



**THE PRODUCTIVITY OF SMES IN MEXICO AND ITS EFFECT ON
INNOVATION, USING THE SURVEY ON INFORMATION AND
COMMUNICATION TECHNOLOGIES, 2013 (ENTIC)**

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SUMMARY

Small and medium-sized enterprises (PyMES) in Mexico represent one of the main entities of the economic activity that supports the bulk of the Mexican population; Using statistics as a fundamental tool for conducting studies in the economic, natural and health sciences areas, among others, it allows us to have propositional foundations for decision-making within companies by senior executives and in the sphere public by officials in charge of promoting the growth of the industry in our country. In this investigation it is about representing under a statistical scheme,

Keywords: SMEs, Innovation, Productivity, ICTs.

1. Introduction

In Mexico, the economic effects of the economic crisis suffered in 2008 as a result of excessive spending by Americans due to low interest rates, triggering an imbalance in the mortgage sector, is identified as the main cause of this crisis. For our country, the effects were evident in the real economy as our exports and remittances from the United States contracted, together with the reduction in confidence in the Mexican economy by entities that promoted the increase in R&D (Research and Development).

From these consequences, our economy seems to have consolidated its stagnation in different areas of our economic activity, such as: mining, electricity, construction, manufacturing, commerce, services, transportation and communications; These activities represent the sectors that mostly absorb the Economically Active Population (EAP: Population 15 years and over) through small and medium-sized enterprises (SMEs).

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Mayorga, VYL, Hernández, JGV; The Productivity of SMEs in Mexico and its Effect on Innovation, Using the Survey on Information and Communication Technologies, 2013 (entic).Revista de Empreendedorismo e Gestão de Micro e Pequenas Empresas V.3, N°2, p.1-27, Mai./Ago. 2018. Artigo received on 05/10/2018. Last version received on 07/21/2018. Approved on 08/01/2018.

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Regarding the income from oil exports for December 2015, these prices are down, due to pressure from the member countries of the Organization of Petroleum Exporting Countries (OPEC) to promote the supply of crude oil. . If this trend continues for the fourth quarter of 2016, an oil surplus is expected (El Economista, 2015). All these factors that limit the dynamism of the Mexican economy provoke the deepening of the weakening of economic activities, negatively impacting the activities carried out by SMEs in the search to absorb as many PEA as possible.

One of the challenges for Mexican companies is to be at the forefront of current technological systems. Being a developing economy, Mexico is subject to the imitation of technologies from central countries such as the United States, Germany, Japan, France and the United Kingdom (G5). As Myro, 2010 points out: “in economies with a low level of development, [...], technical progress should be based more on imitation than on one's own technological effort,” which is why cases such as Mexico's policies on Technological innovation must focus on imitation to achieve the technical progress that SMEs in our country seek.

Thus, Mexico bases its innovative activity through reactive strategies that follow and imitate organizations follow. Pioneering nations such as Germany, Japan, the United States, among other developed nations, follow reactive strategies, since they are pioneers since they are pioneers in technological innovations.

Among the main results that Mexico has in Science, Technology and Industry that the Organization for Economic Cooperation and Development (OECD) carried out in 2013, we summarize that:

- A. Mexico suffers from the consequences of a weak innovation environment, and investment in science and technology remains low by OECD standards.
- B. Among the main obstacles are: patterns of industrial specialization, high prevalence of micro-enterprises, skills gaps and an insufficiently developed and high-cost ICT infrastructure.
- C. Underdeveloped links between research base and economics, which translates into few scientific publications (OECD, 2013).

These characteristics that currently prevail together with the low quality of educational services make it difficult to build a solid technological base in the much sought-after technical progress, even through imitation. In this same report, it is mentioned that “Mexico also faces a series of challenges due to the weaknesses of its ICT infrastructure, including the low penetration of broadband (both fixed and wireless), a low average speed of broadband connection and high prices”(OECD, 2013).

The Information and Communication Technologies (ICTs), due to the role they play in business logistics, play a fundamental role in the praxis of economic subjects. Due to the importance that these tools have in the relations of global economies, keeping them up-to-date is fundamental for the Mexican capitalist system.

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In the following pages of the document, the general aspects of the methodology used are exposed, the statistical design in which the basic statistics are calculated, initially on the stratification carried out by INEGI, followed by the segmentation proposed in this research, at the end The relevance of using average productivity and the Cobb-Douglas production model is established in the methodology section.

In the results section, the general statistics for the INEGI stratification and the proposal made up of small, large and medium-sized companies are presented, describing the type of activity they carry out, the distribution of their income, the items to who allocate their investment, this section also describes the use of traditional means of communication, as well as the impacts of ICTs. In this same section, the impacts of ICTs such as e-mail, the internet, social networks and the web page on aspects of competitiveness are presented. The results of the two regression models are also presented. Finally, the last section presents the conclusions and a series of recommendations.

2. History of the problem

In the reconfiguration of productive paradigms, SMEs use science and techniques for the reconstruction of new technologies. Technology understood as "the sum of knowledge about the means and methods of production of goods and services" (Luter, 1998), this same technology plays an important role in economic theory.

To define innovation, it is necessary to differentiate between invention and innovation (Galindo, 2012 pp.53), invention as a person's idea of a product or process and innovation as the first attempt to put it into practice. Galindo, 2012 also considers that for an invention to become an innovation, the company must combine different elements, such as: knowledge, skills, capacities and resources.

In neoclassical economic theory, innovations are understood as exogenous phenomena in the equation that seeks the balance between supply and demand, while the positive school current that interprets the economy as a dynamic system considers innovation as a variable. endogenous (Hernández, 2009). The positive theory makes reference that although the human being cannot create the matter, if he can create its utility, increase or decrease it, this is precisely innovation, with this the importance of human reasoning is assumed, the ability to invent and to create new forms from materials.

Being Schumpeter one of the modern authors distinguishes the innovations proper and the technical innovations in the studies that I carry out on the growth and economic development. Hernández (2009) distinguishes these two types of innovations, the first referring to the systemic search for general explanations of a phenomenon and technical innovation such as: "an original solution resulting from the synthesis of information about needs or wants, and information about the technical means by which they can be satisfied" (Utterback, 1971, p. 77 in (Hernández, 2009)).

This previously noted appreciation where the human being seeks well-being through minimal effort, the invention of the wheel, the steam engine and the innumerable

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instruments that we use in our lives reflect the technical progress that we have achieved to satisfy “n” human needs. . Innovation is therefore an economic phenomenon that serves to create wealth and satisfy needs.

In this context, Hernández (2009) states that the variables that explain innovation are: entrepreneurial profits or the reduction of production costs, intentional research and development efforts, accumulation of human capital, exploitation of new inventions or in the application of mature technologies or new uses. For the company, innovation is an important factor from any point in which it is considered, since it releases market pressure in the creation or improvement of new products. Many companies that make up the markets base their innovations on scientific knowledge and technological developments, measuring innovation in the number of patents for a given period.

Hernández, 2009 indicates that “the independent variables have to do with intensity or investment in research and development (Mansfield, 1963; Koeller, 1995; Gatti, 1998); with the availability of human capital according to the proportion of scientists and engineers in relation to company personnel, as well as the number of workers with the ability to implement changes or learn new skills (Koeller, 1995; Gatti, 1998; Afuah, 2002) ”.

As companies are the primary entities of economic activities, innovation is a competitive advantage that allows them to extend their life in the market. Innovation and technological change serve each other so that the company that produces them will obtain better returns.

