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# Competitiveness of Manufacturing SMEs and eCommerce Strategies: An Exploratory Empirical Research in Mexico

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## Abstract

Faced with the rapid development of electronic commerce in Mexico and in many parts of the world, it becomes increasingly necessary to rely on theoretical-empirical studies that include both qualitative and quantitative analysis, to help us understand the many faces of electronic trading activity. As SME's are playing a very important role in the world economy, this research is aimed to analyze the relationship between the TOE model by Tornatzky & Fleisher (1990), and the competitiveness of manufacturing SME's Electronic Commerce (EC) strategy. This research is divided into three parts: The first part reviews the Resource Based View (RBV); the TOE model for innovations' adoption; and how concepts on competitiveness create a framework to support analysis on EC strategies' competitiveness - and discusses the link between them. The second parte discusses the results of an exploratory empirical study aimed to identify key factors and variables involved in the success of the SME's EC strategies. A Probit model was used to evaluate the relationship between the TOE factors and the ability of the company to develop effective EC strategies, preceded by a confirmatory factor analysis to specify the most important variables embedded in these three factors.

**Keywords:** competitiveness, electronic commerce, smes

## Introduction

For some years it has been stated that use of information technologies, such as EC, can help to improve SME's competitiveness. The competitiveness of firms is a key element in achieving the optimal utilization of free trade agreements and improves their performance in their participation in international markets. In this research, the three key factors proposed by Tornatzky & Fleisher (1990), were analyzed in its ability to improve the performance of SME's EC strategies. The organizational factor determines the internal dynamics of the company and can be assumed that plays an important role in the design of the formal strategy for activities EC within the company. The environmental factor analyses external agents to the company and has always been a key factor on understanding the customer, their competitors and the market itself, that plays a key role in the success of the EC strategy. Finally, the technological factor is essential to ensure quality in the services offered by the company and achieve innovation and good performance of EC practices within the company, so we may conclude that it can also explain to a certain extent, how good the firm EC strategy is. Theses research develops a Probit model aimed to prove these assumptions.

## Literature review

**Competitiveness**

The term competitiveness can be described as the ability of an organization - whether public or private, profitable or not - to maintain and achieve systematic comparative advantages, to sustain and improve a certain position in the socio-economic environment (Porter, 2001). Competition plays a very important role in every company, as these must be different from its competitors. The competitive advantage of a company would be in his ability, resources, knowledge, attributes, and so on (Barney, 1991).

Competitiveness is not a product of causality nor arises unexpectedly: it is created and it is achieved through a long process of integration of new organizational routines and representative groups that shape the dynamics of organizational behavior from customers, competition and the market. Therefore, competitiveness is currently the characteristic or quality that enables an organization to survive in saturated markets; if a company is not competitive it is doomed to disappear (Porter, 2000).

There are many theories on competitiveness but there are seven patterns or principles on which most authors often coincide (Porter, 2001; Munch 2005:1, Munch, 2005:1 and Monteverde, 1992):
1. **Stay on top of trends.** Keep the company on the pulse of change.
2. **Become a supporter of change.** To be physically and psychologically prepared for the reality of change. The perspective on the change will have a profound impact on the ways in which workers are experiencing.
3. **Recruit, reward and promote the best and brightest workers.** The best employees will carry the company into the future. It should develop a human resources system to identify, train, promote and reward the best staff that exists both within the company and within the labor market.
4. **Think globally, act locally.** Information technology is reducing the world, creating niche markets around the globe. Think about how products and services can satisfy the client somewhere else.
5. **Innovate.** Which is currently done, it should be done better, cheaper and faster. If you do not know is prepared to innovate, then we have to be prepared to lose market action.
6. **Investment in technology, people, and training.** The money spent on technology, people, and training is not a cost but rather an investment.
7. **Fighting complacency of success.** Success is a barrier to change. If the company is successful, that sometimes means that there is no motivation to improve. When one is the leader in its market, we must not feel satisfied for a good season or by the size of the gap between our company, and the company itself.

Based on the Porter's model (1982), the strategic analysis historically has explored why within the same sector there are differences in the performance of organizations. Because of this, the study of the strategy moved into the paradigm of strategy based on the resources and capabilities that firms have or acquire in order to compete, ultimately, moving from outside to inside at the time of promoting the creation of competitive advantages (Porter, 1985). Looking at the near future, those companies that are able to create competitive advantage, through the development and improvement of their capabilities, will be better prepared to face the current and future challenges.

**Factors Determining SME's Competitiveness**

The use of information technology helps companies increase their competitiveness, reaching into major markets and allowing the opportunity to design and implement new services and applications (Botelho, 2005).

EC gives them a great opportunity for SME's to intervene in the dynamics of the global market, and profit from this as long as they have in their products with the quality and competitiveness that

the market requires. Large companies, such as small and medium, have managed, through their Web pages to communicate with their customers in real time and offer their goods and services. Of course, the Internet has made it possible for electronic commerce is understood globally and in a manner most convenient, quick and cheap traditional commerce (Fernandez, 2002).

The United Nations in its Report on EC, argue that the impact of information technology on the performance and competitiveness of businesses and industries will be achieved through an increase in the flow of information, leading to transfer knowledge as well as an improvement of the organization at such companies (United Nations, 2003:2).

From the literature review it can be noticed the relative importance of internal factors versus external, evidence exists that domestic variables have the greatest influence on the competitiveness of organizations. This fact shifts the focus to the analysis of the resources and capabilities related to the success of smaller firms (Aragon & Rubio, 2005).

The benefits that can perceive company from their EC strategies can be classified as direct and indirect benefits. For example, Mehrtens, Cragg and Mill (2001) argue that this technology provides a relative advantage on the traditional methods and businesses tools way improve communications.

