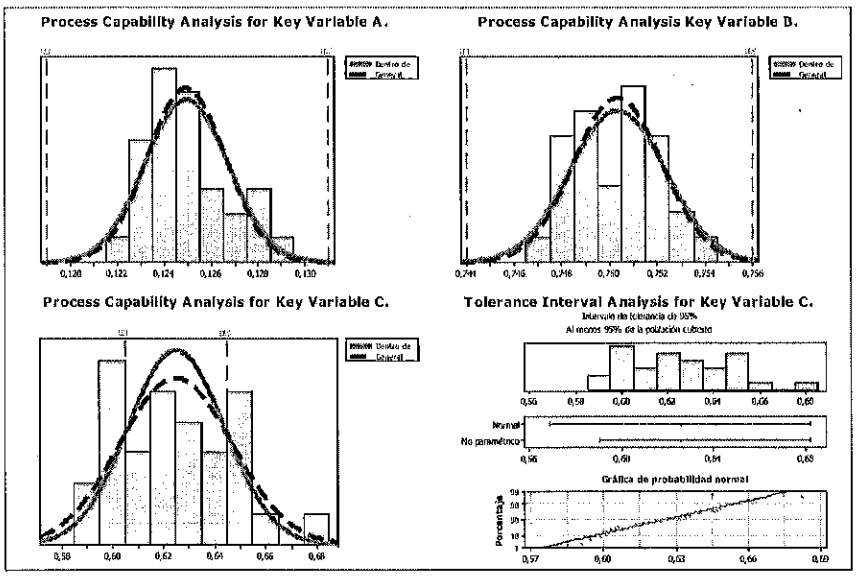


Figure 5.14 Tolerance Analysis for Key Dimension C (based on CTQ condition) (by Cruz)



Equation 3. Process Drift Calculation for Revised C Including Safety Factor of 15%

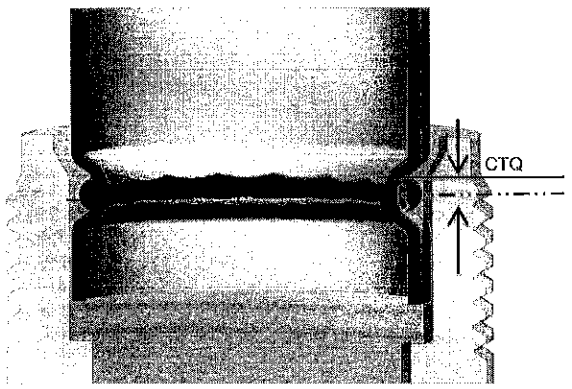
$$PD = \left(\frac{0.645 - 0.681}{0.022} \right) = 1.63\sigma.$$

$$PD^{sf15\%} = 1.63\sigma * 1.15 = 1.87\sigma.$$

Table 5.2 DFMEA Revaluation (effect on RPN)

Actions Recommended	Resp.	Actions Taken	SEV	OCC	DET	RPN
To incorporate a safety factor on feature to eliminate the risk of failure mode	Design Eng.	Safety factor implemented	8	2	3	48

Figure 5.15 Conceptual Design for Revised Key Variable Dimension of C (by Cruz)



Equation 4. Tolerance Design Review for C Based on CTQ Including Safety Factor

$$C^* = 0.625 - 1.87\sigma$$

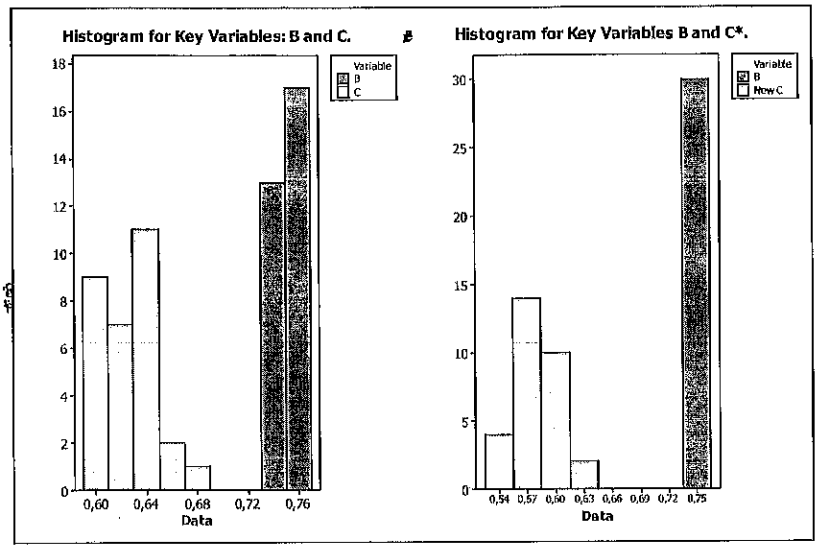
$$C^* = 0.625 - 1.87(0.022) = 0.583.$$

$$C^* = 0.583 \pm 0.02$$

$$C^*USL = 0.603.$$

$$C^*LSL = 0.563.$$

Figure 5.16 Theoretical Analysis for Revised Key Variable Dimensions of C (by Cruz)



DISCUSSION

This study presented the theoretical background on the NPD process and related functions in today's organizations as they relate to competition. NPD was identified as one of the top priorities of every firm, which is why the NPD process must be optimized and oriented toward customers to ensure the quality and reliability of products, while minimizing manufacturing costs. To fully deploy all NPD tools requires basic steps such as the following: marketing and planning, design, process, product process validation and the integration of operations from a concurrent engineering standpoint.

Lean design tools can easily be introduced into the advanced product quality planning process to ensure the implementation of cost-effective new product development processes intended to ensure product and process reliability and minimize failure during the design stage. This approach will significantly impact goals regarding product quality and reliability and customer expectations. The effect on timing and cost is greatly appreciated by top management and it is well known throughout the firm when a strong, reliable product is launched that it is flawless. All departments involved in the introduction of new products are aligned with the top priorities: 1) safe launch, 2) reliable product quality, 3) timing and 4) budget. Although these four priorities appear to be opposing, they must be met concurrently to ensure a successful NPD launch.

The case study presents a typical, straightforward design. Even when the design and development stages are complete, there are opportunities for improvement when the new product enters the manufacturing process, as it is possible to address the potential for failure due to leaks. This case study shows the application of the traditional stage-gate process, which employs a very basic concept of a safe NPD launch but not the application of the advanced product quality planning framework, which aims for a flawless and cost-effective NPD launch.

The NPD tool kit integrates DFMEA, CTQ, FEA, DOE and simulation, among others, which are used in the advanced product quality planning framework. In this case study, the RPN decreased from 240 to 48. Although the potential for failure remains, the occurrence of failure was reduced to parts per million measure in the single digits, which indicated that excellence in manufacturing and reliable product quality had been achieved in addition to low-cost manufacturing. The tools work and the knowledge is there. Top management must simply support the use of this approach to ensure successful NPD launches. Using this approach will earn firms high recognition among end consumers due to their product quality and readiness for manufacturing.

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6 Marketing knowledge as a competitive tool for manufacturing companies in the electronics industry in the Guadalajara metropolitan area

Manuel Alfredo Ortiz-Barrera, Jose Sanchez-Gutierrez, and Guillermo Vazquez-Avila

INTRODUCTION

The classical marketing model focuses directly on a product or a service. Nonetheless, contemporary companies have to face international competition that goes beyond the product itself. Therefore, intangible resources provide a lucrative opportunity for generating growth in active industries, such as the electronics industry. Companies must manage the collection of data and information through their external agents and interest groups in such a way as to allow them to be used to introduce positive changes to traditional models, which are focused on the tangible aspects of the companies. A cognitive vision of the market is a fundamental principle for the development of more competitive systems in contemporary companies.

This trend has broken the traditional paradigms related to the production of capital goods and towards production of services and products recognized by consumers as true satisfiers of their desires and needs. A company's interest groups are also taken into account, arriving at a multi-disciplinary cluster that leaves room for active participation of marketing in collection and processing of information about consumers' interests. Therefore, a classical view where marketing is considered to be an area related to planning, sales, design, product and strategy development should be modified in such a way as to be focused directly on creation of technical and administrative advantages, which will benefit consumers, suppliers and, primarily, companies that implement marketing knowledge techniques. However, many companies, such as those in the electronics manufacturing industry of the Guadalajara metropolitan area, do not consider these elements to be of critical importance. On the contrary, the companies consider them to be more administrative costs, although marketing brings more benefits than harm to an organization. This is how key companies in the so-called Mexican Silicon Valley, such as Jabil, Sanmina or Flextronics, have initiated a transition towards inclusion of new trends into various businesses.

This article provides a description of the industry, application of marketing knowledge to the electronics manufacturing companies and the impact of knowledge processing and implementation on development of competitive marketing advantages, which would allow positioning a cluster to be a true option for manufacturing of electronics.

JUSTIFICATION

Challenges faced by industries in light of existing competition in the global markets have led to the appearance and re-appearance of theories which allow organizations to implement their processes and transactions. Therefore, marketing has become a relevant part of today's

organizations. Benefits obtained through implementation of marketing models are very lucrative from an economic perspective for companies who choose to implement them. Nevertheless, this potential remains far from being developed in terms of collection of knowledge of interest groups for the purpose of arriving at intelligent marketing, which is more aligned with a company's needs.

Therefore, a choice of competitive strategies, which could be beneficial to consumers and enhance the communication process and the relationship between the company and its clients for monitoring product demand, as well as the implementation of designed strategies, must be based on a tool that promotes identification of a useful knowledge that will aid in a company's marketing processes.

The significance of this study lies in the need to acquire substantial competitive advantages based on intangible capital, which is formed on the basis of knowledge related to suppliers, clients, distributors and company staff. It determines the use of marketing to offer more attractive high value products to end consumers. Manufacturing companies should master this model, since they are producing highly sophisticated products, in order to obtain desired positions in the market through apparent advantages, added value and consumer experience. Marketing knowledge exists at all times and in all transactions, but it should be clear that successful results are achieved only when the knowledge is put into practice.