Cantú, 2006 classifies the innovations according to the magnitude of the change that they imply, mentioning the following typology (Cantú, 2006 in Dussage, Hart and Ramanantsoa, 1992, p.14-15):

- A. Incremental: the articulation between concepts and components or product architecture is not changed, only some of its components or concepts are reinforced or improved.
- B. Radical: both the architecture and the components are altered, in fact it is a new product.
- C. Modular: the modular components of a product are radically changed but its architecture remains unchanged; The switch from analog to digital phones is an example of this type of technological innovation.
- D. Architectural: the way in which the components and concepts of the product are articulated is modified but the components and concepts are only reinforced or remain unchanged, examples of these changes occur in personal computers and are not easily identifiable by consumers because they are a system level.

In this way, innovations are transformations that human beings make of the goods provided by nature in order to facilitate the activities they carry out and obtain some benefit by exchanging them with other individuals, not limiting themselves to exclusively technological concepts, if not to find also innovations in the economic, social, organizational and strategic fields of companies.

SMEs are the economic units par excellence that train individuals who, when carrying out a physical activity, exchange this effort for economic remuneration, this in order to meet their physical needs and those of their dependents. As small and medium-sized companies are responsible for absorbing this population stratum, it is necessary to analyze the use of ICTs as an alternative for growth. That is why, one of the main problems that SMEs face is the lag in technological equipment that causes competitive asymmetries and disadvantages compared to foreign companies established in our country.

The process of equipping companies in their different dimensions by establishing themselves in delimited geographical areas causes economic growth in the region. The study of this process is necessary to determine the effects it has on human capital, both in average productivity, and the effect of ICTs on production levels in the company.

This research seeks to analyze this process and the influence on the living conditions of our country. Companies in our country represent a great source of employment that encourages economic growth and social welfare. Thus, the statistics support the operational alternatives in the decision-making of the company in order to promote growth and with it the living conditions of the workers.

3. Review of the empirical literature

To solve the changes that our environment at the global level requires from different societies is through knowledge, the different economic, political and social facts rethink the solution of problems through new and sustainable techniques. The promotion and impulse that governments do in the matter of managing knowledge is directly linked to the work of companies, to increase their profitability, generate regional growth, improve living conditions and others by promoting environmental care.

In this quest to manage knowledge, companies create new and better products, improve their production systems, seeking utopically to solve major social and economic problems such as: health, education, poverty, quality of life, etc., demanding that these further improvements do not compromise environmental conditions.

In this way, companies, universities and the government are responsible for responding with solutions, using different strategies, mechanisms and policies that contribute to the improvement of current conditions. The concept of knowledge economy that is currently developed and involved in the tasks of companies to achieve higher returns, has to do with analyzing the situation, setting goals and finally optimizing knowledge.

Among the main characteristics of this global knowledge economy as stated by ECLAC, in its report "Innovate to grow", we have to:

A. further codification of knowledge

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- B. a closer relationship between technology and science, with higher innovation rates and shorter product life cycles
- C. a growing importance of innovation in GDP growth, as well as education and lifelong learning
- D. a greater investment in intangible elements (research and development, education, software, among others) than in fixed capital, and
- E. substantial changes in the demand for skills in the labor market. (Figuroa, 2015)

These characteristics that foster the emergence of technological innovations involve a process to arrive at a final product or technological improvement. The process to follow can be clearly understood through the following funnel, (Figuroa, 2015).

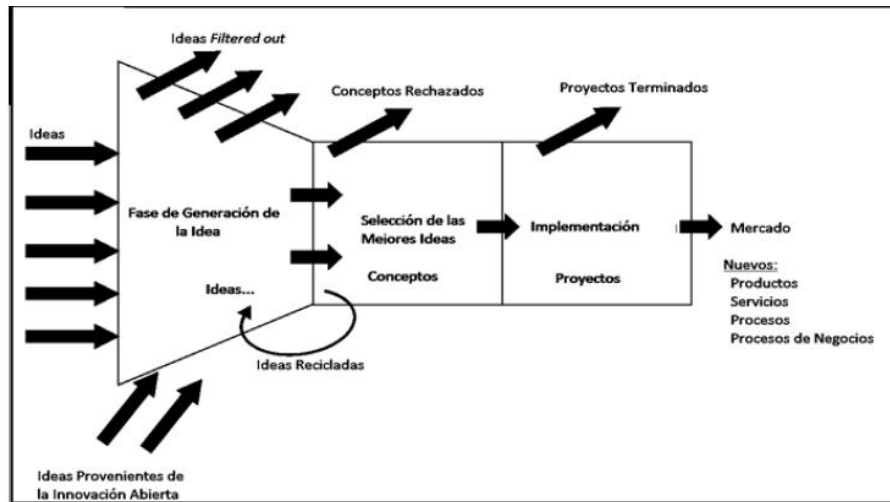


Figure 1. Innovation funnel.

Source: Oxford English Dictionary, 2010(Figuroa, 2015)

In this funnel, all ideas are filtered by ideas that are feasibly applied and that respond to a market need, so their implementation results in new products, services, processes and business processes. The importance of working under this scheme is reflected in the decrease in company costs. Finally, to ensure the success of any technological innovation as mentioned by Figuroa, (2015) a social need, social resources and a receptive social concept must be combined.

4. Research method

A. General features

The use of Information and Communication Technologies (ICTs) by companies in our country has had considerable growth in recent years. The use of computers, landlines, mobiles, internet, among other technological resources, has become essential for the operation of any company.

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The following pages analyze the situation for the year 2013 of the use of ICTs by companies with a busy staff of more than 10 people. These companies are carrying out activities such as: mining, electricity, construction, manufacturing, commerce, services, transportation and communications, according to the classification carried out by the Industrial Classification System of North America 2007 (NAICS2007). This analysis is performed by taking the Survey on Information and Communications Technologies 2013 (ENTIC, 2013) carried out by the National Institute of Statistics and Geography (INEGI).

The survey was designed under a probabilistic scheme so that the results obtained can be generalized to the total population. The population of companies that comprise it with 10 workers and more gives a total of 157,611 and the total of the selected sample is 6,941 companies. The results available are those presented for 42 companies.

It is worth mentioning that in this descriptive research, he had a limited sample of the results of the ENTIC, 2013 that the INEGI publishes on its website, so it represents a mere approximation as an exercise that is proposed as a research work at the level mastery with the full survey. It is thus a cross-sectional study since the survey deals with the use of ICTs in 2013.

B. Statistical design

The design used to carry out this research was an observational study, in which ENTIC, 2013 was taken with the 42 companies that make up the database published by INEGI on its website. When carrying out this research, it was decided to take all the companies since it was a limited database, so the results represent an exercise for calculating the final results that is proposed as a thesis for the master's level.

It was carried out a new stratification based on the size of the number of employees who work in the company, for which 3 groups made up of small companies with a number of workers ranging from 1 to 50 employees, the medium-sized ones from 51 to 250 employees and large companies with more than 250 employed people.

C. Statistic analysis

In the statistical analysis are the basic statistics of the original stratification presented by the INEGI according to the employed personnel, which includes data on the investment in fixed assets of the companies that would allow identifying the items with the greatest influence on average productivity. , the availability of the media in which the behavior of companies with the media is identified to position their products and services.