Beatty, Shim and Jones (2001) pinpoints the improved quality of service that a firm can provide to customers and the ease of communication with suppliers. Lui and Arnett (1999) explain the factors of success on Web sites. They identify four essential factors associated with success on the Internet within a context of EC.
1. The importance of the information observed in the company (either of their customers as their competitors) and the quality of products and services it offers.
2. The use of the system and the technological infrastructure.
3. The design of the site and the electronic service, with regard to technical support.
4. Systems engineering and quality standards.

Golden, Hughes and Ruane (2002) consider three main aspects to analyze the success of SME's to use the Internet:
1. Organizational aspects.
2. Implementing Internet within the enterprise.
3. Maintaining the equipment for the electronic service.

The aim is to identify factors that contribute to improving the performance of e-commerce by SME's. Since some companies use EC to rebuild their business strategies and transform a traditional business and give it a new application that facilitates the transfer of information between those involved in the organization. (Kalakota and Robinson, 1999. Vatcharaporn and Chavananon, 2001).

Vatcharaporn and Chavananon, (2001) determined that success factors depend on the type of business or trade made on the Internet. For SME's seeking competitiveness in their participation in EC is necessary to identify the key variables of good performance in their EC practices. Zhu and Kramer (2005) developed a theoretical model based on the TOE model, which identifies three areas within the company that affect the process of adoption, implementation and use of technological innovations. The first is the technological context, which describes the existence of the use of technology and new technologies that are relevant to the company. The second is the organizational context that relates to the measurement of the size, scope and resources that are available in the company. And the third is the environmental context or environment, which is the arena in which the company operates, considering the industry, competition and government.

Increases in productivity resulting should encourage SME's and bring a higher standard of living, and that the benefits should be particularly high for smaller companies and for the economies of underdeveloped countries, which traditionally have been harmed as a result of the limited information, the high cost of market access and distance from markets (Kumayama, 2001).

The application of e-commerce by SME's means the elimination of traditional barriers to trade, such as the distance between markets and the size difference between firms (Lai and Sharma, 2006). It offers a cost-effective means to deal offers, claims, purchase goods and tracking sales in a manner that allows small and medium enterprises to reduce their fixed costs and administrative costs and gives them the opportunity to expand its operations.

EC can be an important contribution to economic growth, because it promotes competition and productivity. EC effectively promote these goals will depend largely on the commercial and regulatory environment that governments in the region to provide this innovative means (Martin, 2002).

### SME's in Mexico and Their EC Efforts

Manufacturing industry in Mexico has recently faced challenges such as rising administration costs, global competition (mainly from Asian Countries), and the absence of a structural changes to face free markets, among others. Despite the fact that each industry is impacted in a different way, most organizations seek to maximize their business opportunities. While most of the current efforts of Mexican manufacturing companies have been focused on maintaining its operating margins and profitability through the reduction of both operational and administrative costs, they have to begin developing skills that enable them to address levels of international competitiveness within the industry (Yamakawa and Serida, 2002).

The contribution of SME's to economic activity in Mexico is mainly in terms of employment, economic growth, regional development, and participation in international trade.

SME's are a major employer in Mexico; they generate 60% of jobs in the market. In 2001, the employed population in Mexico exceeded 10 million and contributed more than 40% of GDP in Mexico. That year, GDP was about 600 billion dollars of which 240 billion dollars were provided by the SME's (INEGI, 2004).

According to the Commission for the Development of Small and Medium Enterprises in the Mexican Senate (Comision para el Desarrollo de la PYME, 2000), the traditional definition of the concept of small and medium enterprises, is based on several criteria: number of workers they employ, production volume of sales, value of the investment and energy consumption.

Based on the size of the its staff, according to the criterion of stratification, the Official Journal of the Federation of December 30, 2002, companies can be classified as small and medium enterprises if they have between 0 and 250 employees, (INEGI 2004.1).

Manufacturing companies comprises 10.9% of all companies in Mexico, and of this 10.9%, 8.2% are SME's. The 8.2% manufacturing SME's account for 29.6% of the total employed persons. 9.2% of manufacturing SME'suse the Internet to make contact with their customers and suppliers.

## Theoretical Model, Hypothesis and Methodology

To examine the relationship between the RBV, the TOE model by Tornatzky & Fleisher (1990), and competitiveness of EC strategies in the SME's, we departed from the model proposed by (Zhu and Kramer, 2005:63), as shown in Fig. 1
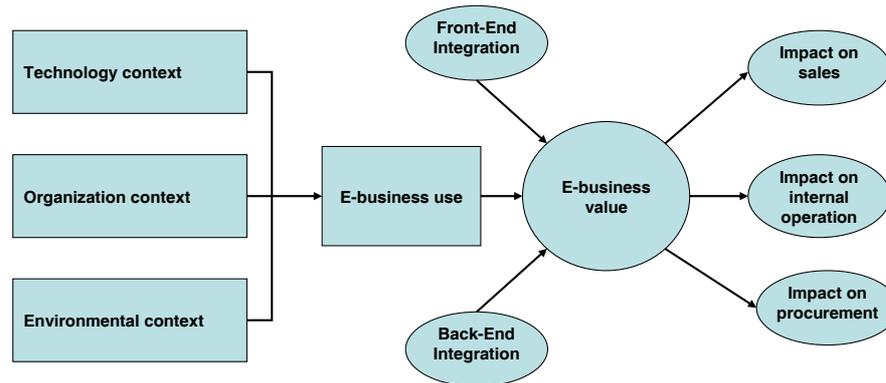
***Figure 1:*** *The Technology-organization-environment by Tornatzky and Fleischer (1990) as adapted by Zhu and Kraemer (2005) to evaluate EB adoption.*

Based on this, it can be assumed that three fundamental factors could be identified as a source of success in EC strategies:

