INFORMATION TECHNOLOGY AND COMMUNICATIONS INVESTMENTS AND ITS IMPACT ON COMPETITIVENESS[1]

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ABSTRACT

With the main goal of keeping and improving competitiveness, the evolution and growing use of information and communication technology (ICT) have affected Organizations; with an impact on their strategic planning processes, their ICT investment decision making processes, as well as their organizational structure. The objective of this work is to develop an approach to the impact of ICT investments in Argentine organizations, based on a field study completed at the School of Economics Sciences of UBA. We will analyze ICT investment patterns and its impact in organization competitiveness in dimensions such as cost reductions, changes in business strategy or changes in organizational structure. Impact of social network usage in competitiveness will be a special focus of this work, analyzing behavioral changes based on size and capital composition of the enterprises.

KEY WORDS: ICT; Investment; Innovation; Competitiveness and Social Networks

INTRODUCTION

The use of information technology and communications (ICT) has increased greatly in the last decade, causing important changes at the level of individuals, organizations and governments. The globalized markets imposed constant changes imposed, companies are increasingly demanding in their demand for products and services with higher technological levels. Companies

[1] This paper arises from the research project ´The influence of information technology and communications (ICT) in business and the competitiveness of firms in Argentina´ developed by authors at the Faculty of Economics of University Buenos Aires.

see ICTs as vehicles necessary for their growth and transformation to improve its competitiveness, in a world where the life cycles of products and services are becoming shorter.

The ICT sector has been growth in a major way in recent decades and is leveraging its policies business to other sectors. According to a report developed by the National Observatory for Telecommunications and Information Systems - Spain (ONTSI) (2011), the total volume of world ICT market was 3,500 billion in 2010. The mentioned report also highlights, that regions with the largest growth in its ICT market (compared with 2009) are Africa / Middle East, with growth of 8.7%, and Latin America, with 8.2%. The firms have been affected by these technological advances in its strategic planning, in making investment decisions in technology and in their organizational structures, among others. All with the goal of maintaining and enhancing their competitiveness.

In our work we intend to present an empirical map of the firms in Argentina characterizing the status of ICT, their relationship with improvements in organizations, perception of the impact of these technologies on competitiveness, the spread and use of new applications and social networks, among others.

Some of the questions that we want to answer are related to:

1. ¿What is the impact of investments in ICT in the competitiveness of firms? Are there differences by type and / or size of business?
2. ¿Is there a prior impact assessment is expected to have investments in ICT projects or projects that use technologies?
3. ¿What is the impact of the use of social networks in business in general and sales in particular?
4. ¿Which are the drivers of investment in ICT?

The structure of the work consists of three sections:

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The 1st section refers to the conceptual framework where we reference mainly the meaning of competitiveness and the ways in which ICT investments can contribute to it.

The 2nd sections called development, describe the methodology used and the data characterization, and then get to the presentation and explanation of the results.

The last section contains the conclusions reached

DEVELOPMENT

Conceptual Framework

At the macroeconomic level, ICTs have generated significant development and improvement

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of the competitiveness of individual countries, both in terms of industries involving technology and its impact on sectors that are not directly related to ICTs contributions.

Advances in communications have allowed, in turn, increased outsourcing business to countries far from the central houses or customers (offshoring). This strategy has become very attractive in the search for cost reductions and gains remote efficiency alternative. The companies are focused increasingly on its core business and seek suppliers or strategic alliances that allow them to be efficient in other activities in the value chain.

The widespread dissemination and availability of information and knowledge have helped shorten the life cycles of the products. In globalized markets there is a constant need to reduce costs and to be innovative to have new products in order to earn additional income and maintain them.

With respect to the term competitiveness, the dictionary of the Royal Spanish Academy defines it as: ´ability to compete; rivalry to achieve an end´ View from a business point of view, we can define it as the ability of an organization to sustain comparative advantages that enable it to achieve, maintain and potentially improve a specific position in its environment.

Sometimes it used the term competitiveness as synonymous with efficiency; but efficiency is the first step to achieving competitiveness; without efficiency it never reaches competitiveness; for example, if we are not efficient allocation of resources, we can not be competitive in costs; needless to say, the efficiency is necessary but not enough to be competitive.

Michael Porter recognizes that competitive costs are part of the equation: "...companies should have a competitive advantage, whether in the form of lower costs or differentiated products that are listed at very good prices" (Porter, M., 1990, p. 10).