THEORETICAL FRAMEWORK

Companies in the new century face a need for a maximum increase of their competitive advantages. Therefore, organizational priorities have to be modified in order to provide due recognition to intangible elements, which can lead to significant changes and improved performance of the companies. Knowledge management is a model that aims to convert this goal into a reality, bringing about improvements to strategic and competitive outlooks and solutions to issues faced by a company (Massaro, Bardy, & Zanin, 2011). Although companies have shown some interest in viewing production capacities from the perspective of the employees (Salvati, Shafei, & Shaghayegh, 2010), it has taken a long time for this concept to evolve, convert and find its own place in the day-to-day vocabulary of enterprises and scientific researchers. According to Šajeva (2010), it was even considered an element that did not have much importance on development of company business plans. From this perspective, scholars, such as Qin Li, Ping Zhou and Xin Li (2011), have a very clear view of knowledge management:

> Information management is the basis for knowledge management. Knowledge management is an extension and a development of information management. The difference from prior information states has to do with the fact that this approach connects information with informational activities, information - with individuals, who in turn transfer it to intelligence teams, which transform it into competitive knowledge, transmitted through a process of inter-personal communication.

Such a statement further elaborates on the ideas of Liao, Chuang and To (2011) that knowledge has the unique property of being created in accordance with the experience of those in charge of collecting data and information, providing organizations with unique structures for each case. In

addition to shared experiences, it is a sustainable advantage in itself (Alavi & Leidner, 2003). Nonetheless, the competitive advantage that has been developed by an organization must be based on the perception by the markets in which they participate (Hung, Chou, & Tzeng, 2011).

Knowledge management pursues three main objectives, which are based on Catanneo's views (2008):

- Provide support to essential organizational processes and performance
- Provide support to new performance-related managerial needs
- Create value generation sources

Each one of these has a basis for improving the quality of decision making, production, sales and process improvements. This concept is described by the term "information and knowledge society" (Crescêncio & Dalfovo, 2003) and contributes to the fact that many organizations have begun to change their behavior and trends towards growth, since global complexity, technological advances and, of course, knowledge accumulated as a result of operations (Martinez, 2006) have modified the paradigm created over the course of many years when scientific knowledge functioned only in science and not in terms of the search for competitive advantages (Tang & Li, 2010). On some occasions, the usefulness of this theory may be the difference between the success and failure for companies that have begun to apply it. Therefore, each organization should strive for better employment of available cognitive resources, distinguishing between three main elements of knowledge management, i.e., data, information and knowledge, since the first two give rise to knowledge, converting it into the most valuable resource of an enterprise and must be coded in accordance with the policies and decisions of the enterprise.

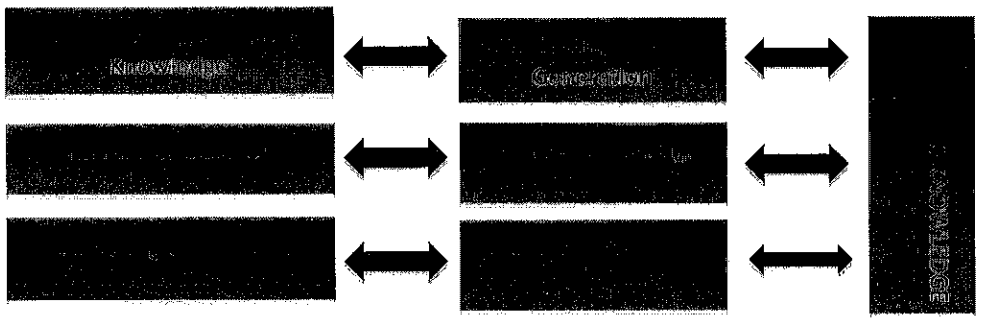
However, coding assigned to knowledge directly depends on the individual in charge of its processing and orientation (López & Meroño, 2011). Therefore, in the majority of cases, a traditional model proposed by Nonaka (1994) on explicit and tacit knowledge is used where it can freely shift between these two phases. This is how a knowledge hierarchy pyramid is built where conceptualization and idealization of abstract cognitives may serve as triggers for the organization's value chain (Kebede, 2010.) Nevertheless, despite being valid for organizations, such theories have been naturally surpassed, due to circumstances related to the transformation of organizational behavioral schemes. Therefore, when it comes to marketing, knowledge has to be transformed at a breathtaking pace in order to make use of the advantages arising within organizations. Marketing is undergoing a period of substantial transformation (Stampacchia & Mele, 2010). In recent years, a considerable amount of attention has been paid to an empirical generalization of marketing (Write & Kearns, 1998). This is how many companies acquire knowledge to face the challenge of being more competitive (Hau & Evangelista, 2007) with respect to their products and services, since company success is defined by the development of new cognitive assets which are used for creating basic competencies (Aktharsha & Anisa, 2011).

Therefore, marketing knowledge has been a pivot point that has contributed to the increasing number of market-focused advantages (Park, Whitelock, & Giroud, 2009). This type of knowledge is different from technological knowledge, since it is focused on product development and research and not on the manufacturing process (Sánchez, Ramírez, & García, 2008). Therefore, it could be concluded that marketing knowledge is a must-have know-how

when it comes to implementing market research activities and including them into business plans. According to Rossiter (2001), the concept may be defined as everything formulated by marketing managers for establishing marketing plans. Nonetheless, consumers are the ones who possess true empowerment, since they are the ones who determine product value by means of their usage experience and not the manufacturer by means of product distribution and production (Rèpres, 2010).

Furthermore, Eeverything is affected by external orientation of markets, with an emphasis on information development based on consumers and competitors, which provides an external knowledge required for creating and consolidating company capabilities (Vaux & Ansu, 2009). This orientation is a mere adoption and implementation of a marketing concept for the establishment of a foundation for knowledge creation and management (Darroch et al., 2004). Much work has been carried out with a focus on the market with the objective of finding a practical application for marketing from a more pragmatic standpoint. Therefore, a specific perspective of these types of tools must mainly be focused on accessing, taking advantage of, application and integration of knowledge accumulated in relation to marketing (Litter, 2005). They can also be used in knowledge conversion models (Nonaka et al., 2006) and the intellectual and social capital developed by Newell, Tansely and Huang (2004) for creating a cognitive focus that fully defines marketing capabilities of an enterprise.

Figure 6.1 Marketing Knowledge Generation Model



Source: Prepared by the authors

Figure 6.1 shows that integration of three marketing-focused principal elements of the organization lead to marketing knowledge. Likewise, integration of marketing processes and tasks directly help to create and sustain competitive advantages (Schlegemilch & Penz, 2002), which are established when the value of marketing is conveyed through managers who have a superior understanding of current and future needs of the consumers with an objective of offering them solutions that are different from those offered by competitors (Ellis, 2009). Nonetbeless, this is only a beginning, since knowledge must be returned in an explicit manner, i.e., a manager must apply this concept, which can be distributed and implemented within the organization (Akroush & Al-Mohammad, 2010).

However, if one wants to ensure the success of marketing knowledge within the operational units, it is necessary to break through the idiosyncrasies of centralized structures, both from the internal environment and the suggested external environment (Ingmar, Wilhelm, & Li, 2004). Therefore, according to a model developed by O'Donnell (2000), a model can be used for

establishing the influence of knowledge flow factors, such as a proposal of modification of marketing knowledge, taking into account the traditional marketing mix model.

The electronics industry must modify its schemes to implement these types of schemes, since this industry plays a fundamental role on a global level, as it is considered a strategic technology sector (Melero & Calatrava, 2000). Thus, it becomes clear that sales of consumer goods are only a small part of the global strategic direction of the industry. As far as the city of Guadalajara and its metropolitan area, according to Partida (2002), it was not until the 1960s that the first *maquiladora* (manufacturing) enterprises started to become established in the location that was later called the Mexican Silicon Valley. Competitive advantages offered by the Jalisco state and, in particular, by the Guadalajara metropolitan area for the establishment of *maquiladora* enterprises, especially contract manufacturing ones, were identified by Merchand (2005) in the following manner:

- Trained Staff
- Population Density
- Government Support
- Industrial Cluster
- Infrastructure

All advantages offered by the city have encouraged multinational companies to perceive the Guadalajara metropolitan area as a natural area for the purpose of investment and establishment of electronics companies of all types. However, in addition to the main established companies related to contract manufacturing, the state government also propels the growth of the industry with tax incentives in order to promote foreign investment in two aspects: direct or indirect (Jalisco State Government, 2006).

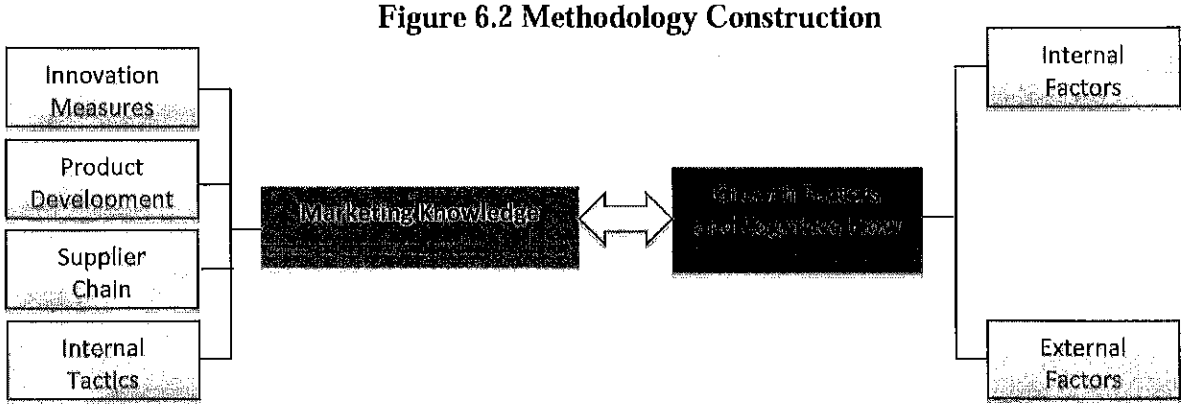
METHODOLOGY

Procedures applied for reaching the proposed study objectives are considered to be more of a general nature than research techniques, but they mark the guidelines that have to be followed to obtain results (Labarca, 2008). There are two main research techniques used in this study: a documentary research method and field research method. Likewise, two types of research were implemented in this study. The first is qualitative, which provides complete information about the organization's overview and background (Donlyres, 2000). It is complemented with quantitative research, in order to discover organizational behavior in numeric terms.

The survey design is based on three different tools, which have been tested and confirmed in international studies. These tools consist of two sections where knowledge creation and flow are measured. The entire survey, except for demographic data, is based on the Likert scale.

Companies were surveyed during November and December of 2011. All surveys were taken in the Guadalajara metropolitan area industrial parks.