I. Organizational Factors

The variables found to be important are (Iacovou, Benbasat and Dexter, 1995), (Hamill and Gregory, 1997, Golden, Hughes and Ruane, 2002):

- Establishment of a strategy clearly defined or at least identification of the company's operation plan by the employees.
- Impact in the operations
- Intensity of use or frequency of use of the electronic services
- Transference of information
- Expansion into new markets

To measure the impact of EC on the organizational factor on the competitiveness, five variables were used: The first is for the existence of a strategy, the second covers the impact of electronic transactions in the company, the third look at the intensity of usage of electronic transactions, the fourth considers the transfer of information, and the fifth inquires into intervening in new markets. A dichotomous measuring scale is used for all items. Its specification is detailed in each of the items.

| Item: | Existence of a strategy and / or plan of operation either identified by the staff working at the company to carry out its operations in electronic commerce. | Impact that EC operations have within the company | Intensity of use | Information transfer | Intervention new market. |
|---|---|---|---|---|---|
| **Questions to answer** | -- Years that the company has been dedicated to this turn of activity.<br>-- The company employs the use of the Internet in their dealings with customers and / or suppliers.<br>-- The company has a department devoted partly or wholly to the attention of his activities through the Internet.<br>-- When incorporate electronic transactions to the company developed a reorganization process, which pose goals and objectives clearly defined?<br>-- It has clearly established strategies or action plans in place, or at least clearly identified by its staff to its operations on the Internet.<br>-- The importance that it attaches to the inclusion of e-business in its planning.<br>-- Frequency with which the company conducts electronic transactions with customers and / or suppliers.<br>-- Quality of the services it provides to its customers and suppliers in their e-commerce activities.<br>-- Frequency has developed programs for improving their e-commerce activities.<br>-- Importance included in the planning business e-commerce activities. | -- Of the total sales of the company gained through electronic commerce.<br>-- Of the total corporate profit, gained through electronic commerce.<br>-- Of the total purchases of the company obtained through electronic commerce.<br>-- If your company has electronic media advertising.<br>-- What is the main obstacle for you to conduct transactions via the Internet? | -- Services offered by the company to its customers and suppliers, whether e-mail, web pages, electronic catalogs, subscriptions, banners and others.<br>-- Through which means by which receives major orders by its customers, either via electronic (e-mail, web page, etc.) or a different one (phone, fax, etc.). | -- Frequency with which information is obtained from customers or competitors exchanged information on the Internet. | -- It has enabled electronic commerce to intervene in markets that were identified, but who previously had restricted or no access. |

## II. Environmental factor

The fundamental intention of exploring their business environment by a company is to respond with strategies and actions developed to be sustainable in its present and future, "aimed to allow the business to operate with a maximum harmony and a minimum of frictions in the changing conditions of an uncertain world"

The analysis of the environment provides not only study the changes in the tastes and habits of the consumer or user, or technology, the company must also respond to changes in social and cultural values, its political climate and growth trends of the economy (GOLDEN, HUGHES AND RUANE, 2002).

To analyze the environmental factor, the following variables were taken into account:
- Market composition: relationships of medium and long term with customers
- Understanding the market dynamics.
- Understanding the customer: Including tendencies and mid term plans, including product usage and purchasing behavior), value generation for the customer (revision of the design of the product to create and to maintain an advantage competitive) and quality (quality level that includes all of them
- Commercialization: reduction of costs, increase in sales, intervention in new markets.

In this case also the quantification of all items that constitute each of the variables mentioned above have dichotomous options and specification detailed in each of the items.

| Items | Market composition | Dynamics of the market | Understanding the client | Marketing |
|---|---|---|---|---|
| Questions to answer | -- Results brought to the company incorporating EC activities. -- Skill level that the company is within its competence, and if they have identified. Just as the services it offers, the benefits, constant monitoring, or various marketing strategies to attract customers. | -- The frequency with which provides them with information about their products, new products, promotions or general information to customers over the Internet. | -- Level of customer satisfaction, through monitoring customers, special promotions, market research and quality control | -- Impact on lowering the costs of marketing activities to incorporate the use of electronic commerce. |

III. Technological Factor

Within this factor the following variables were taken into consideration:

- Technological Capacity (technological development in process technology, innovation).
- Capacity and qualification of the personnel (the personnel optimizes operation of the equipment, he constantly updates the technical personnel and can to innovate and to modify the process).
- Establishment of standards of quality in the service. Or the modification of process systematically to optimize quality, innovation with defined objectives (to attack new markets, for example) or innovation to remain like leader in a market.

In the technological factor were considered variables such as capacity technology, the ability of personnel, the establishment of quality standards, and ultimately, guarantees and benefits to be awarded for participating in electronic transactions. It is important to mention that the formation and activity of the employees who have special skills, is a business resource that drives the development of systems, procedures and tools. The possession of such instruments makes possible the creation of an advantage over competitors in terms of time, safety and availability of products that rely on these capabilities (Fong, 2005:105). Here too the quantification of all items which are to each variable above options are dichotomous and its specification detailed in each of the items.

| Items | Technological Capability | Staff Capacity | Quality Standards | Guarantees and benefits |
|---|---|---|---|---|
| Questions to answer | -- Type of equipment to purchase for electronic transactions -- As described its technological capability to develop its operations over the Internet | -- Who is responsible for technical support? (qualified staff full-time or outsource maintenance and control of its website, as well as the resolution of technical problems) -- How frequently are trained personnel for computer use and management of electronic transactions? | -- Frequency of which are verified or set standards for the quality of its services on the Internet, as well as the importance of conducting constant monitoring on customer satisfaction about their services on the Internet. | -- Warranty and benefits that are given to customers who make a purchase through its website or email. |