These same basic statistics were also determined for the impacts of the use of ICTs on the productivity of companies, this as an alternative to promote competitive advantages against larger national companies as well as foreign companies established in our country that represent potential competition.

In the proposal that is made to restructure the sample into 3 new groups, the structure of their income, the disposition of the media, the use of computer equipment and the impact of

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ICTs are determined, finally they are proposed 2 regression models to determine the average productivity and a modification to the production model using the Cobb-Douglas model using the Minitab statistical program.

5. Analysis of results

INEGI carries out a stratification according to the employed or employed personnel, classifying the companies according to this criterion.

Table 1. Classification of companies.

Strata Busy Personnel	Sample companies
Total	42
1. Over 751	10
2. 251 to 750	6
3. 51 to 250	14
4. 21 to 50	5
5. 10 to 20	5
6. 1 to 9	2

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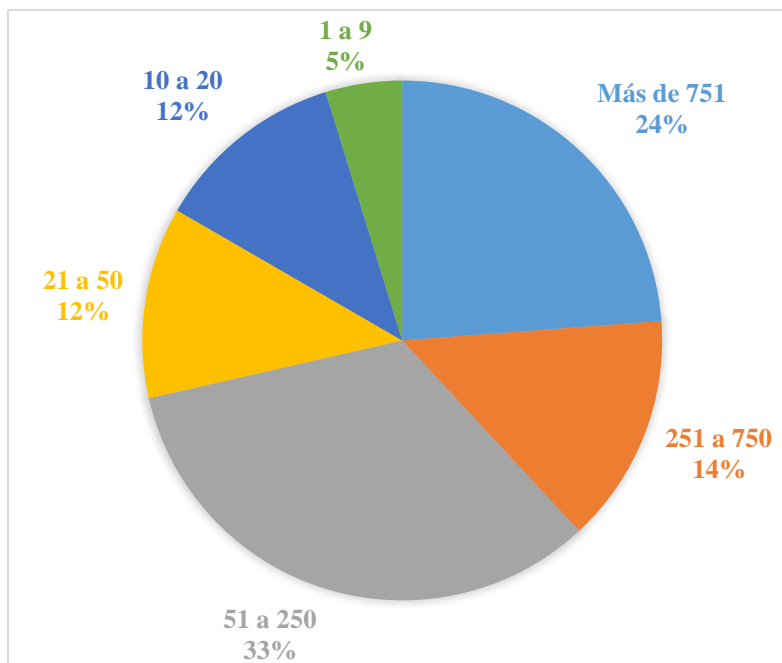


Figure 2. Distribution of the strata by employed personnel. Own elaboration with data from ENTIC, 2013.

The results presented by the INEGI, stratum 3 absorbs 33% of the companies, followed by stratum 1 with 24%, this stratum being large companies in terms of personnel, with more than 751 people employed. The turn of the activities that these companies carry out are: television monitors, electric power commercialization, clothing retail trade, personnel transportation service, crude oil, to name a few, this somehow explains the number of personnel that require to develop their activities.

The turn of the companies is presented in Table 2, this classification is made by the OECD, with a total of 23 branches. The predominant turn in the results presented by INEGI are wholesale and retail sales and service accessories.

Table 2. Distribution of companies by branch of activity.

OECD Branch	OECD Description	Business
2	Mining	2
8	Textiles	one
9	Clothing and fur	one
13	Pulp, paper and paper products	one
14	Publications, printers and reproduction of recording media	one
19	Chemicals (pharmacists)	one
twenty	Rubber and plastic products	one
2. 3	Ferrous Base Metals	one
25	Products made of metal	2

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28	Office, accounting and computing machinery	one
32	Tv, radio and communications equipment	one
3. 4	Motor vehicles	one
37	Planes	one
40	Furniture	one
41	Other manufactures not otherwise specified	one
43	Electricity	one
46	Wholesales	5
48	Transport and storage	3
53	Real estate, rent and business activities	one
59	Community, social and personal services	3
TO BE	Services complement	4
46b	Retail sales	7
MEC	Mining - construction complement	one
Total		42

A. Investment and equity participation of companies

Throughout economic history, talking about investment involves the injection of current assets to promote and reactivate some economic activity in order to grow this type of asset through income. Within companies and any organization, investments are made through direct injections of capital, for example the payment of wages and salaries, purchases of different inputs to make the labor productive as well as the production process itself, ICT equipment, among others.

In the case of our study companies, we can see the distribution of this investment, with the items in machinery and equipment and the investment in computer equipment and peripherals concentrating the largest amount of invested capital.

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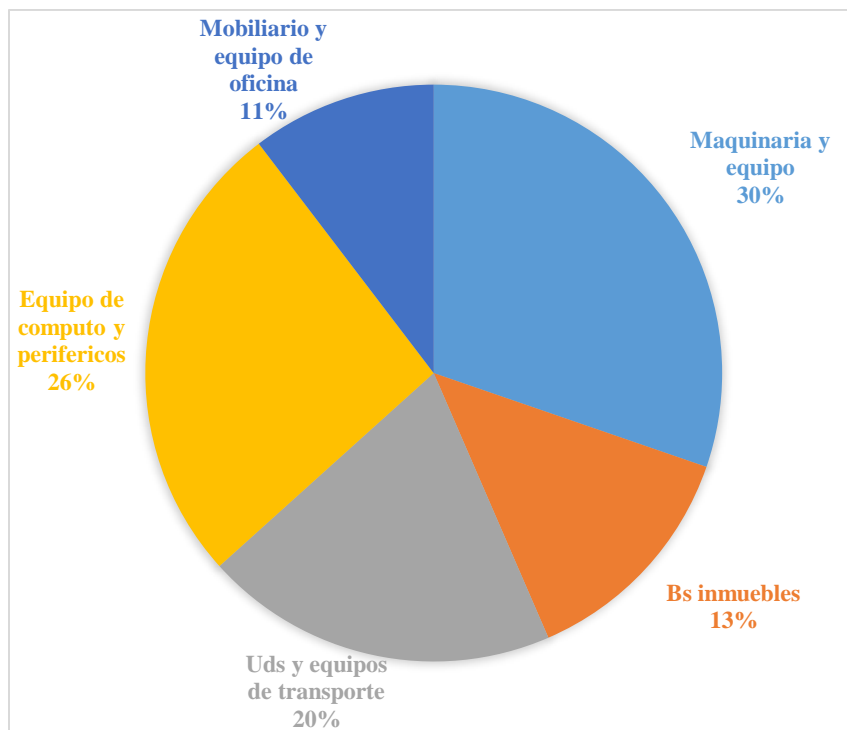


Figure 3. Investment in fixed assets of companies. Own elaboration with data from ENTIC, 2013.

The information presented about the amounts of investment in fixed assets that companies make results with a large variance, in this way through ranges we can have a clearer vision. We see that 54.76% of companies invest less than \$ 999.00 pesos, this investment relationship is a function of the size of the companies that for this research has been stratified in terms of the personnel they have employed.

Table 3. Investment amounts of companies

Rank	Investment	Total companies	% of investment range
one	From \$ 0 to 99	13	30.95
2	From \$ 100 to 999	10	23.81
3	From \$ 1,000 to 9,999	10	23.81
4	From \$ 10,000 to 99,999	5	11.90

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5	Over \$ 100,000	4	9.52
Total		42	100.00

Source: self made

Following the conformation of the participation of the capital stock of these 42 companies, 78.57% is 100% national capital, immediately we have 19.05% with the participation of foreign capital and a public company. Among the companies with foreign capital participation (8 companies), 3 have 99% of foreign capital and 2 companies have 100% of this same type of capital.