Figure 6.2 Methodology Construction



HYPOTHESES

H_1: Greater marketing knowledge provides for better product development
H_2: Greater marketing knowledge provides for better logistics capabilities
H_3: Greater marketing knowledge provides for better technological innovation

QUANTITATIVE ANALYSIS

Twenty-five surveys were conducted with middle and top managers of electronics companies, which employ contract manufacturing as their business model. It was decided to engage these employees because it would be a more adequate way to find out whether a marketing management model was implemented or whether steps had been implemented to accommodate this type of model within the organization. In addition, a scheme used by top management is easier to access than that used by line workers. Only two women carried out management tasks, such as line supervisors or area coordinators, thus male contribution accounted for 23 positions. Bartlett's Sphericity Test and KMO Study were performed, which yielded the following results:

Table 6.1 Bartlett's Sphericity Test

Kaiser-Meyer-Olkin sample adequacy measures		.579
Bartlett's Sphericity Test	Chi (χ) square approximated	2340.743
	Difference	430
	Sig.	.000

Source: Prepared by the authors based on survey data

Table 6.1 shows that variables have a 57.9% correlation. In other words, more than half of the study can be explained with the results obtained from the surveys. Although the industry is represented by 12 companies and 25 surveys were made, it should be noted that the hypotheses have a possibility of carrying out multi-variable studies, performed with statistical software. Moreover, the significance level shows that it is highly significant, since the statistical error is minimal (.000 value), thus it can be concluded that the study is 99% reliable.

Hypothesis 1 Analysis

This assumption considers that greater marketing knowledge provides for better product development. In other words, companies require a marketing knowledge model to add value to their products. A corresponding study was made through ANOVAS, taking into account questions about the tool, which investigation and development considers suitable for contract manufacturing companies and collection of knowledge that they have in place based on client information in order to generate a functional strategic marketing model.

ANOVA behavior indicates that neither knowledge variable was taken into account for performing research and development tasks. This mainly refers to significance levels, which do not show any type of correlation with expressed data. This allows for

Table 6.2 Hypothesis 1 ANOVA

		Sum of Squares	gl	Root mean square	F	Sig.
D121	Inter-groups	.591	1	.591	.724	.404
	Intra-groups	18.769	23	.816		
	Total	19.360	24			
D122	Inter-groups	.173	1	.173	.144	.708
	Intra-groups	27.667	23	1.203		
	Total	27.840	24			
D123	Inter-groups	.641	1	.641	.762	.392
	Intra-groups	19.359	23	.842		
	Total	20.000	24			
D124	Inter-groups	.923	1	.923	.784	.385
	Intra-groups	27.077	23	1.177		
	Total	28.000	24			

Source: Prepared by the authors based on survey data

any errors that may appear. Moreover, it shows that application of knowledge management models do not correspond to the creation of any type of marketing experiences based on prior experience with research and development processes of the organization.

Hypothesis 1 is rejected, due to lack of sufficient data that promotes implementation of any short-term changes in the surveyed companies.

Hypothesis 2 Analysis

This assumption considers that greater marketing knowledge provides for better logistics capabilities. Organizational activities also contemplate outsourcing of logistics activities,

therefore, if marketing knowledge management can be implemented as a growth driver, it is almost taken for granted that organizational competitiveness will grow in this context.

ANOVA analysis was performed, taking into account the responses provided by managers in order to determine the behavioral manner of such organizations in activities which involve logistics in any of its aspects and the relationship between them and organizational marketing.

Table 6.3 Hypothesis 2 ANOVA

		Sum of Squares	gl	Root mean square	F	Sig.
D131	Inter-groups	2.903	4	.726	.302	.006
	Intra-groups	48.057	20	2.403		
	Total	50.960	24			
D132	Inter-groups	1.345	4	.336	.193	.005
	Intra-groups	34.895	20	1.745		
	Total	36.240	24			
D133	Inter-groups	9.059	4	2.265	1.168	.000
	Intra-groups	38.781	20	1.939		
	Total	47.840	24			
D134	Inter-groups	3.436	4	.859	.463	.000
	Intra-groups	37.124	20	1.856		
	Total	40.560	24			
D135	Inter-groups	4.659	4	1.165	.539	.001
	Intra-groups	43.181	20	2.159		
	Total	47.840	24			
D141	Inter-groups	1.916	4	.479	.462	.012
	Intra-groups	20.724	20	1.036		
	Total	22.640	24			

Source: Prepared by the authors based on survey data

Results obtained for this hypothesis show that the implementation of knowledge into the supply chain has been a principal axis for determining marketing-related strategies. This has helped to improve the performance of logistical activities, by reducing a number of errors with receipt and distribution of merchandise from and towards the plant. Nonetheless, there are areas with room for improvement, since the results show a disparity in F statistics. That is, changes are still being made in order to take greater advantage of knowledge provided by product suppliers and consumers, who are not the general public, in order to improve strategies for attracting new companies or maintaining those who are already using services on a regular basis.

Hypothesis 3 Analysis

The third assumption considers that greater marketing knowledge provides for better technological innovation. Here, technological innovation does not refer to product improvement, but to the improvement of plant machinery and equipment.

Table 6.4 Hypothesis 3 ANOVA

		Sum of Squares	gl	Root mean square	F	Sig.
E11 1	Inter-groups	.827	4	.207	.408	.801
	Intra-groups	10.133	20	.507		
	Total	10.960	24			
E11 2	Inter-groups	4.818	4	1.205	2.052	.126
	Intra-groups	11.742	20	.587		
	Total	16.560	24			
E11 3	Inter-groups	6.133	4	1.533	3.108	.038
	Intra-groups	9.867	20	.493		
	Total	16.000	24			
E11 4	Inter-groups	2.998	4	.750	.890	.488
	Intra-groups	16.842	20	.842		
	Total	19.840	24			

Source: Prepared by the authors based on survey data

Significant discrepancies were observed, which mainly refer to the fact that interviewed contracted manufacturing companies were divided into two groups: one of them consisted of big enterprises, such as Jabil, Flextronics and Sanmina SCI. The other was a group of small enterprises that manufacture electronics and do not implement changes to their marketing strategies on an ongoing basis, thus they do not attract potential clients, which helps to set aside the issue of changing existing machinery and equipment. Thus, in the ANOVA the following can be observed:

- Companies introduced few changes to their machinery and work equipment, since they implement few marketing strategies.
- Organizational marketing is focused on the sales of services, not on the creation of value through technical innovation.

Therefore, hypothesis 3 is rejected due to inconsistency in the manner of organizational management.

CONCLUSIONS

Our present information and knowledge society has already penetrated the lives of all human beings in the 21st century. This includes enterprises, which are now required to place a greater emphasis on their intangible resources. A consumer, an employee, a supplier and a top manager may have different points of view on the systems, processes and resources owned and operated by a company. Nonetheless, a clear move towards an interchange of these experiences for the purpose of improving critical production points is a challenge faced by those industries that are the most sensitive to change.

The electronics industry and, in particular, contract manufacturing enterprises must capitalize on their most valuable resource - marketing knowledge - which will allow them to move forward and to continue holding a consolidated position in the consumers' minds. Tbis will also lead to the growth of these companies in international markets, continuing with technological innovation that has a favorable impact on sector competitiveness and influences the requirements of the groups of interest, mainly those directly related to the consumption of goods.

Therefore, the search for positioning and support by consumer and production preferences undertaken by the Mexican Silicon Valley cluster is a task aimed at building a solid industry that will attract direct investments and take advantage, through logistical capabilities knowledge, of communications with suppliers and consumers and thus strengthen the strategic positioning of the most innovatory products.

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7 Logistics competitiveness in Mexico vs. BRICS 2012

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INTRODUCTION

The connection between competition and logistics in a global economy is critical for countries wanting to make ties with global trade and achieve the benefits of globalization. The successful integration of global logistics begins with the ability to move goods across borders rapidly, reliably and cheaply (Francois, Mustra, & Panzer, 2008). Logistics can improve business performance by developing competitiveness in a specific sequence, such as quality, reliability, flexibility, agility and cost efficiency (Ferdows & Demeyers, 1990).

Countries and companies are facing increasing and intensifying global competition, rapid technological advances and growing demands from customer expectations. For instance, the Academic Alliance Forum suggests that a company's traditional competition versus another company's is shifting towards the business model, where the new challenge is the competition of a company's supply chain versus the other company's supply chain (Vokurka, Zank, & Lund, 2002).

Globalization today has created a global competitive environment in which companies and governments are heavily involved. These actors must make strategic decisions continuously in order to improve competitiveness.

One way of carrying out this activity is to analyze the results of the reports issued by the World Bank. The *Connecting to Compete Trade Logistics in the Global Economy* report, published twice a year since 2007, shows the overall context of logistics performance by country, region or worldwide.

This article examines the importance of logistics as an essential part of the competitiveness of Mexico and the BRICS.[16] It also analyzes the Logistics Performance Index (LPI), a document published by the World Bank, as part of its methodology, using statistical data and the application of questionnaires to 6,000 logistics professionals –of which 1,000 are international freight forwarders- in 155 countries. These professionals have expressed their opinion about the eight foreign countries where their companies frequently serve and highlighted the importance of good logistics performance and its impact on the countries' competitiveness.

The data shown in this report clearly demonstrates the level of competitiveness in logistics in these countries, which is why a different analysis methodology is proposed using the published

[16] In international economics, the acronym is used to refer to Brazil, Russia, India, China and South Africa. The thesis was proposed by Jim O'Neill, global economist at Goldman Sachs. According to O'Neill, the economic potential of Brazil, Russia, India, and China is such that they may become the four dominant economies by 2050.

data as a basis to processing via SPSS. With the results, the authors are able to show the real logistic competitiveness.

LITERATURE REVIEW

Logistics

The scope of the term logistics derives from the Greek word *logos*, calculation or thought. The logistics concept has undergone significant changes over the years and has evolved through several stages (Coyle et al., 2008; Kent & Flint, 1997). In the early 50s and 60s, logistics was seen as the emergence of a concept of systems which integrate various logistics functions within the physical distribution, as Ballou stated in 2004 and 2007. Subsequently, physical distribution sought to reduce overall system cost through functional expenses offsets (Brewer & Rosenzweig, 1961; Lekashman & Stolle, 1965).

In the decade of the 80s, the concept of integrated logistics management emerged and physical distribution logistics was added, all in response to transport deregulation and the increase of globalization (Coyle et al., 2008). The influence of Porter (1985) in the value chain model extended logistics management to include efficiency and effectiveness of an overall system where companies are interrelated from business providers to end consumers. To Gravier and Farris (2008), this became a concept known in the 90s as Supply Chain Management (SCM).

As noted, the concept of logistics has evolved; however, this expression in the beginning was a military term used to describe the organization and the movement of troops, as well as the accommodations and provisions of equipment. It has been implemented as a historical instrument of operation of military forces around the world, most notably as a military strategic tool in the war against Iraq in March, 2003. So, it has been so important that it is now considered a factor of success in the business field.