## Proposed Model

To develop a model that measure the level of the competitive capacity of the companies engaged in EC, and bases in the literature review, it was developed to a basic model and three partial ones, in which the diverse factors aforementioned are included. The model (see Fig. 2) is embedded with

the findings of Zhu and Kramer, (2005), Mehrtens, Cragg and Mill (2001), Beatty, Shim and Jones (2001), Lui and Arnett (1999), Golden, Hughes and Ruane (2002), Vatcharaporn and Chavananon, (2001). It is aimed to measure the competitiveness level of the EC strategies of the SME's.
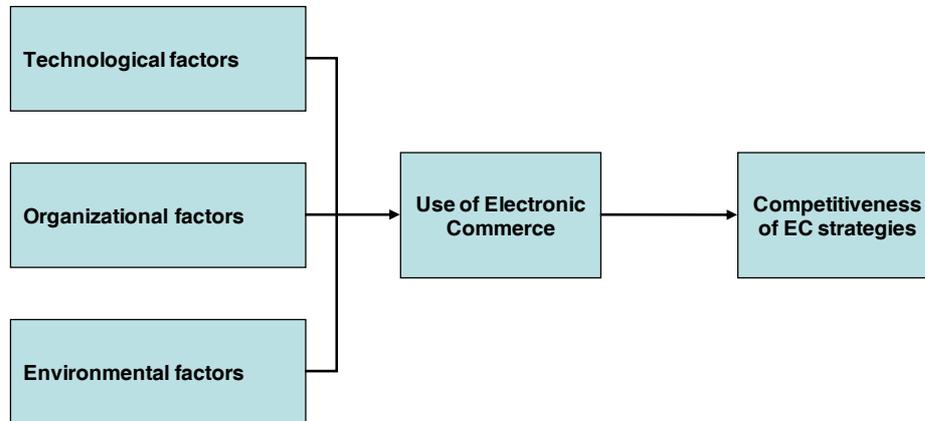


*Figure 2: Model for competitiveness evaluation of EC strategies*

## Hypothesis

The primary objective in this investigation is to identify the relationship between the variables that make up the organizational, environment and technology factors and their relationship with the successful practice of EC. Sample was drown from SME's in the metropolitan area of Guadalajara, Mexico involved in EC and relating it to their competitive level, through the development of an econometric model. Based on a review of previous literature we have been able to raise the next general research hypothesis:

The variables that make up the organizational factor, the environment and technology, within a manufacturing SME engaged in EC, have a significant and decisive role in the competitive level of the company.

As a working specific hypothesis arose:
- Within the organizational factor in the company, the following variables: age of the business, organizational realignment, level of sales, use of internet, information and new markets, have a significant role in the organizational capacity of the company.
- Within the factor of environment, the variables that make it up: competition, market dynamics, customer knowledge and marketing have a significant role in the ability of the company to cope with the environment in which it participates.
- Within the technological factor variables: staff capacity, quality of service and the guarantees offered, significantly determine the technological capability of the company.

## Methodology

A Maximum Likelihood Probit´s model was used to evaluate the impact of the TOE factors in the competitiveness of the EC. Data used to evaluate the model came from a survey developed based in the literature reviewed papers. It was applied to 70 firms. We obtained 61 usable surveys total. The model measures the probability for a company to be successful in its C strategy, measure by the competitiveness of the firm after deploying its EC strategy. This model has three independent factors: the organizational factor, the environmental factor and the technological factor, composed by diverse variables and items. It is a model that measures the probability of competitive capacity of the firms. The specification of the model is shown, next:

Dependent variable is constituted as follows:

$$capacidad_i = (fre\_op, cal\_ser, plan) \tag{1}$$

Where:

> fre_op: frecuency of EC transactions with customers and suppliers.
> cal_ser: quality of services offered to customers / suppliers thru EC technologies.
> plan: planning activities for the EC strategy.

Model's functional relationship is estimated based in the above equation and the independent variables, as follows:

$$capacidad = f (forg_1, forg_2, fentorno, ftecnologia) \tag{2}$$

Once determined the relationship of the independent organizational, environmental, and technological factors and competitive capacity, the following model can be established:

$$capacidad_i = \beta_0 + \beta_1 forg_{1i} + \beta_2 forg_{2i} + \beta_3 fentorno_i + \beta_4 ftecnología_i + \varepsilon_i \tag{3}$$

Where:

> $capacidad_i = 1$ if the firm has competitiveness and $capacidad_i = 0$ if not.
> f is the function of joint density;
> $forg_{1i}$ is the organizational capacity of the firm, expressed by their reengineering efforts.
> $forg_{2i}$ the organizational capacity of the firm, expressed by the improving of internal operations.
> $fentorno_i$ measures the economic results for the firm as a result of their EC activities.
> $ftecnología_i$ measures the technological capacity of the firm to develop EC activities.

Equation (3) can't be estimated in this form, as the dependent variable can only assume values ranging from 0 to 1, say, values that determine probabilities. As $capacidad_i$ approaches 1, a firm has more probabilities of been competitive, and as it approaches 0 it has less probabilities of been competitive. This is why a binary response model of the form shown is needed:

$$P (Y = 1 \mid X = x) = G (\beta_0 + \beta_i) \tag{4}$$

Where:

> Y = competitive capacity, and
> G = a function assuming values ranging from 0 to 1: $0 < G (z) < 1$ for every real number z.
> G is the normal standard distribution: $G (z) = \varphi(z) \equiv \infty \int z \, \varphi (v) \, dv$.
> $\varphi (z)$ is the density of the normal distribution.

From this, the probability for the dependent variable competitive capacity is established as follows:

$$P (\hat{Y} = 1 \mid X = x) = P(\varepsilon > -(\beta_0 + x\beta)) [x] = 1 - F [-(\beta_0 + x\beta)] = F(\beta_0 + x\beta) \tag{6}$$

## Complementary Models

Additionally to the basic model, three complementary models were developed corresponding to each one of the factors under study.