B. ICTs in companies: Investment, uses and impact.

The technological progress that society is currently undergoing corresponds to the satisfaction of the new needs that it has. Within the market made up of large, medium and small companies, the relationships between these have become closer. They are linked by such simple matters as the purchase and sale of articles for daily commercial use, up to the movement of large capitals that, in short, would impact the living conditions of the residents of any place or country where these movements occur.

In this way, the use of ICTs is a tool within companies to make large and small capital movements, to carry out the administrative and operational tasks of the company, understood here the operability from the inputs of inputs - outputs of goods until its commercialization and arrival at the final consumer.

The situation that prevails in the companies that we analyze through the following graph, shows that the companies that responded through a dichotomous variable (yes, no) regarding the resources that were available to them in the year immediately prior to the publication of the survey, the results are presented below:

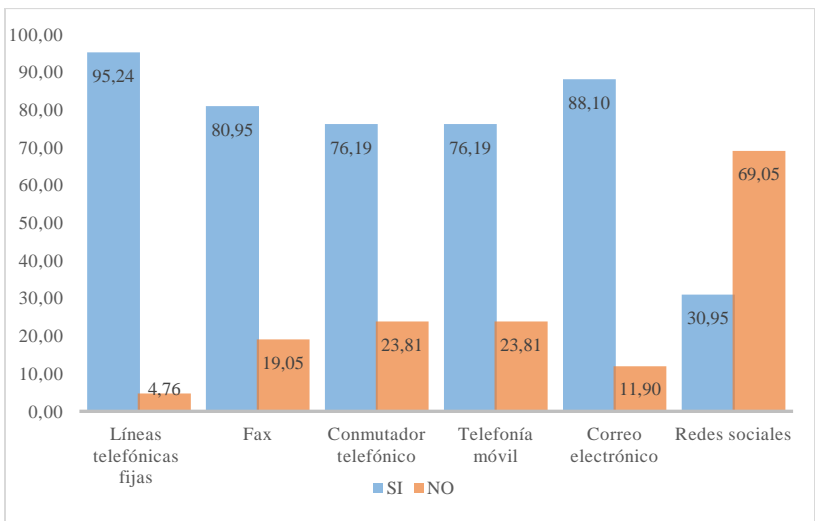


Figure 4. Availability of means of communication used by companies. Own elaboration with data from ENTIC, 2013.

The provision of means of communication such as telephone lines, fax, switch, mobile, email and social networks by companies involves multiple internal and external tasks. The companies as shown in figure 3 show the use of traditional means of communication par excellence, such as landlines, a strong percentage, 80.95 and 76.19% in fax and switch, respectively.

The availability of mobile telephony on par with the same percentage of a traditional means of communication such as fax (76.19%). E-mail with 88.10% of companies shows, being only below the traditional landline, the importance of having this ICT tool for companies in the operation of their activities. On the other hand, we see that only 30.95% of these companies have social networks. We denote here the importance of the rise of social networks in recent years since they currently represent a niche of opportunity for the positioning and sales of companies.

Investments made by companies in the ICT category include the acquisition of computer equipment that includes: desktop computers (PCs), mobile or portable computers (laptop, notebook, netbook, tablet), workstations (workstation), servers, minicomputers, mainframes, supercomputers, in the results that INEGI presents, we identify that on average each person employed within these companies has .35 computer equipment as an average to carry out the assigned activities.

Within the use of these teams, 92.85% who declare percentages in stock, we note that 63.67% of that 92.85% are older than two years and only 17.62% of this equipment is less than one year old, taken into account the speed in which they depreciate (30% each year) this represents for companies a signal to update with new products that allows them to increase their productivity.

Another important aspect to highlight within the use, management and acquisition of computer equipment by Mexican companies is the support that the Mexican government has to support the companies' productive economic activities. One of these programs is PROSOFT 3.0, which supports companies with low levels of development for the adoption and development of new ICTs. Even within their calls, company innovations are encouraged, all with the aim of increasing productivity levels in the strategic sectors of the economy (SE, 2016).

For the results presented by the ENTIC, 2013, 93% of the companies did not receive any government support for these purposes. In the theoretical framework on the advances in the use of information technologies by companies, this use would represent significant advantages in the progress of the activities they carry out. When analyzing the situation of these 42 companies, we can see that in the year of study, that the use of the internet and email have impacts in reducing the time of the companies' processes.

The information that INEGI collects when applying its questionnaire on the impacts of ICTs on the increase in sales and customers, reduction of time and costs, quality of services and market expansion is presented based on the opinion of the person responsible for answering the survey, making it a yes and no answer.

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Although we do not have the percentages of these increases or decreases to make precise estimates, this information helps us to later propose the probabilities that these items have in decreasing or increasing productivity and production when using the internet, website, email or social networks.

The instruments that most served to increase sales were email and the internet, prevailing in most categories: cost reduction, quality of services and increase in customers. Regarding the use of the website, it only impacts more or less significantly on the increase in customers. The topic of social networks turns out to be the one that has the least weight in these categories, having its greatest impact with 20.51% of companies that have social networks in the geographic expansion of their market.

Roughly, these results represent the delay of companies in the use of ICTs to increase their productivity, since they are the tools we have in this century and they mean the possibility of promoting competitiveness and growth in each one of them. .

We stop to observe the impact that email is having within the operations of companies in the survey period. We note that on average companies have .97 units of computer equipment to use with internet access. Because the internet network conditions the use of email, of the people who used computer equipment with internet access they reach an average of 1.45 email accounts. .

The average of email accounts together with the computer equipment with internet access introduce, among other variables, the electronic commerce of goods and services offered by companies, which we will analyze later. In Figure 4 we can see these behaviors.

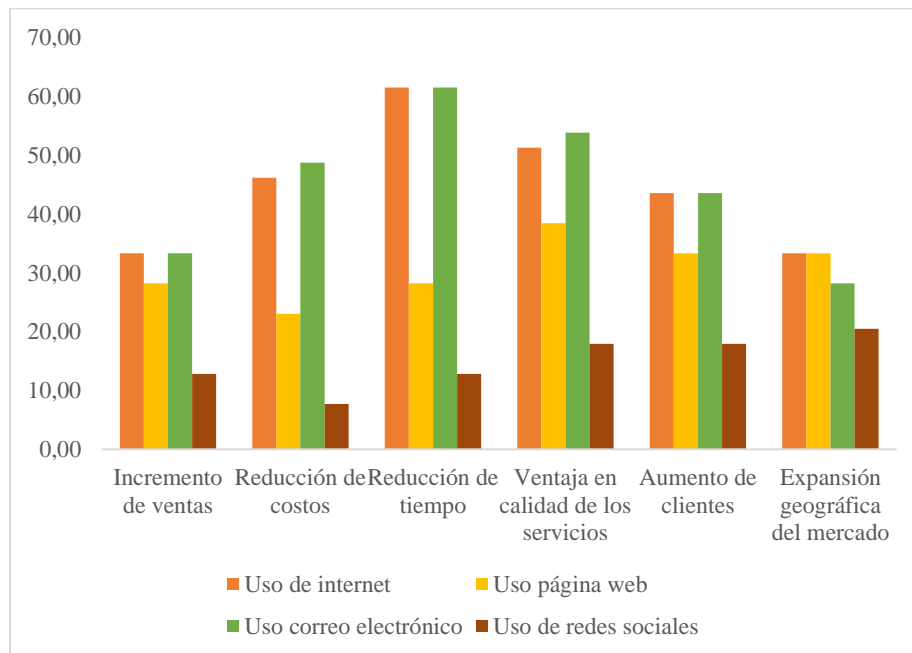


Figure 5. The impacts of ICTs on the competitiveness of companies. Own elaboration with data from ENTIC, 2013

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The increase due to the intensive use of ICTs would be a key factor together with the increase in productivity in the increase in yields, although as we have previously indicated, yields may increase due to the increase in prices without this implying an increase in the productivity of the company. These market forces are poorly controlled by SMEs.