Logistics is increasingly understood as a strategic activity that is apart from operating activities, such as hiring warehouses or transport vehicles. It consists of processes from the beginning in the chain of activities, such as defining the organizational structure, logistics concept product design, definition of customer service levels, determining logistics categories, grouping products by service levels or handling needs, designing information systems, development of communication systems, design of the distribution network, infrastructure design and definition of distribution management indicators.

One might think that an activity as wide as logistics would be as well-known as other professional disciplines, as in the case of marketing, finance, law and engineering. Surprisingly, it is not. As movement does not change the appearance of a product, many people forget that packaging, material handling, storage or transportation will add value to the product. Hence, having located logistics in the business area and its impact from an economic standpoint, the following definitions are given.

The Council of Logistics Management (CLM) provides one of the most comprehensive definitions known in the discipline of logistics: "Logistics is the process of planning, implementing and controlling the efficient and economical flow and storage of raw materials, in

process inventory, finished goods and related information from the point of origin to point of consumption in order to fill customer requirements" (Lambert & Stock, 1993, cited in Carranza Torres, 2004).

The Global Supply Chain Forum defines logistics as: "...the integration of key business processes from end user through original suppliers that provides products, services and information that add value for customers and shareholders" (The Global Supply Chain Forum, 2008).

Supply chain professionals define logistics as: "...the part of the supply chain which plans, implements and controls the efficient and effective flow and storage of both goods, services, and its related information from the point where they originate to the point where they are consumed efficiently and at least cost to meet customer requirements" (Council of Supply Chain Management Professionals, 2008).

According to the latter definition that all organizations belong to one or more supply chains, within that context business success depends on a highly competitive environment.

Bowersox (cited in Douglas, Stock, & Ellram, 1998) claims that logistics can be the best source of competitive advantage for a company because logistics helps other elements of the marketing mix, i.e., product, price and promotion, be duplicated easily. For instance, good management of relationships with logistics services suppliers can help give a company a distinct competitive advantage in the areas of customer delivery speed, reliability, availability and other factors, such as service customers.

To achieve this purpose, companies focus on executing the coordination of the following activities in terms of ensuring the flow that guarantees a high level of customer service and cost reduction: storing, shipping, sourcing, purchasing, material economy, external transport internal transport inter-company transport, distribution, treatment and care of orders, and recycling products returned by the customer, production planning, production control, information and communications, quality control, finance, maintenance, marketing, sales and environmental protection.

Competitiveness

Competitiveness is often used by governments, businesses and the media as a "vague" concept. There is also an absence of consensus on the concept of competitiveness by researchers, which has meant that scholars have approached this concept from different theoretical perspectives (Valenzo, Martinez, & Bonales, 2010).

Krugman (1994) and Baldwin (1995) argue that nationally competitiveness is not a relevant concept, as major countries are in no way competing with each other; it is more about internal affairs of a nation than external appearance. In the same line, Porter (1990) indicates that a nation's competitiveness depends on the capacity of their industries to innovate and improve. Also, Scott and Lodge (1995) believe that competitiveness is increasingly a matter of strategies and structures and less and less a consequence of the natural endowments of a country.

According to the department of industry and commerce in the UK, business competitiveness is defined as: "... the ability to produce good products and services with the right quality and the right price at the right time. This means meeting the needs of customers more effectively and efficiently than competitors" (Department of Trade and Industry UK, 1999).

Ezeala-Harrison (1999) has explained that international competitiveness can be defined as the relative ability of a country's companies to produce and market products of a superior quality at lower prices. Thus, the concept of competitiveness of a nation has evolved into a more related local environment and the determinant endogenous factors of the national economy itself need to be investigated.

For Ambastha and Momaya (2004), competitiveness is defined as the ability to compete. That is the ability to design, produce and deliver superior products on the market to those offered by competitors, considering the price.

Thus, an organization is competitive in the eyes of its customers if that organization can deliver better value compared to its competitors and achieve lower prices with benefits equal or exceeding those of its competitors. Customer value, therefore, can be considered as a perceived advantage (Ambastha & Momaya; 2004, cited in Valenzo, Martínez, & Bonales, 2010).

RESULTS

This section shows the current status of logistics competitiveness in Mexico and the BRICS using the report issued by the World Bank entitled "Connecting to Compete" (*Trade Logistics in the Global Economy 2012*), where the study shows the Logistics Performance Index (LPI) and its six components:

1) The efficiency of the clearance process (speed, simplicity and predictability of formalities) by border control agencies, including customs.
2) The quality of trade- and transport-related infrastructure (ports, railroads, roads, information technology).
3) The ease of arranging competitively priced shipments.
4) The competence and quality of logistics services (transport operators, customs brokers).
5) The ability to track and trace consignments.
6) The frequency with which shipments reach the consignee within the scheduled or expected delivery time.

This report used a standardized questionnaire with two parts (international and domestic). For the international part, respondents evaluated six key aspects in the area of logistics performance in eight major foreign markets. For the inside part, respondents provided qualitative and quantitative data on the logistics environment in the countries where they work. The survey also collected data on internal logistics, such as load times and costs of import and export transactions.

The measurement system used values scales ranging from 1 to 5, 1 being the lowest or least efficient and 5 the highest level or more efficient. The analyzed performance areas were:

Table 7.1 shows the Logistics Performance Index (LPI) and variables, showing the ranking of global leaders, Singapore with Mexico and the BRICS in logistics, and also indicating the positions occupied by these countries globally, noting that the most developed country in this area is South Africa with a score of 3.67, ranking 23 in the world, showing a homogeneous development in all the elements that make up this index measurement.

Table 7.1 Logistics Performance Index (LPI) Singapore, Mexico and the BRICS

Position of Mexico and the BRICS	**Global position**	Country	Study Variables Report Connecting to Compete			
			Logistics Performance Index	**Customs**	**Infrastructure**	**International shipments**
NA	1	Singapore	4.13	Rank 1 Score 4.10	Rank 2 Score 4.15	Rank 2 Score 3.99
1	23	South África	3.67	Rank 26 Score 3.35	Rank 19 Score 3.79	Rank 20 Score 3.50
2	26	China	3.52	Rank 30 Score 3.25	Rank 26 Score 3.61	Rank 23 Score 3.46
3	45	Brazil	3.13	Rank 78 Score 2.51	Rank 46 Score 3.07	Rank 41 Score 3.12
4	46	India	3.08	Rank 52 Score 2.77	Rank 56 Score 2.87	Rank 54 Score 2.98
5	47	México	3.06	Rank 66 Score 2.63	Rank 47 Score 3.03	Rank 43 Score 3.07
6	95	Russian Federation	2.58	Rank 138 Score 2.04	Rank 97 Score 2.45	Rank 106 Score 2.59

Source: Author's calculations based on data from the report "Connecting to Compete" (*Trade Logistics in the Global Economy 2012*), World Bank publication.

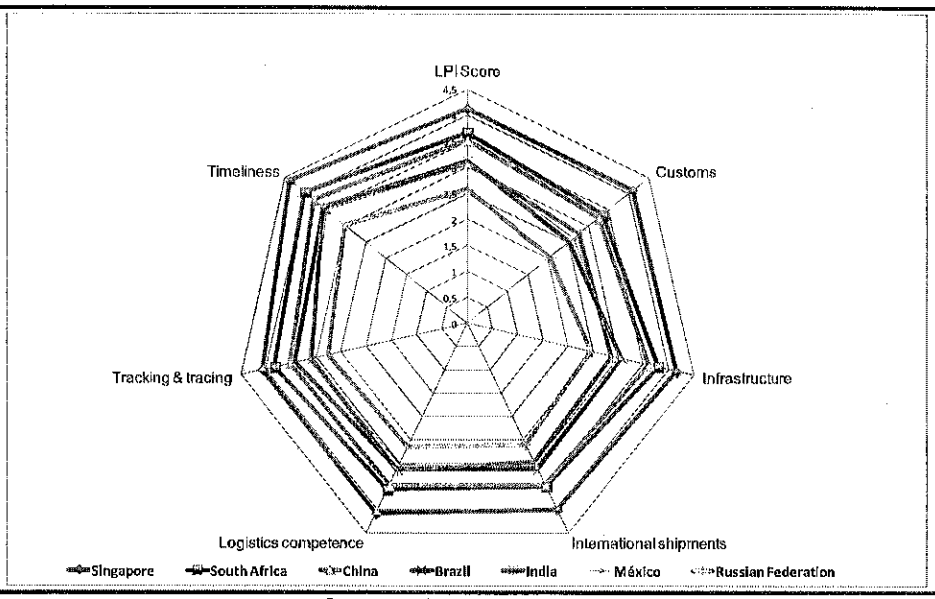
Table 7.2 Logistics Performance Index (LPI) Singapore, Mexico and the BRICS

Position of Mexico and the BRICS	**Global position**	Country	Study Variables Report Connecting to Compete		
			Logistics quality and competence	**Tracking and tracking**	**Timeliness**
NA	1	Singapur	Rank 6 Score 4.07	Rank 6 Score 4.07	Rank 1 Score 4.39
1	23	South Africa	Rank 24 Score 3.56	Rank 16 Score 3.83	Rank 20 Score 4.03
2	26	China	Rank 28 Score 3.47	Rank 31 Score 3.52	Rank 30 Score 3.80

3	45	Brazil	Rank 41 Score 3.12	Rank 33 Score 3.42	Rank 49 Score 3.55
4	46	India	Rank 38 Score 3.14	Rank 54 Score 3.09	Rank 44 Score 3.58
5	47	México	Rank 44 Score 3.02	Rank 49 Score 3.15	Rank 55 Score 3.47
6	95	Russian Federation	Rank 92 Score 2.65	Rank 79 Score 2.76	Rank 94 Score 3.02

Source: Author's calculations based on data from the report "Connecting to Compete" (*Trade Logistics in the Global Economy 2012*), World Bank publication.

Figure 7.1 Comparative Logistics Performance Index (LPI) Singapore, Mexico and the BRICS



Source: The World Bank.(March 17, 2012). *Logistics Performance Index.* Obtained LPI Results 2012: http://lpisurvey.worldbank.org/international/scorecard/radar/254/C/SGP/2012/C/BRA/2012/C/CHN/2012/C/MEX/2012/C/RUS/2012/C/ZAF/2012/C/IND/2012#chartarea

PROPOSED METHODOLOGY: VALENZO-MARTINEZ METHODOLOGY

This section presents the "Proposed methodology for Analyzing the Logistics Performance Index (LPI)" shown in Table 7.1.