# Results and Discussions

## Confirmatory Factorial Analysis (CFA)

A CFA was carried out using Stata 8.0. The CFA establishes unidimensionality of the data and is also used as a technique for data reduction. When the number of original variables is great, with the factorial analysis the original variables can be reduced to a smaller set and still retaining most of the variance (Hair et al., 1999; Santesmases, 2001). Cronbach's Alpha coefficients obtained for the three studied factors were: 0.6952, 0.7920 and 0.6924 for the organizational factor, the environment factor, and the technological factor. Eigen values obtained for these three factors were: 1.04 (8 variables retained), 1.28 (5 variables retained) and 1.21 (4 variables retained). A complete result for variances and factor charges is shown in Figure 3:

| Variable | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Factor 5 | Factor 6 | Factor 7 | Factor 8 | Unicity |
|---|---|---|---|---|---|---|---|---|---|
| **p3** | -0.1364 | 0.0166 | 0.208 | 0.2539 | 0.2777 | 0.4132 | -0.2053 | 0.156 | **0.5172** |
| p5 | 0.249 | -0.4108 | 0.1697 | 0.4467 | 0.1596 | 0.2018 | 0.1456 | -0.2676 | 0.3346 |
| **p6** | 0.2198 | -0.202 | 0.1072 | 0.463 | 0.1553 | 0.1447 | -0.0784 | 0.0556 | **0.5275** |
| **p7** | 0.3035 | 0.3383 | 0.0608 | 0.0911 | 0.0249 | -0.0671 | 0.2547 | 0.321 | **0.5386** |
| p8 | -0.0572 | 0.6835 | 0.2809 | 0.1171 | 0.3011 | 0.236 | 0.1262 | -0.0265 | 0.2487 |
| **p9** | 0.615 | 0.2404 | 0.0111 | -0.1643 | -0.2731 | 0.0876 | -0.0127 | -0.1839 | **0.3493** |
| p10 | 0.6685 | -0.5297 | 0.1197 | 0.0103 | -0.0522 | -0.1449 | -0.0723 | 0.1234 | 0.179 |
| p11 | 0.6775 | -0.1092 | 0.1215 | -0.0241 | 0.0454 | 0.0519 | 0.0745 | -0.3472 | 0.3086 |
| p12 | 0.6576 | -0.028 | -0.0359 | 0.2986 | -0.2602 | -0.063 | 0.222 | 0.0639 | 0.3162 |
| p13 | -0.443 | -0.1051 | 0.7355 | 0.0663 | -0.2057 | -0.0933 | 0.128 | -0.1028 | 0.1456 |
| **p14** | -0.3953 | -0.0842 | 0.7389 | 0.0646 | -0.0867 | -0.2237 | -0.0758 | -0.0331 | **0.1975** |
| p15 | -0.3102 | -0.0757 | -0.0582 | 0.0899 | -0.2325 | 0.08 | 0.5426 | 0.0732 | 0.294 |
| p16 | 0.2864 | -0.2249 | 0.2113 | -0.4686 | 0.1161 | 0.0921 | -0.1467 | -0.0075 | 0.3198 |
| p17 | 0.1869 | -0.0079 | 0.1291 | -0.428 | 0.4219 | -0.0217 | 0.2087 | -0.113 | 0.2602 |
| p18 | 0.2226 | 0.6145 | -0.0005 | 0.1032 | -0.1258 | 0.0109 | -0.0456 | -0.3099 | 0.2146 |
| p19 | 0.244 | -0.1649 | 0.0797 | -0.1777 | -0.1425 | 0.5309 | 0.0927 | 0.1881 | 0.2198 |
| **p20** | 0.3439 | 0.2752 | 0.3809 | -0.1129 | -0.4187 | 0.1736 | -0.2506 | 0.1593 | **0.345** |
| **p21** | 0.4272 | 0.0794 | 0.3512 | -0.2925 | 0.2547 | -0.1605 | 0.2194 | 0.1794 | **0.3904** |
| **p22** | 0.5302 | 0.2292 | 0.0555 | 0.3694 | 0.1983 | -0.364 | -0.1496 | 0.15 | **0.2961** |

*Figure 3: Variances and Factor charges matrix*

## Probit Model Results

Details for main model the results are as follows:

| Number of observations | 59 | | | |
|---|---|---|---|---|
| Wald chi2 (4) | 32.46 | | | |
| Prob > chi2 | 0.00 | | | |
| Log de la Verisimilitude | -16.15 | | | |
| Pseudo R2 | 0.501 | | | |
| Capacity | Coef. | Standard Error | z | P>z |
| forg1 | 2.1300 | 0.8091 | 2.63 | 0.0080 |
| forg2 | 1.6156 | 0.5723 | 2.82 | 0.0050 |
| fenvironment | 1.8152 | 0.8370 | 2.17 | 0.0300 |
| ftechnology | 0.5785 | 0.6077 | 0.95 | 0.3410 |
| _cons | -2.7846 | 1.1158 | -2.50 | 0.0130 |

**Figure 4:** *Competitive capacity model main results*

## Organization Model

The critical value of Z for a level of significance of 5% is 1.96 and therefore, it can be concluded that three of the four parameters are significantly different from zero. The maximized value of verisimilitude factor was -16.15, which is a fair estimation for Log in a Probit's modeling, which should be always negative. That means that the probability for an enterprise to have competitiveness in its internet operation takes values between 0 and 1, with a value less than 1, and as any logarithm of a number of less than 1 is negative, so too will be the sum of the probabilities of logarithms.