One aspect in which SMEs can interfere is in the training of their workers when using ICTs, since by keeping them trained they can update their knowledge of the factors that affect their market. Of the results presented by INEGI, only seven companies trained personnel by taking between 2 to 100 courses in this period, a figure that presents information asymmetry by the size of the company depending on its personnel.

C. The market structure of companies

The output management of the companies made up of goods and services that they produce in the form of manufacturing, mining, energy and services in the construction and sales branches, among others, determine the companies' ability to determine the final consumer.

In this way, large companies, due to the magnitude of their scope, are external to the national market, while small and medium-sized companies have a more or less local scope, with the exception of one company for each group, who export part of their products to the market. Externally, these sales contribute very little to your total income.

We also have the case of companies that do not sell either inside or outside the local market, so they are companies that obtain their income from other sources, their turn therefore are community, social and personal services. In the following graphs we can see how sales in the domestic market and sales abroad (exports), as well as other sources of income, contribute to the total income of companies.

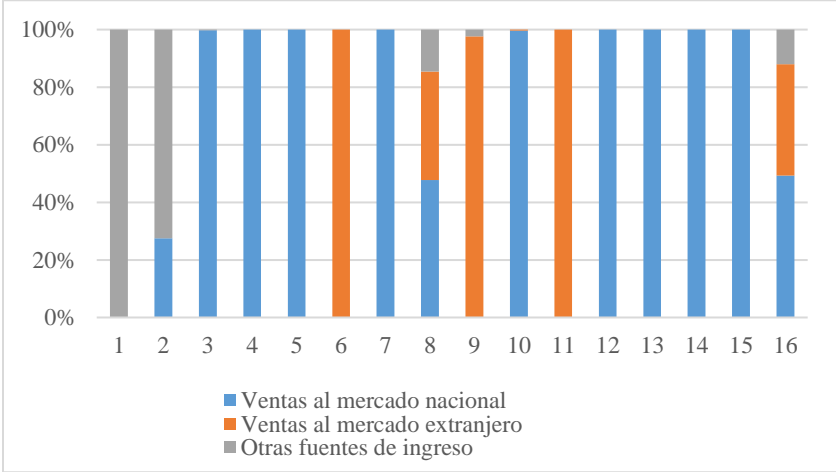


Figure 6. Structure of the income of large companies. Own elaboration with data from ENTIC, 2013

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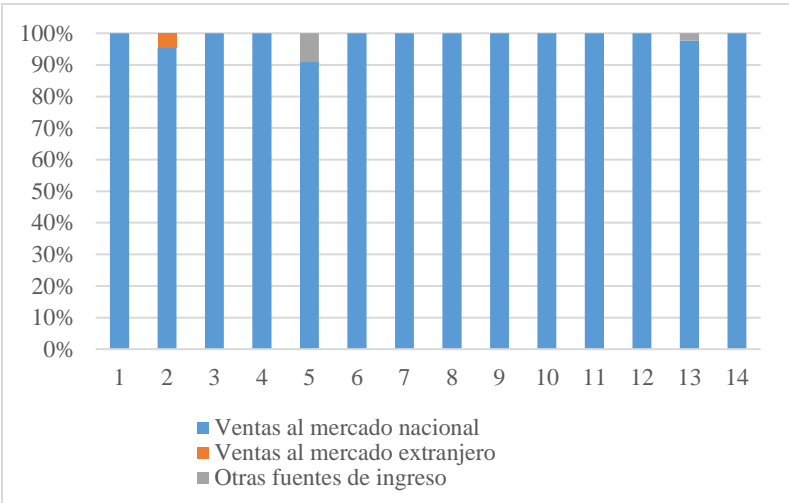


Figure 7. Structure of the income of medium-sized companies. Own elaboration with data from ENTIC, 2013

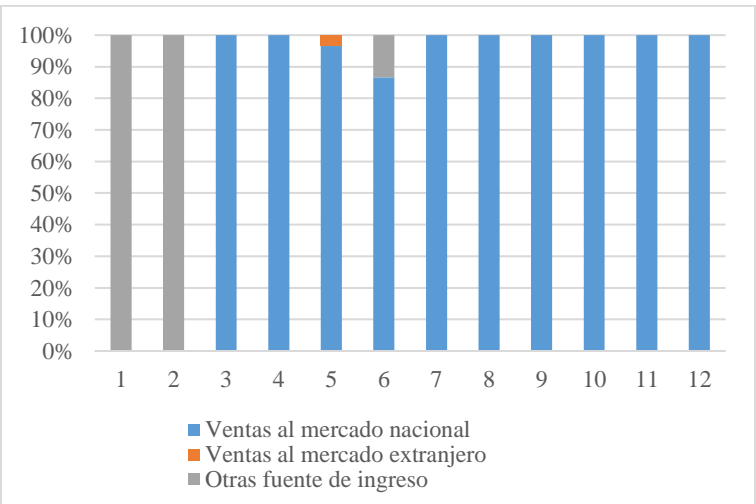


Figure 8. Small business income structure. Own elaboration with data from ENTIC, 2013

When classifying the companies in these 3 groups according to the size that, as we have previously mentioned, is a function of the total number of employed personnel, we analyze the availability of the media. We can see that the results are similar between medium and large companies.

Large companies, being hypothetically consolidated in the market, their technological equipment is also consolidated, a situation that it shares with medium-sized companies. In this way, the companies classified as large achieve 100% disposition on landline and email lines and only 31.25% of the total companies available on social networks, a percentage below the medians that report 35.71% of the total companies.

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On the other hand, we have a considerable gap between small companies with these two groups (medium and large), although they share a low use of social networks and a high percentage on telephone lines. As the group of small companies represents 84.18% of the total population, according to the methodological document presented by INEGI for the ENTIC, 2013 represents a central issue for directing policies for the use of ICTs by the bodies of competent governments. The following graph details the use of the media by the companies of the classified groups:

