

## **SOCIOECONOMIC DEVELOPMENT THROUGH ICT USE IN BRAZILIAN ENTERPRISES: AN ANALYSIS OF LABOR FORCE CONTRIBUTION**

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### **ABSTRACT**

This paper explores the relationship between Information and Communication Technologies (ICT) and socioeconomic development from a business management perspective. ICTs undoubtedly influence the development of countries, especially those known as developing countries. Enterprises could be one of the main drivers of this shift as they create employment and produce direct income, and can indirectly improve education and quality of life. Business activities, however, have been affected in recent years by the rise of ICTs, in particular the Internet, which enable not only new ways of communicating and interacting with the general public, but also of conducting business globally, from a new perspective and at previously unknown speeds. In this sense, this article seeks to analyze the experience of Brazilian enterprises in ICT usage to discuss their level of adoption and impact on the country's development. The study will focus on the presence of an IT department within these enterprises as a factor for facilitating the adoption and use of ICT.

The analysis relies on the dataset produced by the ICT Enterprise Survey, conducted annually since 2005 by the Brazilian Internet Steering Committee (CGI.br) through the Brazilian Network Information Center (NIC.br). This nationwide survey has more than forty indicators for investigating ICT usage and dissemination by formally established Brazilian enterprises with 10 employees or more. A factor analysis will be conducted from a selection of some variables related to Internet usage for the purpose of identifying factors regarding web presence, social network presence, e-commerce, basic activities, and infrastructure. Subsequently, a test of association will be made between these variables and the 'presence of an IT department' and 'hiring of IT experts' in order to investigate the impact of skilled labor on the level of ICT adoption. Should any dependence be identified among the variables, a logistic regression model will be used to estimate the relationship between the conditional variables.

Preliminary studies have shown that an IT department in enterprises can in some way affect technology infrastructure, but there is little relationship with activities carried out on the Internet. Due to the importance given to ICT and their contribution to the development and the role of enterprises to help achieve this goal, it is important to discuss the keys aspects and obstacles to ICT adoption which includes issues related to specialized labor and entrepreneurial initiatives.

**Key words:** ICT, specialized labor force, Internet usage, development, enterprises, innovation.

## INTRODUCTION

The aim of this study is to discuss the presence of qualified staff in Brazilian enterprises in order to investigate the contribution that this factor could make to the appropriation of technology.

The advent of new information and communications technologies (ICT) has led to changes in society and the economy of every country in the world. They were responsible for impressing a new perspective of space and time on an environment in which the impacts of the concomitant process of globalization had already affected social and cultural relationships and policies of government and society. Concepts such as the Information Society, Knowledge Economy, Digital Age, Creative Economy and others that are used to define the current global scenario, highlighted the importance of new technologies to the development of a society in which computerization has come to play a central role (Santinha et al, 2006).

In this new scenario, ICT have become necessary tools to enable the flow of data and information and interaction between people, enterprises and governments in real time and from any place to any other place and at a much lower cost. As it "not only affects every industry and every service, but also every function within these industries and services" (Freeman, 2009), they serve as vectors for the establishment of a new paradigm, transforming society and culture, the market and the generation of wealth.

According to Brynjolfsson et al (2014), the new unified global market that has flourished as a result of technological advances is not only reducing the cost of labor but is also creating a new asset of production: ideas. At different speeds, developed and developing countries are being threatened by the imbalance between demand for cheap and qualified labor that has arisen through access to technologies and the consequent process of automation in all sectors of the economy.

In the light of this scenario, this study proposes to analyze the experience of Brazilian enterprises with technologies to discuss the level of adoption and the impact on the development of the country. The internet, as a global infrastructure for creating value and knowledge, does not only change the role of man and his relationship with his institutions (Negroponte, 1995), but also changes the organizational structure of post-industrial societies. Due to its powerful reach, it is a tool that can support these technologies by improving the performance of enterprises that will in turn contribute to the economic and social development of the region in which they are located.