The statistical Wald with 4 degrees of freedom, as is a large value (17.46), shows that the model as a whole is good, indicating that the variables explain the level of competitiveness of enterprises and are significantly different from zero.

To be able to interpret the estimated coefficients, as these represent signs of the partial effect of each variable on the likelihood of response, it is necessary to estimate derived from each rate, in order to obtain the change in the probability of obtaining a greater or lower in the dependent variable, given the change in any independent variable, namely to know the intensity of the organizational capacity of influence, the environment and technology (forg1, forg2, fenviroment, ftechnology) on the competitive capacity.

| Capacity | df/dx | Established Robust Errors. | Z | p>Z |
|---|---|---|---|---|
| forg1 | 0.3673 | 0.1167 | 3.88 | 0.0000 |
| forg2 | 0.3259 | 0.1088 | 2.77 | 0.0060 |
| Fenvironment | 0.5338 | 0.3224 | 2.06 | 0.0390 |
| ftechnology | 0.1089 | 0.1102 | 1.11 | 0.2680 |
| Prob. Observed | 0.763 | | | |
| Prob. Prediction | 0.920 | | | |

**Figure 5:** *Organization, estimation de derivates y established robust errors.*

With the estimation of derivatives, the effect of variable forg1 is .3673, namely the fact that it implements a process of organizational realignment to incorporate e-commerce into the company increased average 37% likelihood that the company obtains a higher level of competitiveness. In the same way forg2 variable with a value of .3259, explains that often develop improvement programs to conduct e-commerce activities increased by 32.6% the likelihood of obtaining a higher level of competitiveness.

In the variable *fenvironment* the derivative of its coefficient is .5338, which means that an increase in information obtained from customers and suppliers, as well as knowledge of the competition and the dynamism of the market, contributing in a 53.4% the likelihood of obtaining competitive ability on the part of businesses. The variable ftechnology is significant at 30% and has a value of .1089, tells us that an increase in the technological capacity of the company contributes 10% the chances of achieving competitiveness.

## Supplementary Model for Organization:

| | | | | |
|---|---|---|---|---|
| Number of observations | 57 | | | |
| Wald chi2 (4) | 25.88 | | | |
| Prob > chi2 | 0.00 | | | |
| Log de la Verisimilitude | -26.14 | | | |
| Pseudo R2 | 0.331 | | | |
| organization | Coef. | Standard Error | z | P>z |
| Age | -1.2774 | 0.5471 | -2.33 | 0.0200 |
| readjust | 0.6659 | 0.4410 | 1.51 | 0.1310 |
| sales | -1.2914 | 0.5555 | -2.32 | 0.0200 |
| Use | 1.3383 | 0.5416 | 2.47 | 0.0130 |
| Info | 0.7641 | 0.4293 | 1.78 | 0.0750 |
| numerc | 0.7558 | 0.4545 | 1.66 | 0.0960 |
| _cons | -1.0795 | 0.4697 | -2.30 | 0.0220 |

*Figure 6: Supplementary model for organization main results*

Regarding the estimate; statistical Z, to a level of significance of 5%, with critical value of 1.96, it can be conclude that the parameters of age, imp, use and information are significantly different from zero. The value of the Verisimilitude function was maximized up to -26.14. The statistical Wald with 4 degrees of freedom (25.88) is a large value and shows that the model as a whole is fair, indicating that the variables explain the level of competitiveness of enterprises and are significantly different from zero.

The estimate of those arising from the ratios we note that the effect of the variable *age* is -. 4036, which does not correspond with the sign and waited but the variable is statistically significant, we assume that the greater the number of years of operation of the company, are more reluctant to incorporate new technologies, such as EC.

The variable *readjust* with a value of .2498, explains the purpose of an organizational realignment in the process of a company before incorporating electronic transactions, increased by approximately 25% obtaining a higher organizational level. In the variable sales derived from its coefficient is -. 5338, it does not correspond with the expected, so it may be assume that information is not sufficient to carry out the analysis and that at the time of data collection, the staff did not have precise and accurate sources to determine the level of sales that are obtained by electronic means.

| organization | df/dx | Established Robust Errors | Z | p>Z |
|---|---|---|---|---|
| Age | -0.4036 | 0.1222 | -2.59 | 0.0100 |
| readjust | 0.2498 | 0.1522 | 1.57 | 0.1170 |
| sales | -0.4424 | 0.1195 | -3.06 | 0.0020 |
| Use | 0.4955 | 0.1533 | 2.81 | 0.0050 |
| Info | 0.2881 | 0.1543 | 1.80 | 0.0720 |
| numerc | 0.2749 | 0.1437 | 1.80 | 0.0730 |
| Prob. Regarded | 0.339 | | | |
| Prob. Prediction | 0.484 | | | |

*Figure 7: Estimate derived and robust standard errors for organization.*

The variable *use* has a value of .4955, tells that an increase in the intensity of usage of electronic transactions of the company contributes 50% chance of more. The variable *info* with a value of .2881, tells us that an increase in the information collected from customers, contributes approximately 29% in the organizational capacity of the company. Finally, *numerc* (.2749), tells us that entering in new markets, which have greater access through electronic commerce operations, increases the chance at a 27.5% in the organizational capacity of the company.

The robust estimate also took place at this model and shows that the problem of heteroscedasticity that could present the model is irrelevant. The probability of 34% observed, it determines that this model to ignore the organizational capacity of the company will be achieved, however the probability prediction shows that by applying the model suggested by the likelihood of improving the organizational capacity of the company increases to 48 %.