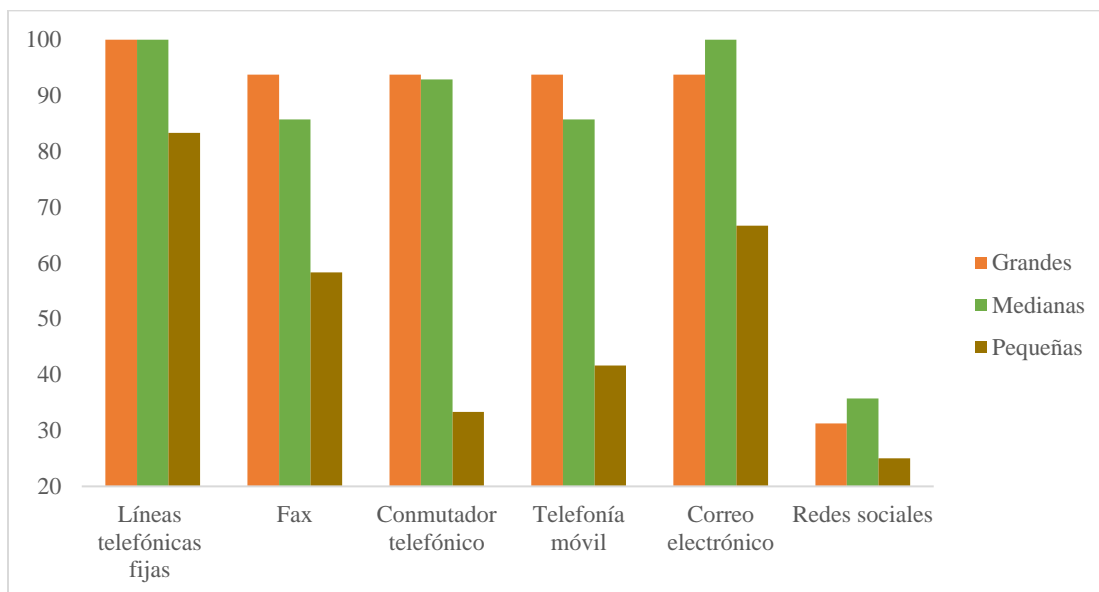


Figure 9. Disposition of the media by small, medium and large companies. Own elaboration with data from ENTIC, 2013

Differentiating the size of companies to carry out the analysis allows us to identify the technical and technological advantages of medium and large companies in terms of cutting edge and acquisition of computer equipment. In terms of equipment per worker, medium-sized companies have a .38 computer equipment greater than the overall average (.35), large companies are on the average, and small companies, as would be expected, are below the average. half.

The high percentage of obsolescence of the computer equipment of small companies is evident, which results in a disadvantage when competing with medium and large companies. Because of this, small businesses have a market to gain, and equipping themselves can be a powerful measure to achieve this goal. We see this information summarized in the following table:

Table 7. *Obsolescence and equipment per capita of companies according to their size.*

Age of the computer equipment%

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Company type	Computer equipment per capita	Under 1 year	1 to 2 years	Over 2 years
Big	0.35	29.33	23.07	47.60
Median	0.38	13	24	63
Little	0.31	6.5	4.3	89.2

Source: self made

Regarding the use of ICTs to create competitive advantages within the market, we found a more or less uniform behavior among the groups of companies. On the one hand, 50% of small companies saw their sales favored with the use of the internet and 60% of these same companies increased their customer base, which speaks of an important use of the internet.

In the case of medium-sized companies, these saw their administrative process and activities times reduced with the significant use of the internet with 64.29% of the companies that declare to use these ICTs for their operations. With this indicator we can speak at first that medium-sized companies are more productive with respect to small and large companies.

The results of large companies are mainly due to the turn of their activities, highlighting manufacturing as predominant, in medium-sized manufacturing and services, and small companies in services. This can be seen in the following graph:

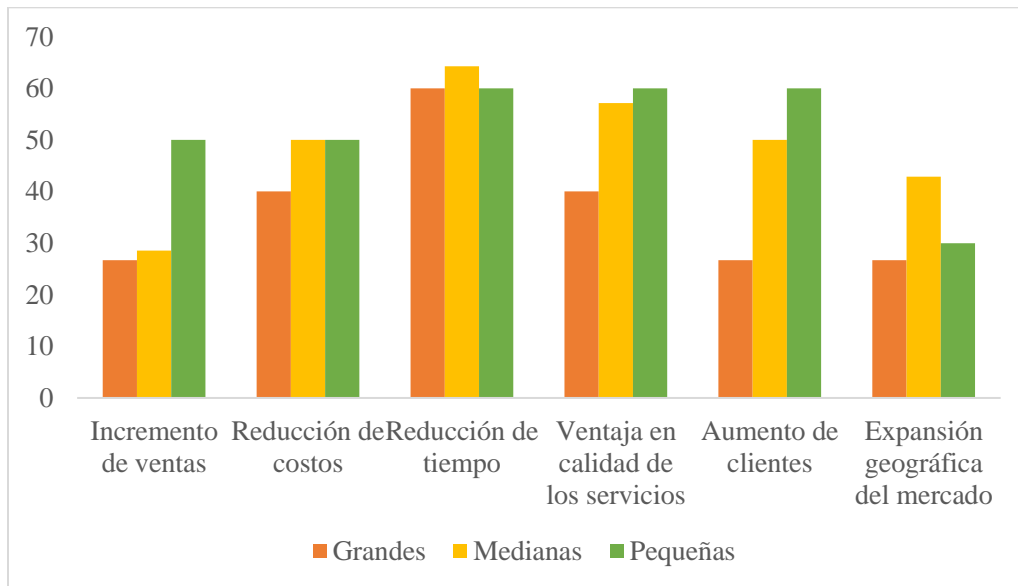


Figure 10.Competitive advantages of the internet for small, medium and large companies. Own elaboration with data from ENTIC, 2013

The advantages provided by having an official website for each of the companies would represent an image positioning. The results presented for the companies' web pages

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highlight the low use by small companies, having the greatest impact for medium-sized companies, which means a more effective use to increase sales, offer quality services and a geographic expansion of the market.

Large companies are again below the effects that medium-sized companies could have, with web pages being a website where characteristics are reflected and, due to the magnitude of these companies, we would expect these results. This can be seen below:

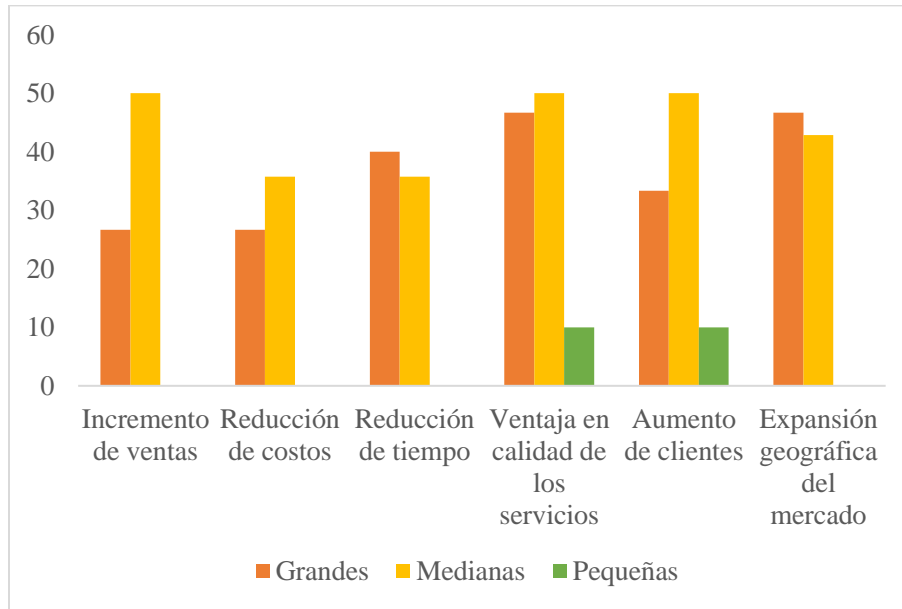


Figure 11. Competitive advantages of web pages for small, medium and large companies. Own elaboration with data from ENTIC, 2013

The electronic mail constitutes one more tool of the TIC's for the accomplishment of the activities of the companies and in view of its impact in promoting the competences we warn its prevalence for the medium companies in the points on the increase of sales, reduction of costs , improvements in the quality of its products as well as increases in the customer base.