Overall improvements in competitiveness in firms can be summarized as productivity improvements or enhancements differentiating character.

Tricoci (2011) mentions that "productivity gains, unless they are guarded by new techniques or secret recipes can be quickly matched by competitors or new entrants to the industry. First diluted by struggle among bidders players, in the medium term are transferred from the producer surplus to consumer surplus" (Tricoci, G., 2011, p. 77). Sustainable differences are found in additional elements to technology.

At present, the aim of reducing costs is constantly present and is part of the culture of many of the companies, with innovation, differentiation, the great challenge today.

The perception on the impact of ICT on productivity it begins to perceive in the 80s, but does not compensate for productivity problems of labor coming from the previous decade.

In 1993 E. Brynjolfsson in Productivity Paradox puts on the table the discussion of complementary innovations that are necessary for a general purpose technology (TPGs) and ICTs

have real impact.

The TPGs require changes in working methods and structures of organizations to acquire real impact. The same occurred with the development of the steam engine and electrification, which took many years for their effects to be visible and widespread.

Later works like Jorgenson et al. (2011) point out that the companies that use ICTs are generally most productive.

This increase in productivity occurs not only at the industry level but also at the level of firms. E. Brynjolfsson and LMHitt (2003) found that firms using ICT has higher levels of productivity and grow more than its competitors[2].

Yoguel et al. (2004) analyzed the impact of ICT investments on productivity of organizations and potential benefit improvements in the field of manufacturing companies in Argentina. The aforementioned impact is associated with improvements in their operations and in their endogenous capabilities that can maximize the tools that ICTs provide. This work shows the differences between levels of diffusion of ICTs and endogenous capacities of firms to get the most out of technology.

Peirano and Suárez (2006) in their work focused on SMEs, argue that there is a change of the prevailing dogma that said ´investing in ICTs and generated benefits´ to a reality in which the complementary investments are as necessary as ICT, to make profits. ICTs are a necessary but not sufficient condition; we need other skills to explain the performance of firms in general, and especially those of small and medium enterprises.

For the manner in which ICTs affect competition between firms, Brynjolfsson and McAffee (2007) conclude that ICTs can deepen the differences between firms rather than reduce, and that the added value comes from the innovation process that ICT platforms can be distributed.

ICT is a general purpose technology (TPGs) and as such has many angles of impact. Wright (2000) TPGs defined that are profound ideas or techniques that have the potential to produce significant impacts on many sectors of the economy. Brynjolfsson and McAffee (2014) identify the impacts productivity enhancers and said the TPGs are very important economically because they can disrupt the normal course or speed of economic progress. They also mention that require significant changes in the organization for the purpose of fully capture the benefits they provide. That is why we must see not only the introduction of ICT, but also from other investments and / or additional innovative changes to reap its benefits.

The TPGs generate improvements in producer surplus. After some time and as extending its

[2] About 600 firms evaluated the impact on productivity was driven investments 5-7 years before the time to make the investments and organizational changes and business process. For every dollar invested in hardware must invest about $ 9 in coaching and training, software and changes in business processes.

incorporation by competitors, transferring those profits go into the pockets of consumers. What was at first an extraordinary income spent producer surplus to consumer surplus. Everyone took and included new technologies in their production functions. Hence the importance of being innovative in its use.

The emergence and spread of social networks in the last decade has changed the ways of communicating and sharing information and facts of our life. Facebook, for example, receives as many photos and videos on a weekly basis that the photos may reveal Kodak several years of its existence. Its use has been very relevant, causing social impacts not only in our daily lives but in the generation and maintenance of social events like youth rebellions in Arab countries, political campaigns, etc.

We must ask: ¿The widely among individuals has extends to firms?, ¿ What is the level of use at firms and their impact on business?

Finally, by way of reference, we cite below some comments on the situation of our country compared with other countries with regard to competitiveness and ICT[3].

The World Economic Forum produces, by the European Institute of Business Administration (INSEAD) based in France, two global indices to which we will refer. The first is the Networked Readiness Index (NRI)[4] in more than 140 countries worldwide. The other index is Global Competitiveness Index (GCI) Benchmarking which are tools that allow determining the strengths and weaknesses of ICT and competitiveness of nations and assessing their progress (they have almost 14 years since its first issue). The NRI shows the country in 100 place among 144 countries in its 2013-2014 version, this being similar to the previous version published (99 of 140) position. With regard to the competitiveness index GCI, our country is in the 100 place among 144 countries, and the 2012-2014 version was in place 94 144. Within this index is based on a subset Tecnologycal Readiness[5] Argentina taking place 88 of 144 in its latest version.