## Supplementary Model for Environment:

In this model, we note that the variables as a whole account for the 24.3% of the ability of SME's to participate in e-commerce to meet the changing environment in which it participates.

| Number of observations | 60 | | | |
|---|---|---|---|---|
| Wald chi2 (4) | 9.5 | | | |
| Prob > chi2 | 0.0497 | | | |
| Log de la Verisimilitude | -14.76 | | | |
| Pseudo R2 | 0.243 | | | |
| environment | Coef. | Standard Error | z | P>z |
| comp | 1.3424 | 1.1183 | 1.20 | 0.2300 |
| dynam | 1.0087 | 0.5863 | 1.72 | 0.0850 |
| cone | 1.0146 | 0.5660 | 1.79 | 0.0730 |
| comer | -0.6291 | 0.6535 | -0.96 | 0.3360 |
| cons | -0.5073 | 1.0281 | -0.49 | 0.6220 |

*Figure 8: Supplementary model for environment main results.*

The Wald's statistic with 4 degrees of freedom shows that the model as a whole is good, indicating that the variables explain the level of competitiveness of enterprises and are significantly different from zero.

| Environment | df/dx | Est. Robust Error | Z | p>Z |
|---|---|---|---|---|
| comp | 0.3272 | 0.3384 | 1.34 | 0.1810 |
| dynam | 0.1543 | 0.1069 | 2.05 | 0.0410 |
| cono | 0.1263 | 0.0723 | 1.77 | 0.0770 |
| comer | -0.0571 | 0.0412 | -0.96 | 0.3380 |
| Prob. Regarded | 0.900 | | | |
| Prob. Prediction | 0.950 | | | |

*Figure 9: Environment, estimate derived and robust standard errors.*

The estimate of those arising from the ratios we note that the effect of the variable comp is .3272, which means that the meet competition, increases by about 33% probability of increasing the ability of the company to understand the environment in which it participates.

The variable *dynam* with a value of 0.1543 explains that understanding the dynamics of the market, increased by 15.5% probability of increasing the ability of the company to address the environment in which it interacts. In the variable *cone* derived its ratio is 0.1263, which means that the increasing customer satisfaction and quality with which offers electronic, increases by 13% the capacity of the company to cope to the environment in which it operates. The variable *comer* (-0. 0571), but 33% is significant, the sign is the expected and explains that by reducing marketing costs for the use of electronic transactions will contribute to improving the company.

The estimate of robust was performed in model and shows that the problem of heteroscedasticity in the model is irrelevant. The probability of 90% observed determines that ignoring this model the company managed to cope with the environmental factors efficiently, however the prediction probability shows that applying the model suggested may improving the capacity for interaction with the environment increasing to 95%.

## Supplementary Model for Technology:

| Number de observations | 53 | | | |
|---|---|---|---|---|
| Wald chi2 (4) | 14.80 | | | |
| Prob > chi2 | 0.00 | | | |
| Log Verisimilitude | -27.19 | | | |
| Pseudo R2 | 0.214 | | | |
| technology | Coef. | Standard Error | z | P>z |
| Staff | 0.8007 | 0.4216 | 1.90 | 0.0580 |
| quality | 0.8028 | 0.4092 | 1.96 | 0.0500 |
| garant | 0.4480 | 0.3971 | 1.13 | 0.2590 |
| _cons | -0.8137 | 0.3876 | -2.10 | 0.0360 |

*Figure 10: Supplementary model for technology main results.*

The Wald's statistic with 4 degrees of freedom shows that the model as a whole is good, indicating that the variables explain the level of competitiveness of enterprises and are significantly different from zero.

The estimates of the coefficients derived from us that the effect of variable staff is 0.2965, which means that the type of people who advise and joined the company in its electronic operations and

the frequency of training for staff The attention of their electronic transactions, increased by approximately 30% probability of increasing the technological capability of the company.

| technology | df/dx | Est. Robust Error | Z | p>Z |
|---|---|---|---|---|
| Staff | 0.2965 | 0.1549 | 1.88 | 0.0600 |
| quality | 0.2930 | 0.1463 | 1.94 | 0.0520 |
| garant | 0.1643 | 0.1472 | 1.11 | 0.2650 |
| Prob. Regarded | 0.642 | | | |
| Prob. Prediction | 0.667 | | | |

*Figure 8: Technology, estimate derived and robust standard errors.*

The variable quality with a value of .2965, explains that often in establishing standards and measuring quality in their electronic transactions, a 30% increase in the probability of increasing the technological capability of the company.

In the variable guarantor derived its ratio is .1643, which means that the increase guarantees and benefits that are granted to customers to conduct their transactions via the Internet, increases by approximately 16.5% of the technological capabilities company.

The robust estimate also took place at this model and shows that the problem of heteroscedasticity that could present the model is irrelevant.

The probability of 64.2% observed, it determines that by ignoring this model the company I managed to increase their technological capabilities, however the probability prediction shows that by applying the model suggested by the likelihood of improving the technological capabilities of the company increased to 66.7%.

## Conclusions

Probit model suggests the importance of taking into account elements of strategic planning at the moment of deciding to participate in EC, it shows as well the importance of considering the environment when developing better EC strategies as well as a proper assimilation of the technology; all of them are vital for achieving competitiveness thru EC.

From the evidence found; all hypothesis are to be accepted, as they support the argument that the organizational, environmental and technological factors within an SME in the manufacturing influence its ability to deploy sound EC strategies to achieve a better competitive position.

The organizational factor demonstrated that the existence of an EC action plan or development of an EC planning process is of great importance. However, the factor that contributes the most to reach a successful EC strategy leading to competitiveness thru EC is the intensity of use of the electronic media.

The environmental factor has been proven the most important one when the search for competitiveness in the firms is made thru EC strategies. It has been shown that knowledge of competition (known practices of competitors, as well as their action plans), understanding of the market dynamics (interaction between customers and suppliers), the level of customer satisfaction, the benefits afforded them by conducting electronic transactions and information received from the players (customers, suppliers and competitors), constitute key elements for fostering the performance of the company in the context in which it participates.