The proposal shows a new level of analysis, since the one given by the Logistics Performance Index only shows the positions of Mexico and the BRICS and does not give any guidelines for finding the accurate level of logistics competitiveness in the analyzed countries.

Furthermore, the Valenzo-Martinez methodology allows for a different classification from the one used by the World Bank and also helps the reader to interpret the shown data in a more flexible and easily interpretable way. As well, this methodology shows the general position of the country in logistics performance; this method provides a competitive performance level

logistics under the perspective of the methodology proposed in Latin American countries. Similarly, the proposal allows for the analysis of logistics performance by variables.

To implement the proposed methodology, the following steps need to be followed:

1. Begin with the LPI data, which has values of 1 to 5, where the value 1 is the lowest or least efficient and 5 is the higher or more efficient (or any other report that needs to be analyzed).
2. Establish a measurement scale in which the different levels are determined logistics competitiveness, as shown in the following table:

Table 7.3 Logistics Performance Scale

Very High			High			Middling			Low			Very Low		
H	R	L	H	R	L	H	R	L	H	R	L	H	R	L

Note: H= High, R= RegularL= Low

3. After creating the scale, feed the data into the SPSS software. Then proceed to the analysis. Next, open the tab "analyze" and select "descriptive statistics." A new dialog window will open. Select "contingency tables" and proceed to select the variable "country" and the variable to be analyzed. The program yields the shown results right away.
4. The results of the final grade for each country, once processed, are classified in the ranges set out in Table 7.2.
5. The analysis has been done and the results are shown below.

OPTICAL ANALYSIS UNDER THE PROPOSED METHODOLOGY

The methodology allows for a deeper analysis and can thus establish the classification of Mexico and the BRICS according to the Logistics Performance Index (LPI) but with a greater accuracy.

Next, the results of IDL are displayed. Those results are shown at two levels of analysis, the traditional way (used by the World Bank: one of five ranges) and the methodology, "Valenzo-Martinez," which is also a scale of five ranks, but subdivided into three sub-ranges, High, Regular and Low, generating a Likert scale of 15 sorting classification options and permitting a deeper level of analysis of the data already shown in the earlier report issued by the World Bank, using a different perspective to allow for more detailed decision making.

Table 7.4 Logistics Performance Index (LPI) Mexico and the BRICS Traditionally

Very High Logistics Performance 5 - 4.2 pts.	High Logistics Performance 4.1 – 3.41 pts.	Regular Logistics Performance 3.40 – 2.60 pts.	Low Logistics Performance 2.59 – 1.8 pts.	Very Low Logistics Performance 1.7 - 1.0 pts.
5	4	3	2	1
	South África (3.56), China (3.47)	Brazil(3.13), México (3.06) Russian Federation (2.65)		

Source: Own Note: This is the scale used for the classification of countries according to the World Bank LPI where 1 is the worst and least efficient and 5 the best or the highest or most efficient

As seen in Table 7.4, the classification made by the World Bank does not allow the Mexican government and the BRICS to make a proper evaluation, since the gap between one nation and another is not clear.

To give an example, if we place Brazil in the variable infrastructure 3.07 compared to Mexico with a 3.03, it only shows a difference of 0.04 tenths, benefiting Brazil, but this rate does not show both countries' competitiveness level, globally or regionally.

Table 7.5 Logistics Performance Index vs. Proposed Methodology (Valenzo-Martin)

Logistics Performance Index (LPI) World Bank			PROPOSED METHODOLOGY VALENZO- MARTINEZ														
			Very High Logistics Competitiveness 5 - 4.2 pts.			High Logistics Competitiveness 4.1 - 3.41 pts.			Regular Logistics Competitiveness 3.40 - 2.60 pts.			Low Logistics Competitiveness 2.59 – 1.8 pts.			Very Low Logistics Competitiveness 1.7 - 1.0 pts.		
Position of Mexico and the BRICS	Global position	Country	H	R	L	H	R	L	H	R	L	H	R	L	H	R	L
1	23	South África (3.67)						X									
2	26	China (3.52)						X									
3	45	Brazil (3.13)								X							
4	46	India (3.08)								X							
5	47	México (3.06)								X							
6	95	Russian Federation (2.58)										X					

Source: Author's calculations based on data from the report "Connecting to Compete" (*Trade Logistics in the Global Economy 2012*), World Bank publication.

Table 7.5 shows the Logistics Performance Index (LPI) based on the World Bank classification. It is observed that there is a numeric variation between the first position, South

Africa (3.67 points) and the Russian Federation (2.58) and there is only a difference of 1.09 in favor of the first country. However, this kind of measurement does not allow governments to have a clear vision of the Logistics Performance Index. On the contrary, with the proposed methodology, these six economies appreciate three levels. They are as follows:

Rank *High- High:* South Africa, China
Rank *Regular- Regular*: Brazil, India, México
Rank *Low- High:* Russian Federation

Table 7.6 Customs vs. Proposed Methodology (Valenzo-Martinez)

CUSTOMS World Bank			PROPOSED METHODOLOGY VALENZO- MARTINEZ CUSTOMS													
			Very High Logistics Efficiency 5 - 4.2 pts.			High Logistics Efficiency 4.1 – 3.41 pts.			Regular Logistics Efficiency 3.40 – 2.60 pts.			Low Logistics Efficiency 2.59 – 1.8 pts.			Very Low Logistics Efficiency 1.7 - 1.0 pts	
Position of Mexico and the BRICS	Global position	Country	H	R	L	H	R	L	H	R	L	H	R	L	H	R
1	26	South África (3.35)							X							
2	30	China (3.25)							X							
3	52	India (2.77)									X					
4	66	México (2.63)										X				
5	78	Brazil (2.51)										X				
6	138	Russian Federation (2.04)												X		

Source: Author's calculations based on data from the report "Connecting to Compete" (*Trade Logistics in the Global Economy 2012*), World Bank publication.

Table 7.6 shows the logistics efficiency level as expressed by the World Bank. It is remarkable that there is a numeric variation between the first position, China (3.25 points) regarding India (2.77), achieved as a result the difference of 0.64 in favor of China. Apparently, the difference is minimal. However, on the contrary, with the proposed methodology these six economies appreciate three levels. They are as follow:

Rank *Regular- High:* South Africa, China
Rank *Regular-* Low: India
Rank *Low- High:* Brazil, México
Rank *Low- Low:* Russian Federation

Table 7.7 Infrastructure vs. Proposed Methodology (Valenzo-Martinez)

INFRASTRUCTURE World Bank			PROPOSED METHODOLOGY VALENZO- MARTINEZ INFRASTRUCTURE														
			Very High Logistics Infrastructure 5 - 4.2 pts.			High Logistics Infrastructure 4.1 - 3.41 pts.			Regular Logistics Infrastructure 3.40 - 2.60 pts.			Low Logistics Infrastructure 2.59 - 1.8 pts.			Very Low Logistics Infrastructure 1.7 - 1.0 pts.		
sition xico l the ICS	Global position	Country	H	R	L	H	R	L	H	R	L	H	R	L	H	R	L
1	19	South África (3.79)					X										
2	26	China (3.61)						X									
3	46	Brazil (3.07)								X							
4	47	México (3.03)									X						
5	56	India (2.87)									X						
6	97	Russian Federation (2.45)										X					

Source: Author's calculations based on data from the report "Connecting to Compete" (*Trade Logistics in the Global Economy 2012*), World Bank publication.

Concerning the Logistics Infrastructure Variable, it appreciates five levels by using the proposed methodology, emphasizing that South Africa enhanced its infrastructure due to high investment in the Football World Championship in 2010. Next, the classification of these countries is shown:

Rank *High- Regular:* South Africa
Rank *High- Low:* China
Rank *Regular-Regular:* Brazil
Rank *Regular- Low*: India, México
Rank *Low- High:* Russian Federation

Table 7.8 International Shipments vs. Proposed Methodology (Valenzo-Martinez)

INTERNATIONAL SHIPMENTS World Bank			PROPOSED METHODOLOGY VALENZO- MARTINEZ INTERNATIONAL SHIPMENTS														
			Very High Logistics International Shipments 5 - 4.2 pts.			High Logistics International Shipments 4.1 - 3.41 pts.			Regular Logistics International Shipments 3.40 - 2.60 pts.			Low Logistics International Shipments 2.59 - 1.8 pts.			Very Low Logistics International Shipments 1.7 - 1.0 pts.		
sition xico l the ICS	Global position	Country	H	R	L	H	R	L	H	R	L	H	R	L	H	R	L
1	20	South África (3.50)						X									
2	23	China (3.46)						X									

3	41	Brazil (3.12)								X								
4	43	México (3.07)								X								
5	54	India (2.98)								X								
6	106	Russian Federation (2.59)										X						

Source: Author's calculations based on data from the report "Connecting to Compete" (*Trade Logistics in the Global Economy 2012*), World Bank publication

According to the International Shipments variable and the Valenzo-Martinez methodology, there are only three proposed levels. Two main groups can be seen and they are:

Rank *High- Low:* South Africa, China
Rank *Regular-Regular:* Brazil, India, México
Rank *Low- High:* Russian Federation

Table 7.9 Logistics Quality and Competence vs. Proposed Methodology (Valenzo-Martinez)

LOGISTICS QUALITY AND COMPETENCE World Bank			PROPOSED METHODOLOGY VALENZO- MARTINEZ LOGISTICS QUALITY AND COMPETENCE															
			Very High Logistics quality 5 - 4.2 pts.			High Logistics quality 4.1 – 3.41 pts.			Regular Logistics quality 3.40 – 2.60 pts.			Low Logistics quality 2.59 – 1.8 pts.			Very Low Logistics quality 1.7 - 1.0 pts.		
Position of Mexico and the BRICS	Global position	Country	H	R	L	H	R	L	H	R	L	H	R	L	H	R	L	
1	24	South África (3.56)						X										
2	28	China (3.47)						X										
3	38	India (3.14)							X									
4	41	Brazil (3.12)								X								
5	44	México (3.02)								X								
6	92	Russian Federation (2.65)									X							

Source: Author's calculations based on data from the report "Connecting to Compete" (*Trade Logistics in the Global Economy 2012*), World Bank publication.