Methodology and Data

The exposed data collection work has been done through a survey made to managers who rank first or second level of the organizations involved. The points surveyed in the survey include positioning data signatures, details of decision-making investment in ICT, impact assessments of internal variables that affect technology decisions, decisions of the same nature in the economy generally and in industry they belong. In all cases, the ratings were qualitative aspects associated with a rating scale from one (1) and seven (7), where 1 refers to the lowest and 7 the highest or

3 These comments are only for reference and context.
4 Index preparedness be networked or internet interconnection world.
5 Technological Readiness: state of technological readiness.

ideal value.

The survey method was complemented, in parallel, with interviews with personalities from various sectors related to the topic, namely, academics, consultants in systems and processes, software providers and managers (CIOs) business systems. These exchanges were very useful, in the first step to formalize and build the content of the survey and in the final stage for the analysis and interpretation of results.

The working panel is composed of 240 cases of companies with their headquarters in the City of Buenos Aires and Greater Buenos Aires, interviewed between November 2012 and August 2013. The companies were classified by size, in microenterprises[6], with less than $5 million annual turnover; in small, with annual revenue between $5 million and $90 million pesos; medium, with annual revenues between $90 million and $360 million pesos; and large, with annual sales greater than $360 million pesos.

The distribution panel cases corresponds to 13% for large companies, 69% to small and medium firms and 18% for micro macro approaching the characterization of the economy, where the dominant type of companies are SMEs or micro enterprises, taking billing criterion based. It has a median number of staff to 75 people and an average annual turnover of $ 2.5 million (eliminating the subgroup of micro enterprises). With regard to the formation of capital: 23% have total capital or partly abroad[7], of which: 16% of firms are completely foreign and 7% are mixed. The remaining 77% are from national capitals. The distribution of the sample is similar to the thematic work such as in Yoguel et al (2004). For large companies, the percentage of firms in the sample is above the average of the economy (based on data from the Observatory of Employment and Business Dynamics, Ministry of Labor, Employment and Social Security (MTEySS) 2013) to the effect that the data are statistically representative.

Entering the specific aspects of the data, 66% of companies have in their structure with the specific function of systems and at least 60% of cases, it depends on the highest level of the organization.

Regarding staffing systems area, 46% is composed of 5 or less people, 14% between 5 and 50 people, or 4% more than 50 people and 36% function is covered by not own staff.

Obtained Results

A. The situation regarding the use of ICT.

In order to know the process of adoption of information technology with regard to connectivity and automaticity, the following areas were surveyed:

6 In different tables that show the results of this work we have added micro small businesses.
7 The companies were classified by type of capital in National, Mixed (National and foreign) and Foreign.

1. Usage penetration and Internet automatic means for making purchases and sales.
2. Presence in social networks and impact assessment on the results of the firms.

The results of dichotomous questions (´they are or not´) can be seen in Table No.1. The first column shows the results of the responses of the total sample, in the second column is shown and the answers combined with previous positive cases to the presence in social networks result.

Table N°1: ICT adoption process in terms of connectivity and automaticity

	Total Sample	Respondents who were in social networks
¿Do you have website?	90%	94%
¿Do you make purchases by electronic means (from B2B to a mail)?	83%	86%
¿Do you perform sales (total or partial) by electronic means?	40%	47%

Source: Own Elaboration. Prepared based on the information processed in surveys

There is significant use of internet technology and e-commerce. The percentage of electronic shopping is very much significant when compared with sales done through this way. The results of this use are increased in all cases when the answers are limited to the responding firms that have a presence in social networks.

Regarding the presence in social networks, only 50% of companies claim to have participation. This result, in principle intuitively considered, is lower than expected, shows that there is a process of adoption of new technologies, but in this case making a significant investment, that it becomes a barrier to entry required.

Table No. 2 shows the social networks used by the companies surveyed.