The technological factor, less significant that the above factors, constitute an important variable for the development of the company, since the correct assimilation of technological innovation (use of

all means to reach out to customers via the Internet), simultaneously with the establishment of quality standards and the inclusion of top notch computer equipment contribute to improve the performance of the company and achieve greater competitiveness. Within this factor capacity and training to the staff is of uttermost importance, since efficient and effective use of technological innovations depends on this.

## References

Smith, J., (1996): Title of the paper, Journal Name, Vol. 31, No. 4, pp. 231 - 239.

Smith, J., (1974): "Title of the Book," Publisher, City.

Smith, J., Novak, J., (1993): Title of the conference or the chapter in a book, "Book (Publication) Title", Location and time - only for Conference Proceedings, W.D. Engelsman, (Editor), Publisher, City.

Aragon, A. and Rubio, A., (2005): Factores asociados con el éxito competitivo de las pymes industriales en España, Universia business review, cuarto trimestre.

Betty, R., Shim, J. and Jones, M., (2001): Factors influencing corporate web site adoption: a time-based assessment, Information & management, No. 38, pp. 337-354.

Barney, Jay. B. (1991): Firm resources and sustained competitive advantage, Journal of Management, No.17, pp. 99-120.

Botelho, A. (2005): "Empleo, mpymes y comercio electrónico," Universidad Milano Bicocca, Italia.

CANIETI (2006). Regulación y Comercio Electrónico en México [Home Page of the 'Cámara Nacional de la Industria Electrónica, de telecomunicaciones y Tecnologías de la Información]. [Online]. Available: http://www.canieti.org/index.asp?_option_id=89&_option_parent_id=61&_option_level= 2 [2006, June 27]

Fernández, M. (2002): Comercio Electrónico y Mundialización. Revista Electrónica de Comercio Electrónico. [Online]. Available: http://www.delitosinformaticos.com/ecommerce/ [2006, June 27]

Fong, C., (2005): "La teoría de recursos y capacidades. Fundamentos microeconómicos", Universidad de Guadalajara, México.

Golden, W., Hughes, M., and Ruane, L., (2002): Successfully eEnable SME's – What have they got in common?, 15th Bled eValues Conference, Bled, Slovenia, June. Available: http://domino.fov.uni-mb.si/proceedings [2006 June 27]

Hair, Jr. J. F., Anderson, R. E., Tatham R. L., and Black, W. C. (1999): "Análisis Multivariante", Prentice-Hall, Madrid.

Iacovou, C., Benbasat, , A. and Dexter. (1995): Electronic data interchange and small organizations: adoption and impact of technology, MIS Quart, 19.

INEGI, (2004,1): "Industrias manufactureras", Censos económicos 2004, México. [Online]. Available: http://www.inegi.gob.mx [2006, June 18]

---------, (2004,2): "Uso de equipo informático", Censos económicos 2004, México. [Online]. Available: http://www.inegi.gob.mx [2006, June 18]

Kumayama, M. (2001): "Electronic commerce and exportation promotion policies for small and medium enterprises: East Asian and Latin American experiences", Santiago de Chile. CEPAL.

Lai, K. and Sharma, P.A., (2006): "Small islands, new Technologies and globalization: a case of ICT adoption by SMEs in Mauritius", Maastricht economic and social research and training centre on innovation and technology. Netherlands.

Liu, C. and Arnett, P., (1999): Exploring the factors associated with web site success in the context of electronic commerce, Information & management, No. 38.

Martin, G. (2002): Avances en material de regulación mercantil y civil del comercio electrónico en México y los aspectos fiscales del establecimiento permanente, Revista Contaduría y Administración, No. 204, Enero-Marzo.

Mehrtens, J. Cragg, P. and Mills, A., (2001): A model of internet adoption by SME's, Information & management, No. 38, pp. 165-176.

Monteverde, A., (1992): "Estrategias para la competitividad internacional", Ed. Macchi, Buenos Aires, Argentina.

Munch, G. L., (2005:1): "Calidad y mejora continua: principios para la competitividad y la productividad", Ed. Trillas. México D.F.

----------, (2005:2): "Administración y estilos de gestión: la clave de la competitividad", Ed. Trillas, México D.F.

Porter, M., (1982): "Estrategia competitiva: Técnicas para el análisis de los sectores industriales y de la competencia", Ed. CECSA, México, D.F., Reimpresión 2006.

------------, (1985): "Competitive advantage" Free press, Nueva York.

------------, (2001): "Strategy and the Internet," Harvard Business Review, March.

------------, (2002): "Ventaja competitiva: creación y sostenimiento de un desempeño superior", México, Editorial CECSA.

Santtesmases, M., (2001): "DYANE Versión 2: diseño y análisis de encuestas e investigación social y de mercados", Ed. Pirámide, Madrid.

Tornatsky, L G. and Fleischer, M. (1990): "The processes of Technological Innovation", Lexington Books, Lexington, MA.

UNITED NATIONS (2003): "Informe sobre Comercio Electrónico y Desarrollo, 2003: Perspectiva General", Conferencia de las Naciones Unidas sobre Comercio y Desarrollo. Nueva York y Ginebra.

Vatchaparon, E. and Sivaporn, C., (2001): Electronic commerce y electronic business implementation success factors, 14th Bled Values Conference, Bled, Slovenia. June. Available: http://domino.fov.uni-mb.si/proceedings [2006 June 27]

Yamakawa, P and Serida, J., (2002): "Adopción e implementación del comercio electrónico por empresas medianas en el Peru: un estudio de caso" ESAN cuadernos de difusión, año 7, no. 13, December.

Zhu, K. and Kramer, L., (2005): Post-Adoption variations in usage and value of e-business by organizations: cross-country evidence from retail industry, Information systems research, March. pp.61