In this sense, the study seeks to analyze specifically how hiring specialists contributes to how enterprises use the internet. The most important question that the study seeks to answer is whether the presence of people who are skilled in the use of technologies can encourage more advanced use of the internet and whether this use makes a difference to the general performance of enterprises and, consequently, their economic performance.

The study is organized into several sections in addition to this introduction. The following section contains a review of the literature on new perspectives concerning development and its links to ICT and the importance of human capital in the use of ICT to organizational performance. The third section outlines the methodology of the study in question. This is followed by an analysis of the results, and the final conclusions bring the article to a close.

## **NEW INFORMATION AND COMMUNICATIONS TECHNOLOGIES AS PROPELLERS OF DEVELOPMENT**

Considering the range of approaches that exist today concerning the impacts of ICT on development, in the following paragraphs some of the perspectives found in the literature will be presented. First of all, an effort will be made to establish the relationship, within this context, between new technologies and economic growth propelled by the private sector and the importance of human capital in this relationship.

The growing use of ICT has contributed to a new phase of global economic development. ICT have enabled a capacity for innovation in the business world that was previously not possible and have led to competitiveness that spurs the demand for new qualifications and skills in organizations, especially concerning the use and deployment of available resources. It's not that development is conditioned only by new information and communication technologies, but these are instruments that can be used in its advantage. If it doesn't occur by generating economic growth, they can at least promote socio-economic changes in the way of improve living conditions (Avgerou, 1998).

The use of computers, for instance, can be associated with the growth in production and productivity in the long term (Brynjolfsson and Hitt, 2003). But even more important than this growth is the fact that computerization raises investments in complementary fields that aid growth through innovation and qualification of workers. According to Spitz (2006) the increasing presence and development of activities that make use of this tool lead to much more complex tasks being required in enterprises that were not required several years ago, when computers were used less.

With advancing technology, computerization in enterprises has ceased to be a simple mechanized process. As "computing technology increased in power and expanded its scope beyond back-office support to its current pervasive" (Bresnahan *et al*, 2002), the use of ICT has come to be based on the generation and processing of information. Therefore, in the Information Society, where the production model is mainly subsidized by knowledge, technologies can supplant human potential (Bell, 1977; Castells, 1999).

The internet as a global infrastructure of communication and interaction that is increasingly used for commercial purposes helps to boost this transformation. The literature on the impacts resulting from this technological advance on the market is extensive. Mark Weiser (1991), in his article *The Computer for the 21st Century*, surmised what would come to be the full-time availability of technological tools to be used in people's daily lives. What he called ubiquitous computing can be seen today in many resources that are interconnected in a worldwide exchange of data and information, providing increasingly advanced services and making the machine more and more interactive, "invisible" and "embodied virtuality", which can even increase human capacities.

Corr (1995) also discussed the consequences and contradictions of pervasive technologies in developed and developing countries. The Digital Age was established with the advent of these technologies and led to the almost constant need for access "to accurate and up-to-date information" that is essential "in competitive international markets". To this author, the main problem today between less industrialized countries is that they are "information poor" in an age when "information equates to power".

Innovations in business and management models are increasingly based on the use of this type of tool, whose reach not only affects the competitiveness of companies but also alters the quality of

the services that they offer and reconfigures the relationship between society and technology. Seeking to become part of this process is fundamental to all countries and markets owing to the "pivotal role of innovation in economic development" (OECD, 2012).

Nevertheless, the mere presence of technology does not guarantee that such changes will take place. For this to occur, it is necessary to discuss not only the impacts of ICT on business and market performance, but also the contribution that the labor force can bring to the implementation and use of these technologies by enterprises.

### **The impact of human capital on new information and communications technologies**

As noted above, economic growth can be achieved through investing in ICT, expanding markets and entering the global economy with a competitive advantage and attracting external investments, in addition to improving the quality of life of the population (OECD, 2005). The application and use of new ICT in business, in this sense, can enable an advance in social and economic development (Hamelink, 1997; Avgerou, 2003). This is the case principally in developing countries, where ICT can lead to economic progress, whereas "the lack of ICT is understood to be an important factor contributing to the widening of the gap between 'developed' and 'developing' countries" (Avgerou, 2003).