For medium-sized companies it is a tool for brand expansion and positioning. The benefits that the medinas companies declare in the ENTIC, 2013 for having emails with considerable percentages in these items show the importance of the adoption of this ICT.

On this point, large companies were favored by the use of mail in a slightly greater reduction in time than medium-sized companies, with 73.33% over 71.43%, while 40% of these same companies saw their market expand geographically. In relation to small companies, the percentages regarding the impact of the use of email do not mark a significantly beneficial trend, as shown below:

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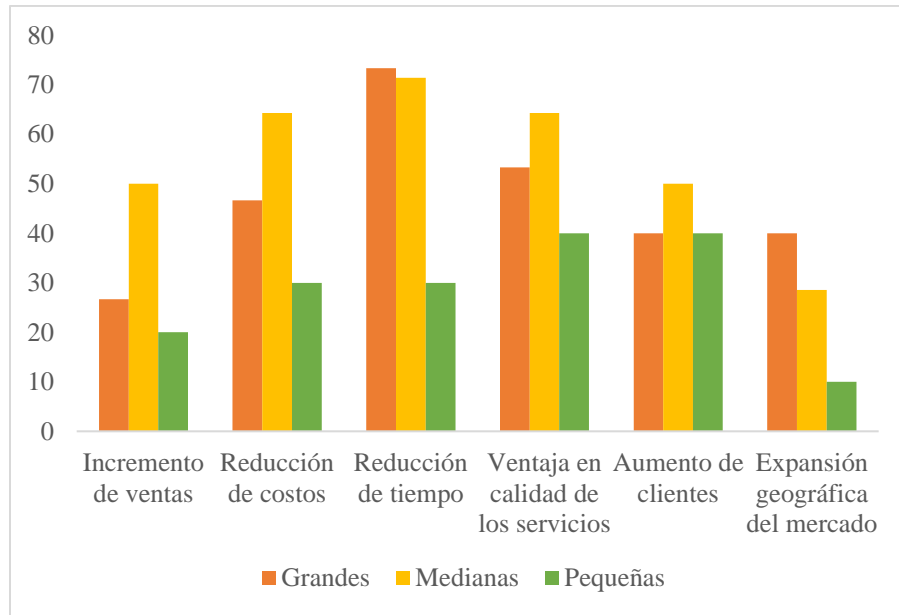


Figure 12. Competitive advantages of email for small, medium and large companies. Own elaboration with data from ENTIC, 2013

Finally, we have social networks as an ICT in which most companies have little significant impact, as we have seen together, and we strengthen this thesis based on size. There seems to be a complementarity between large and small companies on the benefits of this ICT.

The little exploitation of ICTs by companies limits them to take advantage of benefits that would allow them to increase their sales through the positioning of their product, increase their customers since through these networks it is possible to publicize and achieve greater expansion of its national market and on a smaller state or regional scale.

Summing up, small companies are those who obtain advantages over social networks to increase their sales and increase the number of customers, although this tool is not the most notable in the analysis, we can review this behavior in the following graph.

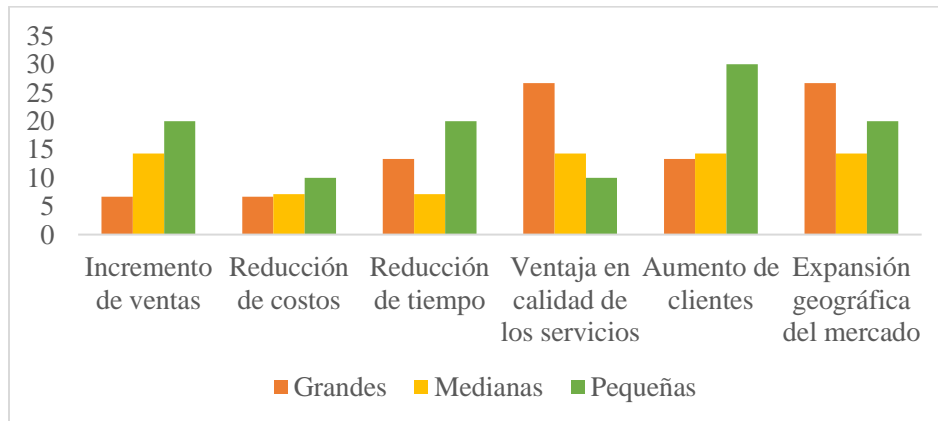


Figure 13. Competitive advantages of social networks for small, medium and large companies. Own elaboration with data from ENTIC, 2013

In this general outline, we can identify that the use of ICTs to create competitive advantages, depending on the size of the companies, the medium-sized companies are those that are most favored, followed by small companies and finally by large companies. What can tell us about the low level of updating and investment that large companies have to function through the use of ICTs.

Efforts to adopt ICTs must be and are, as this detailed analysis shows, by small and medium-sized companies, since they are the entities that are obliged to invest in order to grow. In the case of large companies, the effort turns out to be less since they have reached a degree of maturity and consolidation within their market, they already have a portfolio of clients and their market is made up of the national and foreign markets.

The undoubted importance of technical and technological equipment for the provision and use of ICTs by companies in any of their dimensions accompanied by users of these technologies: human capital converges on higher or lower income for companies.

For the analysis we take the total income of companies, previously presented and made up of sales to the national market, sales abroad and other types of income as an indicator of productivity that depends on the level of equipment in ICTs, in this case it is the investment in computer equipment and the work factor as the total number of personnel employed.

The model for approaching the productivity of the company would be represented by the following expression:

Average productivity model

$$\ln P_{MEi} = \alpha + \beta \ln I_{TICi} + \gamma \ln I_{NOTICi} + \delta Tam + \varepsilon_i$$

Where:

$\alpha = \text{intercepto}$

$\ln P_{MEi} = \ln \text{Productividad media por trabajador de la empresa } i$

$\beta I_{TICi} = \ln \text{Inversión en TIC por trabajador de la empresa } i$

$\gamma \ln I_{NOTICi} = \ln \text{Inversión en equipo NOTIC por trabajador de la empresa } i$

$\delta Tam = \text{Dummy del tamaño de la empresa}$

$\varepsilon_i = \text{error aleatorio}$

Certain characteristics that companies acquire according to capital, personnel, type of activities they carry out, size, administrative and production processes, among others, make them adopt work mechanisms, decision-making on the distribution of functions, tools to use. Thus, in the search for increasing returns, it is equipped with technical and

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technological tools with which to minimize process times and generally optimize the company's human and material resources.

Through the general linear double logarithm model to determine the average productivity of workers through elasticities that show the increases of increasing 1% more ICT or non-ICT equipment. The results of the model by stratum show a significance of 24.53% (R).

The constants by strata, 6.58 for large, 5.83 for medium and 5.25 for small companies shows the level of equipment that each group has. These results are to be expected since large companies, due to their dimensions, would have to have a higher fixed capital than medium and small companies.

In the coefficients of the general model, we identify that increasing the investment in ICT by computer equipment by 1%, the average productivity per worker increases by 0.18%, while doing it in non-ICT investments (investment in furniture and equipment) the Average worker productivity grows by 0.25%. These differences in significant degree correspond to a low intensive use of ICTs by small Mexican companies, which as we have indicated before represent 84.18% of the total population of the ENTIC, 2013.