Concerning Logistics Quality and Competence, according to the proposed methodology, the countries that appreciate are:

Rank *High- Low:* South Africa, China
Rank *Regular-High:* India
Rank *Regular-Regular:* Brazil, México
Rank *Regular-Low:* Russian Federation

In Table 7.10 with the variable Tracking and Tracing, and according to the proposed methodology, three groups are located on the same level, Brazil, South Africa and China, which results in the following:

Rank *High- Low:* South Africa, China, Brazil,
Rank *Regular- Regular:* México e India
Rank *Regular-Low:* Russian Federation

Table 7.10 Tracking and Tracing vs. Proposed Methodology (Valenzo-Martinez)

TRACKING AND TRACING World Bank			PROPOSED METHODOLOGY VALENZO- MARTINEZ TRACKING AND TRACING														
			Very High Tracking and Tracing 5 – 4.2 pts.			High Tracking and Tracing 4.1 – 3.41 pts.			Regular Tracking and Tracing 3.40 – 2.60 pts.			Low Tracking and Tracing 2.59 – 1.8 pts.			Very Low Tracking and Tracing 1.7 – 1.0 pts.		
sition xico l the ICS	Global position	Country	H	R	L	H	R	L	H	R	L	H	R	L	H	R	L
1	16	South África (3.83)						X									
2	31	China (3.52)						X									
3	33	Brazil (3.42)						X									
4	49	México (3.15)								X							
5	54	India (3.09)								X							
6	79	Russian Federation (2.76)									X						

Source: Author's calculations based on data from the report "Connecting to Compete" (*Trade Logistics in the Global Economy 2012*), World Bank publication.

Table 7.11 Timeliness vs. Proposed Methodology (Valenzo-Martinez)

TIMELINESS World Bank			PROPOSED METHODOLOGY VALENZO- MARTINEZ TIMELINESS														
			Very High Timeliness 5 – 4.2 pts.			High Timeliness 4.1 – 3.41 pts.			Regular Timeliness 3.40 – 2.60 pts.			Low Timeliness 2.59 – 1.8 pts.			Very Low Timeliness 1.7 – 1.0 pts.		
ition xico the ICS	Global position	Country	H	R	L	H	R	L	H	R	L	H	R	L	H	R	L
1	20	South África (4.03)				X											
2	30	China (3.80)					X										
3	49	Brazil (3.55)						X									
4	54	India (3.09)						X									
5	55	México (3.47)							X								
6	94	Russian Federation (3.02)								X							

Source: Author's calculations based on data from the report "Connecting to Compete" (*Trade Logistics in the Global Economy 2012*), World Bank publication.

Finally, in the Timeliness Variable the small but significant differences are appreciated and they can demonstrate different levels:

Rank *High- High:* South Africa
Rank *High- Regular: China*
Rank *High- Low:* Brazil e India
Rank *Regular-High:* México
Rank *Regular-Regular:* Russian Federation

CONCLUSIONS

The methodology, Valenzo-Martinez, was conceived with the aim of proposing a different perspective of analysis regarding the work issued by the World Bank, entitled "Connecting to Compete," which was used in this paper as a major input to show the benefits of the proposed methodology and which, when making the comparisons, resulted in marked differences when ranking countries by their logistics performance. With the methodology used and the results obtained, this allowed for better decision making in relation to each of the variables that impact logistics performance.

Regarding the scope of this proposed methodology, we can say that it is broad and diverse and can be used in databases and established reports, as well as for research that requires some kind of ratings or rankings on a scale where a Likert scale is used.

According to the results shown by the World Bank, where Mexico and BRICS in logistics performance is shown, South Africa ranks 23rd, China 26th, Brazil the 45th, India 46th, Mexico ranks in 47th place and the Russian Federation in 95. So the report shows the logistics performance of these countries: 3.67, 3.52, 3.13, 3.08, 3.06 and 2.58, respectively.

However, if we look at the results reported by the World Bank, they show a descending high to low and do not infer a significant difference between one country and another; only the numerical difference.

Since this classification is given in values from 1 to 5, the World Bank proceeded to give a description of each range: 5 very high, 4 high, 3 regular, 2 low and 1 very low in logistics performance. Once the analysis is done under these values, we find that: Chile and 11 nations fall in the range of "regular" and 7 countries in the range of "low logistics performance." Accordingly to this formation, two groups are formed in Latin America. These results show a high concentration in the range of "regular." Although the numerical differences are marked, in some cases they are included in the same rank equally. For example: Brazil, India and Mexico with logistics performance of 3.13, 3.08, 3.06 and a 2.58 Russian Federation, are classified in the same range of Middling Performance Logistics despite the noticeable difference between the first three and the last one.

On the other hand, when using the methodology Valenzo-Martinez, the five scale ranges remain: 5 very high, 4 high, 3 average, 2 low, and 1 very low logistic performance. However, within each of these ranges, three sub-ranges were established, High, Regular and Low, giving a Likert scale with 15 sorting options resulting in a deeper level of analysis, which will be demonstrated in the following results:

Rank *High*- High: South Africa, China
Rank *Regular*- Regular: Brazil, India, México
Rank *Low*- High: Russian Federation

Finally, we can say that for Mexico and the BRICS there are noticeable differences in logistics performance as was evident by the results.

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8 Selection criteria used for personnel recruitment in an environment of uncertainty

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INTRODUCTION

The pursuit of competitive advantage for firms participating in highly turbulent global markets, coupled with improved education and training of the human factor (human capital), has forced company managers to include human resources management in their strategic decisions. This is considered the "soft trend" of HR (Clarer, Gascó, & Llopis, 1995), as opposed to the so-called "hard trend" that advocates achieving results, i.e., increased productivity, cost reduction, etc.

To that end, organizations need to transform management of human resources and adopt it as a key success factor that will address relevant corporate change, as it plays a vital role in driving a company's strategic direction. Therefore, it is necessary to identify and develop human resources roles, responsibilities and competences so as to adapt them to the culture and structure of the organization.

Hence, the planning of human resources results in an essential part of the process. The relevance of intellectual capital in business becomes more important every day, because it is a transcendent element for people and companies (Gonzalez, 2004). Cases of human resources recruitment are done under the existing criteria of theories of certainty and chance.

Previous arguments have established that all companies need to follow a process when planning their activities so as to make sound decisions and efficiently achieve their goals under appropriate actions and position themselves as competitive administrations. Currently, in the changing world in which companies develop, this implies the need for high-impact planning in the company, due to changes in technology, competition, society and, foremost, the economy.

Milkovich and Bogreu (1998) report that human resources planning involves the collection and use of information that supports human resources investment decisions. Caballero Merinno, Gento and Redondo (2005) affirm that staff planning is a decision process regarding human resources necessary to achieve organizational objectives in a given period. That is, staff are prepared to meet the future demands of the company. The importance of preparing an organization's staff in terms of quantity and quality is paramount. Human resources planning is made according to strictly rational criteria and a purely quantitative approach.

For the selection process, the manager in charge must have knowledge of the needs and characteristics of the human resources required by an organization for each position. This knowledge can be based on bis/her experience or the result of participation of experts in the human resources area who provide their opinion based on their ample knowledge of the organization by which they can obtain the respective estimates (Kaufmann & Gil Aluja, 1991; Gil Lafuente, 2002; & González et al., 2004).

The initial assumption is to consider that in a proper recruitment process a group of apparently brilliant and qualified candidates are selected, with the inconvenience that the amount of candidates is larger than the positions available. The first challenge is how to select the best candidate for a determined position. According to Wether and Davis (2000), a personnel's selection process for a company has the following three elements as a base:

> 1) The information that the analysis of the position provides, i.e., job description, human qualifications and levels of performance required; 2) Human resources' short and long term plans that include predicting future vacancies with some accuracy and also carrying out the recruitment process in a logical and orderly form and 3) The candidates that make up a group for selection.

From the above, it can be established that at this stage of human resource planning in an organization, staff selection is at the core of the basic work, which is ultimately to be informed of the characteristics and attributes of the person occupying each of the positions within the organization.

To assign their capability levels, an estimate of an applicant's grade for each one of their qualities, characteristics and attributes must be taken into account. This is done by evaluation, which is considered in the field of uncertainty, assigning values in the interval [0,1].

THEORY OF UNCERTAINTY FOR THE EVALUATION OF HUMAN RESOURCES

The valuation. It is convenient to distinguish between the concepts of "evaluation" and "valuation." Evaluation is the association of a numeric value, which can be negative, positive or null, to an object (concrete or abstract) carried out by an expert. A valuation is the expression of a true level; a level that takes its values of the confidence interval [0,1].

When working between 0 and 1 for valuations, valuation should not be confused with the term probability. A valuation is subjective data, which is supplied by one or several people. Probability is "objective" data and therefore theoretically accepted by everyone. The notion of probability is linked to random. Valuation is linked to uncertainty and subjectivity. It is important not to confuse "probable" and "possible." Probable is associated with the notion of measurement. Possible is associated with subjectivity in the absence of measurement. The confusion between chance and uncertainty appears everywhere, not only in ordinary language but also in science. Classification must be precise: Chance requires measurement, hence, probability; uncertainty can only be estimated in a subjective manner, often pushing the limits of probability and adding even more subjectivity, i.e., a maximum of presumption.

Kaufmann, Gil Aluja and Terceño (1994) recognize that theories related to uncertainty arise from the perception of senses and reflection. Valuation is not a measure. On the contrary, measurement is a valuation. What is probable is possible and what is possible is not necessarily probable.

Valuations can be assigned to all the numbers' value scales. The most usual in the binary field is that a valuation is shown by a 0 or a 1, while in the multivalent or blurred areas this valuation is a number between 0 and 1, inclusive. Meaning a valuation is a subjective numerical estimate. It can be shown by a number from [0,1], for example: 0.3, 0.45, 0.67, 0.89, etc., but it can also be shown by two extremes in [0,1], which is known as a confidence interval.

An additional ability of expression is if we are able to express our subjectivity in only one number. One can go further, if useful, between two extremes establishing a "presumption maximum" to form a triplet, always with numbers between [0,1]. Thus, we have triplets such as 0.3, 0.7, 0.5, where 0.7 is the maximum for presumption. The valuation can be expressed in everyday language through: words, relative pronouns, superlatives and even by subjective values associated to language. This occurs when the numbers seem a better form of communication than words. A valuation, from a more practical point of view, is the expression of a level of truth that takes its values of the confidence interval.

THE THEORY OF BLURRY SUBSETS

The mathematical definition of sets is simple. It is a group of various objects different from each other and very well specified. Take a group of people involved in a selection process - they will face knowledge competition with all the psychosocial factors involved in their performance. Thus, a set is often specific to one or more properties. A subset does not necessarily comprise all of the elements of a set, although sometimes for convenience mathematicians admit that a set is a subset of itself. It is possible to determine the property or non-property of a particular subset when considering an element of a set. The reference set is often called referential.