Table N°2: Use of social networking in companies

Social Network	Primary Use	Use in combination with other networks
Facebook	41%	92%
Youtube	1%	1%
Twitter	2%	2%
Otras	5%	5%

Source: Own Elaboration. Prepared based on the information processed in surveys

The average of the sample with respect to the assessment of the impact of social media on sales, gives a value of 2.92 points. This average rises to 3.94 points when we restrict the analysis

to those companies that have been measured revealed that the impact on their sales to be in social networks. Both values, are very similar to those obtained in Tricoci et al. (2013)[8].

B. Investments in ICT and its motivators

74% of firms made, investments in ICT in the year preceding the survey. Tables No. 3 and No. 4 show the distribution of firms that invested in ICT by size and type of capital.

Table N°3: Investments in ICT by company size

	Big	Median	Small
Firms that made investments in ICT last year by size	89%	72%	67%

Source: Own Elaboration. Prepared based on the information processed in surveys

Table N°4: Investments in ICT capital by composition

	Foreing	Mixta	National
Firms making investments in ICT last year by type of capital	93%	68%	70%

Source: Own Elaboration. Prepared based on the information processed in surveys

A greater tendency to investment in ICTs big companies and when is foreign capital can be observed. Small and locally-owned firms are found below average. Similar trends are at work Tricoci (2011)[9]. In firms that made investments only in 64% of cases respondents responsible for systems involved in decision-making of such investments. This data can see that although they have made investments in many cases we find an absence of professional decision-making procedures of investment in ICTs.

Tables No. 5 and No. 6 show the number of companies that made some level of quantification of ex ante for investment in ICT benefits.

The results show a marked tendency again when firms are larger and foreign capital.

[8] In the aforementioned study sample included only 100 signatures. The ratings were for the impact of social media on sales that yielded results 2.82 points on average and when the group was restricted to companies that had measured this impact the value rose to 3.81 points.

[9] This publication refers to a set of data published by the INDEC for the years 2004 to 2006, which included only manufacturing industries. In this case the number of companies investing in ICTs was just over 50% of the sample.

Table N°5: Quantification of benefits from investments in ICT by company size

	Big	Median	Small
Firms that made investments in ICT last year by size	66%	41%	24%

Source: Own Elaboration. Prepared based on the information processed in surveys

Table N°6: Quantification of benefits from investments in ICT by capital composition of the company

	Foreing	Mixed	National
Firms that performed quantification of benefits by type capital	74%	41%	30%

Source: Own Elaboration. Prepared based on the information processed in surveys

¿Which were the motivating investments in ICT?

Tables No. 7 and No. 8 show the results, on average, by company size and type of capital investment motivators ICT.

Table N°7: Motivating investment in ICT by company size

	Big	Median	Small
Changes in processes and working methods	68%	64%	73%
Changes in strategy	16%	21%	7%
Changes in the structure of the organization	16%	15%	20%

Source: Own Elaboration. Prepared based on the information processed in surveys

Table N°8: Motivators for investment in ICT by capital composition of the company

	Foreing	Mixed	National
Change in processes and working methods	67%	80%	68%
Changes in strategy	16%	10%	15%
Changes in the structure of the organization	17%	10%	17%

Source: Own Elaboration. Prepared based on the information processed in surveys

The most significant investment in ICT motivator has to do with changes in working processes or methods that are directly related to improving productivity[10] and the search for greater efficiency. The rest of the drivers (changes in structure and strategy), elected in a manner way, raise deeper reforms.

If we introduce the variable size of the firms and type of capital, the results are quite similar, but with some nuances. In small and medium enterprises, the relative weight of the structures and strategy changes are somewhat higher than in large ones.

The primacy of motivator: changes in processes and working methods are interesting because it raises the solution or improve basic issues: the processes. These improvements, in many cases, are consequences of the development or purchase of new software, which requires adjustments in processes and/or working methods. The software firms world class providing (Worldclass) have included in their products the idea of best practices and knowledge embedded in transmission systems. This results in standardized and replicable processes firm signature, provided that these software systems are implemented. These processes suggest, at first glance, that all firms from the same branch can incorporate the same practices.

The motivating factor less chosen, strategy changes, may be showing less Technology Association of possible deeper changes in business. One element that corroborates this statement has to do with the existence or not of a specific area of systems and with the active participation of that area, if any, in investment decisions in technology.