By company strata, we observe that for large companies the average productivity is 0.64% higher than the average productivity of small and medium-sized companies. Being a statistical linear regression model, we reference the characteristics of the data to validate the assumptions, so we find that the data come from a normal distribution.

General Regression Analysis: LN de la pro versus LN I TIC x t, LN I en Mob , ..

Regression Equation

NVO ESTRATO	LN de la productividad media	=	6.58481 + 0.183428 LN I TIC x trabajador + 0.259564 LN I en Mob y Equipo x trabajad
1	LN de la productividad media	=	6.58481 + 0.183428 LN I TIC x trabajador + 0.259564 LN I en Mob y Equipo x trabajad
2	LN de la productividad media	=	5.83628 + 0.183428 LN I TIC x trabajador + 0.259564 LN I en Mob y Equipo x trabajad
3	LN de la productividad media	=	5.25229 + 0.183428 LN I TIC x trabajador + 0.259564 LN I en Mob y Equipo x trabajad

Coefficients

Term	Coef	SE Coef	T	P
Constant	5.89113	0.286289	20.5776	0.000
LN I TIC x trabajador	0.18343	0.298885	0.6137	0.543
LN I en Mob y Equipo x trabajad	0.25956	0.120802	2.1487	0.038
NVO ESTRATO				
1	0.69368	0.374024	1.8546	0.072
2	-0.05485	0.358887	-0.1528	0.879

Summary of Model

S = 1.57328 R-Sq = 24.53% R-Sq(adj) = 16.37%
 PRESS = 114.072 R-Sq(pred) = 6.00%

Figure 14. Results of the linear regression of the Average Productivity model

Production model

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Starting from the production function mostly used and exposed by Cobb and Douglas in 1948, we determined the relationship between product with labor and capital in which technology is kept constant. (Sánchez, 2016), in this way we will have:

$$Q = AL^{\alpha}K^{\beta}$$

Where:

$Q = \text{Producto}$

$L = \text{trabajo (Personal Ocupado)}$

$K = \text{Stock de Capital}$

$\alpha = \text{Participación del trabajo en la generación del valor agregado o producto}$

$\beta = \text{Participación del capital en la generación del valor agregado o producto}$

$A = \text{Factor de escala o parámetro de eficiencia, que refleja el nivel de tecnología}$

Finally introducing the double logarithm we will have:

$$\ln IN_i = \ln A_i + \alpha \ln L_i + \beta \ln K_i$$

Under this model scheme we will obtain the elasticities of the product of labor and capital. In this sense we take Q as the total income of the company, A referring to a scale factor or parameter of technological efficiency and supported by regression analysis where we calculate average productivity, where large companies are intensive in the use of ICT's, medium-sized companies to a lesser degree and finally small ones such as those that make the best use of ICT, we will use this same classification or parameters, where 1 are those that use the highest technology, 2 those that use medium technology and 3 those that use they use less technology.

For L we will take the total personnel employed and for K that represents the capital stock, we take the total variable of investment in fixed assets 2012 In the first stage where we calculate the relationships that have the product taken as the income of the sample companies with the explanatory variables, in this case of total personnel, the capital stock and the level of technology, where stratum 1 is intensive companies, 2 companies with medium intensity and 3 those that use technology the least, we have as a result This model fits 76.9%.

By increasing 1% to employed personnel, the product increases by 1.10% as the most relevant variable, followed by capital stock which, when increased by the same percentage, increases 0.78%, in the case of the strata that represent the intensity of the Using technology as a parameter, when increasing one stratum to another it turns out to have a weight of 0.031%, remembering that this is a classification variable, the result then of moving from one stratum to another. In the following table, we can find the results of the regression, the normality graphs are presented to meet the assumptions of distribution of the sample data in annex number 2:

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Regression Analysis: LN Ing Tot versus LN Total perso, NVO ESTRATO, ...

The regression equation is

$$\text{LN Ing Tot} = 4.40 + 1.11 \text{ LN Total perso} + 0.03 \text{ NVO ESTRATO} + 0.787 \text{ LN Stock}$$

Predictor	Coef	SE Coef	T	P
Constant	4.401	1.920	2.29	0.028
LN Total perso	1.1058	0.2628	4.21	0.000
NVO ESTRATO	0.031	1.147	0.03	0.979
LN Stock	0.7871	0.3432	2.29	0.027

S = 1.55822 R-Sq = 76.9% R-Sq(adj) = 75.1%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	3	307.96	102.65	42.28	0.000
Residual Error	38	92.27	2.43		
Total	41	400.22			

Source	DF	Seq SS
LN Total perso	1	295.02
NVO ESTRATO	1	0.17
LN Stock	1	12.78

Figure 14. Results of the linear regression of the production model

Conclusions and recommendations

The delay that Mexican companies present in their technological equipment allows them to be placed at a disadvantage compared to multinational companies established in our country. The companies collected for this analysis locate most of their sales in the national market, making decision-making by senior managers to rethink investment efforts directed at Information and Communication Technologies of significant importance. .

These results are preliminary and represent an exercise, therefore it is recommended to carry out future studies in depth and with the entire sample. The efforts made by companies in their investments are based on the purchase of machinery and equipment (30%), followed by computer equipment and peripherals (26%), which means the use of ICTs.

The companies studied continue to use traditional means of communication such as landlines, fax and switch lines. On the other hand, by using email and the internet, companies favored the reduction of their costs, the increase in the quality of their services and increased their customer base.

In the results of the regression model in the coefficients, we identified that increasing the investment in ICT by 1% through computer equipment, the average productivity per worker increases by 0.18%, while doing so in non-ICT investments

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(investment in furniture and equipment) the average productivity of workers grows by 0.25%.

It should also be noted that by increasing the personnel employed by 1%, the product increases by 1.10% as the most relevant variable, followed by capital stock which, when increased by the same percentage, increases 0.78%, in the case of the strata that They represent the intensity of the use of technology as a parameter, when increasing one stratum to another it turns out to have a weight of 0.031%, remembering that this is a classification variable, the result then of moving from one stratum to another.

The positioning of companies in the Mexican market does not turn out to be simultaneous, but rather poses a series of actions that guide companies in growth and permanence, within the actions carried out by these companies as a result of conducting this research is a low investment with less than \$ 999.00.

The companies under study, mostly with national capital (78%), have to increase the training of their personnel to use ICTs, programs such as PROSOFT 3.0 created to promote innovations and for the adoption and development of New ICTs should be used as 93% of companies do not receive support of this type.

Another point worth noting is the necessary updating of the computer equipment used by companies, since 63.67% of companies have equipment over two years old and taking into account the depreciation per year (30%) is relevant to take action for replacement.

When medium and large companies have consolidated their market, their efforts do not have to be comparable to those of small companies, so it is necessary to formulate strategies through tax subsidies, strengthening government programs in favor of small companies. so that this gap is shortened. This obsolescence in small companies represents a significant obstacle since they have a market to win.

It is important to mention that the low equipment in computer equipment (.35 per capita of the total of companies) responds to a circumstance of disadvantage, the occupied personnel is limited to the development of their activities through these technologies that would allow them to limit their efforts. and minimize time and costs.

Finally, electronic commerce must be promoted among companies, since through this path the future of a new virtual generation and friendly to the environment is marked, which would allow the reduction of costs and satisfying human needs simultaneously.

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