ORDERING BLURRY NUMBERS

The theory of fuzzy subsets is to build property functions, which are applications of a reference set in the range [0,1], instead of using traditional sets in which an element can take the values 0 or 1 only (Zadeh, 1965).

It is common to perform sorting in optimization problems to determine which element is "better" or "worse than" the other. According to Gil Aluja (1995, b), optimization is based on the concepts of relationship, allocation, grouping and sorting.

Since reality is more complex every day, it is useful to do non-quantitative comparisons. This author proposes some arrangement methods, such as the ordinal-based of a graph or Latin matrix.

Given two fuzzy numbers $\tilde{A}$ and $\tilde{B}$, then $\tilde{A} \vee \tilde{B}$ represents a fuzzy number which has the following property function named fuzzy max operator:

$$\mu_{\tilde{A} \vee \tilde{B}}(z) = sup_{z=x \vee y} \left\{ \mu_{A_\alpha}(x) \bigwedge \mu_{B_\alpha}(x) \right\}$$

From this concept, Caballero, Gento and Redondo (2005) define the following link to order (Dubois & Prade, 1980; Kaufmann & Gil Aluja, 1994).

Given two fuzzy numbers $\tilde{A}$ and $\tilde{B}$, then fuzzy s $\tilde{A} \gtrapprox \tilde{B}$ if and only if

$$\max(\tilde{A}, \tilde{B}) = \tilde{A} \leftrightarrow \forall h \in [0,1] \begin{Bmatrix} inf\{x: \mu_{\tilde{A}}(x) \geq h\} \geq inf\{y: \mu_{\tilde{B}}(x) \geq h\} y \\ sup\{x: \mu_{\tilde{A}}(x) \geq h\} \geq sup\{y: \mu_{\tilde{B}}(x) \geq h\} \end{Bmatrix}$$

Although it is well founded, this order creates situations of indecisions where, as noted by Dubois, Kerre, Meisar and Prade (2000), intuitively one would expect that $\tilde{A}$ should be considered greater than $\tilde{B}$, because they are very different. To solve this question, we have considered the proposal of De los Cobos and Gutierrez (2011).

Consider two fuzzy numbers $\tilde{A}$ and $\tilde{B}$ and a real number h_0 then $h_0 \in [0,1]$. Then, $\tilde{A} \gtrapprox^{h_0} \tilde{B}$ if and only if $\forall k \in [0,1]$ is verified

$$inf\{s: \mu_{\tilde{A}}(s) \geq k\} \geq inf\{t: \mu_{\tilde{B}}(t) \geq k\}$$

$$sup\{s: \mu_{\tilde{A}}(s) \geq k\} \geq sup\{t: \mu_{\tilde{B}}(t) \geq k\}$$

Decision making based on fuzzy numbers usually assumes that they have been previously ordered. The order of fuzzy quantities is based on the comparison of similarities between the fuzzy sets. These similarities can be, for example, a center of gravity below an area of property function or various points of intersection between the fuzzy sets.

In practice, according to the method, various orderings can be produced for the same sample of fuzzy sets, which certainly complicates decision making (Caballero, Gento, & Redondo, 2005).

HAMMING DISTANCE BETWEEN TWO FUZZY SUBSETS

As mentioned in the summary, we refer to two general criteria for the selection of human resources for the company applying the techniques of Hamming and Euclidean distances as a base element in decision making: the parameters indicated in the concept of distance.
Let E be a finite referential $\tilde{A}$ and $\tilde{B} \subset E$, define the Hamming distance as:

$$d(\tilde{A}, \tilde{B}) = \frac{1}{n} \sum_{i=1}^{i=n} |\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i)|$$

With $x_i \in E \quad \forall i = 1, \dots, n$ and being $n = card\ E$ and $\forall i\ \ \mu_{\tilde{A}}(x_i), \mu_{\tilde{B}}(x_i) \in [0,1]$
The other parameter defining based on the methodology that supports decision making in this document is the Euclidean distance.

In the case that the referential E is the set of real numbers ($E = \mathbb{R}$) the Hamming Distance would be defined $\forall x_i \in [x_1, x_2]$ as:

$$d(\tilde{A}, \tilde{B}) = \frac{1}{n} \int_{x_1}^{x_2} |\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i)| dx$$

EUCLIDEAN DISTANCE BETWEEN TWO BLURRY SUBSETS

Let E be a finite referential and $\tilde{A}$ and $\tilde{B} \subset E$. We define the Euclidean distance as:

$$d(\tilde{A},\tilde{B}) = +\sqrt{\frac{1}{n}\sum_{i=1}^{i=n}\left(\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i)\right)^2}$$

With $x_i \in E \quad \forall i = 1,\ldots,n$ and being $n = card\ E$ and $\forall i\ \ \mu_{\tilde{A}}(x_i), \mu_{\tilde{B}}(x_i) \in [0,1]$

PROPOSED METHODOLOGY FOR THE SELECTION OF STAFF

The forms available for evaluation are based on elements that are needed for reference, have an acquired data analysis and are partially or fully able to make decisions. Between the minimum of elements (psychosocial) recommended as the minimum necessary for consideration in the analysis, we find: entrepreneurial behavior, a good level of socialization, intellectual level, cultural and civic level, healthy and balanced life, leadership, loyalty and personality. Physical elements include physical fitness (by a general medical examination), how likely the person is to contract common diseases and the degree of recovery and the degree of fatigue at work.

According to Guerrero and Terceño (2012), academic elements are considered fundamental for recruitment, as well as expertise and experience, as they would in any business which evaluates the curricular ability of an individual, but Lapuente recommends that companies should require dealing early with the following aspects:

1. Each of the positions in the company should be occupied by a professional, where they request certain qualities, characteristics, and attributes to a certain level.
2. The characteristics may vary depending on the position being analyzed.
3. The level required for each quality, characteristic or attribute need not be the same for all positions that comprise the company.

THE STAGES OF THE SUGGESTED SCHEME FOR HUMAN RESOURCE SELECTION

First: An ideal profile of each position in the organization is composed so that the applicant is identified with the vacant position according to his/her academic career, for example, with his/her qualities, characteristics and attributes.

Second: Once the recruitment process is established, a sufficient number of candidates are determined for each position in the company, according to the ideal profile and the candidate for the vacancy in the organization.

Third: The profile of each candidate for the vacant position in the organization is defined.
Fourth: Fuzzy Logic techniques to assess each applicant and determine the most suitable for each position are applied.

The personnel who better fulfill the characteristics will be best placed to provide services or to be a potential candidate for the company or institution. When a candidate is far from the ideal profile, hiring is less recommendable from a purely technical perspective.

According to González (2004), the allocation of the level of abilities – taking into account the estimate of the degree to which each candidate fills the vacancy and, in this case, the position – will depend on the qualities, characteristics or attributes and this is done with valuations in numbers in the range [0, 1].

According to González (2009), the purpose of the application of this approach is to provide alternative information to the classical theory, which will result in more efficient decisions and selection of human resources. Successful leaders understand that ideas and creativity are essential tools to molding and motivating an entire organization. The generation of ideas leads to creativity so that, in turn, important functions develop. These occur if a person is continually seeking new information reflecting his/her own experience and exploring new perspectives, not only regarding markets, technology and human behavior. The test of knowledge or capability provides a real diagnosis of the individual skills a person has and an aptitude test provides a forecast of his/her development potential in the short and long term.

According to Gil Aluja (1996), in considering a person who wants to participate for the vacant position, it is understood that the position requires a minimum set of skills, although others may be considered, such as aptitudes, psychological, communication skills, etc. This list of qualities will be different and will be structured according to the vacancy. It can be presented as a referential fuzzy subset that is finite. The same is expressed as:

Being: $C = \{c1, c2, c3, \ldots, cn\} = \{ci\}$
Where: C = subset of skills
ci = quality or skills (i), i = 1,2,3, .., n
ci $\in$ C,, is not graded numerically by 0 or 1, these give rise to a property function, declared as: Ci $\in$ {0,1}, is declared as a fuzzy subset.
If any quality or competition is not required, simply remove it from (C).

Since we have established the fuzzy subset, the process consists of comparing the qualities and skills required for each level of participation in "perfect conformation" with those possessed by each of the candidates for the same position. In this way, numerical values can be obtained for the fuzzy subset expressed in the "endecadaria semantic scale," as stipulated by Gil Aluja (1996). The same can be amended to conform to the evaluation (Gonzalez et al., 2009) and are presented below:

Table 8.1 Endecadaria "Semantic Scale."

Indicator	Grade
1	Perfect
.9	Very good
.8	Good
.7	Almost good
.6	Not very good

.5	Fair
.4	A bit bad
.3	Almost bad
.2	Bad
.1	Very bad
0	Awful

Source: Endecadaria referential scale.

To cover an ideal profile of an applicant, it is convenient to explain some aspects described below:

The initial process for finding a potential applicant is to have an ideal reference profile, as it is the way we will be doing this comparison and studies to the n) profiles that are closest to it, obtained in the previous step concerning staff recruitment.

This document makes use of forecasts of attributes or properties that a person must have to occupy the competitive position. It is uncertain estimates will match, so it is relevant to know the differences between these forecasts. These reflect the behavior of each applicant in the institution. We will refer to the professional represented by Pi and we will make use of the separation, which will be established with a mathematical model, applicable to different situations, and empirical applications, like selecting candidates to participate in any other vacancy in the future. Returning to the concept of separation that does not belong to the physical world, this can happen, as indeed it begins to happen as they have behavioral maps at hand, established as a set of attributes or characteristics that define a job profile in the case study. In this context, separation still plays a role in full validity mathematics, affirms Gonzalez (2009).

From the point of view of Caballero, Gento and Redondo (2005), facts must be discovered in the business environment and these can be established through quantitative analysis and numerical concept. So there must be procedures to obtain these values.

In the first instance, it is necessary to be clear about the meaning of terms of length; there must be rules for the measurement process. This enables securing a number for a certain body or process, so that we can say that the number represents the value of the magnitude of that body.

From the standpoint of physical observations, it must be considered from a reference among the field of sets of objects, to consider the object having reference lengths in such a way that, before talking about points or distances, the following set of referential rules must be established:

- Specify when one considers equivalences in two lengths; this context refers to a physical plane and discards all reference numbers.
- Specify the lengths of combinations. It is clear that both lengths can be physically joined in various ways, which must satisfy certain conditions to suit the additive operation between numbers.
- Conventionally determine what is taken per unit.