Moreover, this statement could be related to the degree of development of the company as a culture of information technology. According Tricoci (2011), culture in information technology an organization usually grows from an initial situation in which firms decide only record their daily operations, to a stage where systems to aid in decision making are valued and finally, to a higher level where systems are drivers of innovation. The first stage involves investments in ICT as a way to assess and reduce costs on firms and not as a potential profit generator for differentiation.

C. Assessment of the impact of ICTs on competitiveness

The assessment of the impact of ICT in enhancing the competitiveness of firms showed an average of 4.78 points. Taking into account that the maximum score is 7, the average of the sample meant that more than 60% chose the maximum value.

The average values are shown as a function of firm size and composition of capital in Tables

[10] In general terms you can qualify the competitive advantages of firms as productivity-oriented (costs) or towards innovation, ie new products (income). The former are more difficult to sustain over time and have the opportunity to be matched by the competition with ease, sweeping away the competitive advantages sought.

No. 9 and No. 10.

Table N°9: Rating of ICT in enhancing competitiveness by company size

	Big	Median	Small
Average	5.36	4.83	4.70

Source: Own Elaboration. Prepared based on the information processed in surveys

Table N°10: Rating of ICT in enhancing competitiveness by composition of capital of the company

	Foreing	Mixed	National
Average	5.06	5.39	4.73

Source: Own Elaboration. Prepared based on the information processed in surveys

The average rating decreases as well as the size of firms. Large firms are above the overall average, around 10%. Regarding the type of capital, foreign capitals are above average.

One wonders what happens to firms that have ex-ante quantified benefits make investments in ICT (firms seem to have a more professional management level). It is interesting that for them the average assessment of the impact of ICT in enhancing the competitiveness of 5.48 is nearly 12% above the overall average. This could indicate that a more professional management of investments in the issue raised the rating.

As previously stated, a way to gain competitive advantages is to differentiate from competitors', through innovation. This implies new products that can arise from research and development activities. When we look at the assessment of the impact on those firms that conducted research and development expenses in the average value it is 5.32 points (almost 11% higher than the overall average).

¿Have any influence the presence in social networks on the competitiveness? If we form a subset of firms that are connected to social networks valuation rises 5.24 points (almost 10% above the average).

¿What are the variables with which to measure the impact of ICTs on competitiveness?

In this case, respondents could select a single variable or more, indicating one as the first. Table No. 11 shows the results.

Table N°11: Most relevant factors to measure the impact of ICTs on competitiveness

	Unique Indicator	First with other indicators	Total
ROI	14%	16%	30%
Increase in turnover	15%	1%	16%
Lower costs	21%	11%	32%
Increased market share	8%	8%	16%
Others	6%		6%

Source: Own Elaboration. Prepared based on the information processed in surveys

The way that firms measure the impact of ICTs on competitiveness it shows great correlation with some portion of the investment motivators. Those related to cost reduction and return on investment show a preference for improving productivity, as a feature, which will be added to the aforementioned increase in sales and even increasing market share.

Again becomes more relevant the idea of productivity, cost efficiency and competence with respect to other factors associated with differentiation of products.

CONCLUSION

The use of technology applications available shows that almost all of the sample has website, with a slight positive bias to larger company, almost 80% use some means to make such purchases and sales by electronic means only takes about half of the sample. The presence in social networks only reach in less than half of the surveyed firms with low valuation and the impact of participation.

The results referring to investments in ICT related to the size of firms and type of capital, show large firms as the most prone to this type of investment, which appears to be consistent with the increased understanding of the benefits of using technology and economies of scale in the process. The same can be seen in foreign-owned firms, but in this case suggests that they respond to their parent conditions, which generally compete in challenging markets and where the relationship between ICT and competitiveness is more known and proven.

The results relating to the assessment of the impact of ICT in enhancing competitiveness can appreciate that valuation increases as the size of the firms is higher, the level of management is

more professionalized and firms show a trend innovation, measured in terms of conducting research and development expenses. Firms that are in social networks also have above-average rating, allowing infer that while the valuation of its presence on networks has no significant impact on sales, perceive this presence can be beneficial with respect to a broader concept as what is competitiveness.

Proponents of investments in ICT are mainly those related to improving productivity and efficiency, making it a distant place for those related to changes in business strategy.

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Please refer to articles in Spanish Bibliography References.

BIOGRAPHICAL ABSTRACT

Please refer to articles Spanish Biographical abstract.

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