However, the benefits that come in the wake of new technologies do not depend only on investments in infrastructure to enable availability and access to the market. Indeed, there are a growing number of studies assuming that new technologies, the pervasive technologies, are immersed in society almost inseparable from it. For this reason, the successful use of these resources cannot be measured without taking social, cultural and political factors into account, which affect how a technology can be adopted and used. From this perspective, it is also important to discuss the role of human capital in achieving these goals. According to Ahmed (2011), this factor, when understood "as the skills and knowledge intensity of the labour force in an economy", can aid development from the positive effects that a trained and qualified labor force offers in many senses: from a business point of view in a more micro sense and, consequently, from the viewpoint of the national economy in a broader sense.

Brynjolfsson and Saunders (2013) also demonstrated in *Wired for Innovation* that the faster productivity seen in most of the world in recent years cannot be explained as solely resulting from investment in IT. Based on the sources-of-growth model, the authors claim that several factors related to productivity and labor come together, where quality and investment in work tools (such as ICT) are as valuable as education and skills, representing "the contribution of improvements in human capital to productivity" (p.46).

Human capital would thus play a major role for developing countries in terms of their insertion in the Digital Age. In this new kind of environment, the development of these countries could not be ensured through investments in high technology equipment and resources if there continues to exist "the painfully slow and largely ineffective assimilation of computer-based technology", which is in turn caused mainly by an "acute shortage of trained personnel" (Corr, 1995).

In this sense, as stated by Heeks (2010), "infrastructure and access are only the starting point for understanding the contribution of ICT to development". That is, in order to have a true contribution from these technologies, it is necessary that the availability of technology to become the

appropriation of technology. From this viewpoint, seeking to answer the query proposed in this paper, it is essential to have a discussion that goes beyond the use of ICT in enterprises. The problem is less whether the different actors of a country economy are using the resources available. The new information and communication technologies tend to be widespread very rapidly and globally, but its benefits will not be seen unless a parallel transformation on the social and cultural level occur. For this reason, it's also important to discuss the role of human skills within the context of the use of technologies in the workplace, which is the objective of this paper.

The next sections will address the methodology and the results of the study based on secondary data from the ICT Enterprises Survey aiming to collaborate with the debate on the necessary conditions for a positive contribution of ICT.

## **METHODOLOGY**

The study will analyze the data derived from a national research on the use of ICT in Brazilian enterprises (ICT Enterprises 2013) collected by the Regional Center for Studies for the Development of the Information Society (Cetic.br), a department of the Brazilian Network Information Center (NIC.br), which in turn is an executive branch of the Brazilian Internet Steering Committee (CGI.br), which is responsible for implementing its decisions and projects.

The Brazilian Internet Steering Committee is a multi-party agency with representatives from the academic and government sectors as well as representatives from the civil society, responsible for discussing and suggesting policies and initiatives for the development of the technological infrastructure in Brazil, especially the internet. To aid in these discussions, the Cetic.br undertakes the task of producing data and statistics capable of measuring and monitoring the advance in the infrastructure and use of ICT in different sectors of the country's economy.

The ICT Enterprises survey, in this sense, aims to measure the access and use of information and communication technologies in Brazilian companies with 10 employees or more, engendering indicators and statistics on the use and appropriation of information and communication technologies in the Brazilian private sector. This nationwide survey addresses seven different topics to investigate how and in what degree Brazilian enterprises have access and use the new technologies.

The surveys conducted by the Cetic.br are designed to maintain international comparability. For this reason, in the case of ICT Enterprises, it is used the methodological standards proposed in Unctad's (2009) manual, prepared in partnership with the Organization for Economic Cooperation and Development (OECD), the Statistical Office of the European Commission (Eurostat) and the Partnership on Measuring ICT for Development. This coalition, which is comprised of various international organizations, seeks to harmonize core indicators in ICT surveys.