Once the rules are established, numerical values representative of the valuations can be placed of the characteristics that are considered to be evaluated. The set of qualities correspond to a set

of geometric points. These are the lengths of extension that separate them. These, in turn, correspond to numerical measures and therefore will govern the relationships between various geometric points. This is when the application of the concept of distance arises.

According to Kolmogovov and Formin (1957), the metric space is defined as a set of points where each possible pair of points plots a function of a denominated distance. Therefore, it is established that there is a metric space <A, d> provided that: The set of points expressed by A: {x, y, z ...} where the points are identified by x, y, z, the Cartesian product AxA expresses all possible pairs that can be formed from AxA: {(x,x),(x,y),(x,z),.....}. The distance function is the real function corresponding to pairs of points always when it satisfies the properties of positivity, symmetry and triangle inequality.

According to Kaufmann and Gil Aluja (1995) and Gil Lafuente (2002), the types of distance most used are Hamming's, Euclid's, the Minkowski metric, as well as Mhalanobis'. We will only use the techniques of Euclidean and Hamming distances. The mathematical expressions, we have defined already.

CASE STUDY

When comparing a particular person with the ideal profile, the ideal is not to obtain a pass or fail result. Rather it is to evaluate characteristics and technical qualities. It is possible to determine his/her full capacity through grading that can be developed in fuzzy subsets, estimating the deviation, the distance between the ideal profile and the candidate that is being analyzed. Therefore, the ideal profile (A).

It has been mentioned that it is important to have experts who have knowledge of each position in the organization and who will indicate the exact description through grades of each of the attributes necessary in individuals who should occupy the position; this we name the ideal profile.

In the example described in the table, the particular case of a job in the organization is described through the exact degree of each of the attributes that are required to cover the position.

Table 8.2 Ideal Profile

a. Academic background	1
b. Leadership	1
c. Socialization	.6
d. Physical health	.7
e. Time availability	.7
f. English language knowledge	1
g. Responsibility	1
h. Work experience	.8

To work in a consistent manner according to the definition of fuzzy subsets, the ideal profile for the position will be written horizontally, as follows:

$\underset{\sim}{A} =$

1	1	.6	.7	.7	1	1	.8

In the recruitment process, 5 candidates were determined with the characteristics or attributes described in the following fuzzy subsets.

$\underset{\sim}{c_1} =$

1	.7	.6	.6	1	.8	1	.2

$\underset{\sim}{c_2} =$

.7	.9	.9	.8	.8	.7	.7	.6

$\underset{\sim}{c_3} =$

.6	.8	1	.8	.8	1	.6	1

$\underset{\sim}{c_4} =$

.8	.8	.9	.7	.8	.9	.6	.8

$\underset{\sim}{c_5} =$

.7	.9	.9	.7	.8	.9	.6	.9

Using the technique of Hamming's distance, we obtain:

$$d(\tilde{A},\tilde{B}) = \frac{1}{n}\sum_{i=1}^{i=n}|\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i)|$$

$$d(\tilde{A},\tilde{c}_1) = \frac{1}{8}(|1-1| + |1-.7| + |.6-.6| + |.7-.6| + |.7-1| + |1-.8| + |1-1| + |.8-.2|)$$
$$= \frac{1.5}{8} = 0.1875$$

$$d(\tilde{A},\tilde{c}_2) = \frac{1}{8}(|1-.7| + |1-.9| + |.6-.9| + |.7-.8| + |.7-.8| + |1-.7| + |1-.7| + |.8-.6|)$$
$$= \frac{1.7}{8} = 0.2125$$

$d(\tilde{A},\tilde{c}_3) = \frac{1}{8}(|1-.6| + |1-.8| + |.6-1| + |.7-.8| + |.7-.8| + |1-1| + |1-.6| + |.8-1|) =$ 1.8/8=0.2250

$$d(\tilde{A},\tilde{c}_4) = \frac{1}{8}(|1-.8| + |1-.8| + |.6-.9| + |.7-.7| + |.7-.8| + |1-.9| + |1-.6| + |.8-.8|)$$
$$= 1.3/8 = 0.1625$$

$d(\tilde{A},\tilde{c}_5) = \frac{1}{8}(|1-.7| + |1-.9| + |.6-.9| + |.7-.7| + |.7-.8| + |1-.9| + |1-.6| + |.8-$ .9|)=1.4/8=0.1750

This implies what the order of the candidates would be, i.e., the most suitable candidate for the position is 4, and so on:

$$\tilde{c}_4 \succ \tilde{c}_5 \succ \tilde{c}_1 \succ \tilde{c}_2 \succ \tilde{c}_3$$

In the case of using the concept of Euclidean distance we have:

$$d(\tilde{A},\tilde{B}) = +\sqrt{\frac{1}{n}\sum_{i=1}^{i=n}\left(\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i)\right)^2}$$

$$d(\tilde{A},\tilde{c}_1)$$
$$= \sqrt{\frac{1}{8}((1-1)^2 + (1-.7)^2 + (.6-.6)^2 + (.7-.6)^2 + (.7-1)^2 + (1-.8)^2 + (1-1)^2 + (.8-.2)^2)}$$
$$= 0.2716$$

$$d(\tilde{A},\tilde{c}_2)$$
$$= \sqrt{\frac{1}{8}((1-.7)^2 + (1-.9)^2 + (.6-.9)^2 + (.7-.8)^2 + (.7-.8)^2 + (1-.7)^2 + (1-.7)^2 + (.8-.6)^2)}$$
$$= 0.2318$$

$$d(\tilde{A},\tilde{c}_3)$$
$$= \sqrt{\frac{1}{8}((1-.6)^2 + (1-.8)^2 + (.6-1)^2 + (.7-.8)^2 + (.7-.8)^2 + (1-1)^2 + (1-.6)^2 + (.8-1)^2)}$$
$$= 0.2693$$

$$d(\tilde{A},\tilde{c}_4)$$
$$= \sqrt{\frac{1}{8}((1-.8)^2 + (1-.8)^2 + (.6-.9)^2 + (.7-.7)^2 + (.7-.8)^2 + (1-.9)^2 + (1-.6)^2 + (.8-.8)^2)}$$
$$= 0.2092$$

$$d(\tilde{A},\tilde{c}_5)$$
$$= \sqrt{\frac{1}{8}((1-.7)^2 + (1-.9)^2 + (.6-.9)^2 + (.7-.7)^2 + (.7-.8)^2 + (1-.9)^2 + (1-.6)^2 + (.8-.9)^2)}$$
$$= 0.2179$$

Given these criteria, the order of the candidates is:

$$\tilde{c}_4 \succ \tilde{c}_2 \succ \tilde{c}_5 \succ \tilde{c}_1 \succ \tilde{c}_3$$

Using fuzzy techniques as a decision maker, in both cases 4 is the right candidate for the position and the least likely is number 3.

However, the second, third and fourth options differ in both cases.

In addition to personnel selection in the difficult task of human resource planning, it is possible to improve the usefulness of the data obtained so far so that this information can be used to perform the calculation of Hamming distances between the various candidates:

It is obvious that: $d(\tilde{c}_i, \tilde{c}_i) = 0$

$d(\tilde{c}_1, \tilde{c}_2) = 0.25 \quad d(\tilde{c}_1, \tilde{c}_3) = 0.3375 \quad d(\tilde{c}_1, \tilde{c}_4) = 0.25 \quad d(\tilde{c}_1, \tilde{c}_5) = 0.2875$
$d(\tilde{c}_2, \tilde{c}_3) = 0.1375 \quad d(\tilde{c}_2, \tilde{c}_4) = 0.1 \quad d(\tilde{c}_2, \tilde{c}_5) = 0.0875 \quad d(\tilde{c}_3, \tilde{c}_4) = 0.0875$
$d(\tilde{c}_3, \tilde{c}_5) = 0.075 \quad d(\tilde{c}_4, \tilde{c}_5) = 0.0375$

We obtain the following fuzzy:

	$\tilde{c}_1$	$\tilde{c}_2$	$\tilde{c}_3$	$\tilde{c}_4$	$\tilde{c}_5$
$\tilde{c}_1$	0	0.25	0.3375	0.25	0.2875
$\tilde{c}_2$	0.25	0	0.1375	0.1	0.0875
$\tilde{c}_3$	0.3375	0.1375	0	0.0875	0.075
$\tilde{c}_4$	0.25	0.1	0.0875	0	0.0375
$\tilde{c}_5$	0.2875	0.0875	0.075	0.0375	0

This distance matrix, a matrix of dissimilarities complement to 1, provides the similarity matrix.

	$\tilde{c}_1$	$\tilde{c}_2$	$\tilde{c}_3$	$\tilde{c}_4$	$\tilde{c}_5$
$\tilde{c}_1$	1	0.75	0.6625	0.75	0.7125
$\tilde{c}_2$	0.75	1	0.8625	0.9	0.9125
$\tilde{c}_3$	0.6625	0.8625	1	0.9125	0.925
$\tilde{c}_4$	0.75	0.9	0.9125	1	0.9625
$\tilde{c}_5$	0.7125	0.9125	0.925	0.9625	1

Now, level-by-level, values for α found in the sub maximum similarity relations are looked for. The Pichat algorithm will be used.

For example, the maximum level of $\alpha = 1$ will be used for:

	1		2		3		4		5
1	1	2	1	3	1	4	1	5	1

The following levels of similarity between:

Of $\alpha = 0.9625$ between candidates 4 and 5
Of $\alpha = 0.925$ between candidates 3 and 5
Of $\alpha = 0.9125$ between candidates 2 and 5
Of $\alpha = 0.8625$ between candidates 2 and 3

This progressive decomposition is particularly interesting when highlighting the similarities between the candidates in the event that the intent is to conduct training in groups, which ultimately considers the similarities between those involved to get the maximum competitive advantage from the participants.

CONCLUSIONS

All organizations that want to achieve their goals, adjusted to a planning process of activities, must have outstanding intellectual capital in each of its positions, mainly in those where relevant decisions are the framework of appropriate action. The desire to achieve goals in this way has a purpose; to achieve a competitive position.

The case study of both techniques leads to the same choice for the most suitable candidate for the position or office in question, though this does not necessarily always occur.

For management of human resources (HR), the difficult task of selecting staff occurs in an environment of uncertainty and subjectivity. This methodology reduces uncertainty and subjectivity as much as possible.

The use of these techniques, as noted, removes subjectivity and uncertainty and the proposed methodology can be implemented by a computer program making it more efficient.

The above demonstrates the great potential of this tool and makes it suitable for those organizations pursuing the same objectives to place themselves as competitive organizations.

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