The survey sample was selected from the Central Registry of Enterprises (Cadastro Central de Empresas – Cempre) of the Brazilian Institute of Geography and Statistics (IBGE)<sup>1</sup>, which aggregates

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<sup>1</sup> IBGE's Cempre provided consolidation and updating of enterprises and other formally established organization information, recorded in the National Registry of Legal Entities (CNPJ) of the Secretariat of Revenue and its respective local units that responded to the IBGE economic surveys and/or submitted the Rais declaration to the Ministry of Labor. The IBGE provides a yearly overview of the active formal organizations in the country, highlighting information on their legal status, employees and economic activities.

registry and economic information from the IBGE annual surveys and from the Ministry of Labor's Annual List on Social Information (*Relação Anual de Informações Sociais – Rais*) (CGI, 2013).

The Cempre 2010 database, the last registry released by the IBGE, is composed of approximately 5.1 million active enterprises and other formal organizations established in the country. The National Classification of Economic Activities (*Classificação Nacional das Atividades Econômicas – CNAE*) is a basic framework used to categorize registered Brazilian enterprises according to their economic activities and has been officially adopted by the National Statistics System and by the federal agencies that manage administrative registries. The classification of economic activities used in this survey is the CNAE version 2.0 which is derived from the International Standard Industrial Classification of All Economic Activities (ISIC 4.0), administered by the United Nations Statistics Division. The choice of CNAE sections as well as enterprises size followed the recommendations proposed by Unctad (2009).

The ISIC 4.0 does not distinguish types of ownership, legal nature, size of business, mode of operation or legality of activity. Its hierarchical structure has the following levels of detail: sections, divisions, groups, classes and sub-classes. For the ICT Enterprise Survey, the section level is used to classify enterprises.

The 2013 ICT Enterprise survey comprises all active Brazilian enterprises with 10 or more employees registered with the Cempre in 2010 and operating in the relevant ISIC 4.0 market segments to maintain international comparability (CGI.br, 2014. p. 419). The enterprises surveyed operate in the following segments:

- Manufacturing;
- Construction;
- Wholesale and retail trade; repair of motor vehicles and motorcycles;
- Transportation and storage;
- Accommodation and food service activities;
- Information and communication;
- Real estate activities;
- Professional, scientific and technical activities;
- Administrative and support service activities;
- Arts, entertainment and recreation;
- Other service activities.

The survey sample was designed using the stratified sampling technique, which aims to improve estimate precision, ensuring the inclusion of subpopulations of interest. The stratification occurred in two steps. The first step covered the definition of natural strata by correlating the variables: geographical region (Central-West, Northeast, North, Southeast and South) and the ISIC 4.0 activity segments (C, F, G, H, I, J, L+M+N, R+S). As a result, 40 nonzero natural strata were formed (Ibidem. p. 424).

From each natural stratum the final strata were defined, which considered the division of natural strata by enterprise size. The size ranges considered were 10 to 49 employees for small enterprises; 50 to 249 for medium enterprises; and 250 or more employees for large enterprises. Micro enterprises, those with 1 to 9 employees, are not included in the scope of the survey.

With the stratification variables defined, the strata ensured that all regions, markets and sizes were represented in the sample and permitted analyses for the areas defined by these three variables individually.

Each enterprise in the sample was allocated a basic sample weight obtained by dividing the population size by the sample size in the corresponding final stratum. These weights were adjusted to incorporate all the concurrent treatment corrections for the data collection situations identified in the sample control phase. All calculations necessary for estimating the totals of the variables of interest were produced independently within each final expansion stratum. The values obtained in each final expansion stratum were aggregated according to the area for which the estimate was intended.

The data were collected between September and December 2013. Computer Assisted Telephone Interviews (CATI) were conducted at each enterprise, where the person in charge of information technology, computer network management or similar areas was interviewed. In large enterprises (with 250 or more employees), a second respondent was interviewed, preferably the accounting or finance manager. If one of these professionals was not available, the next option was the person in charge of administrative, legal or government relations, who responded only to questions about e-commerce, e-government and activities carried out on the Internet.

For this study, a factor analysis and logistic regression were used on the data of the ICT Enterprises study. Initially, the variables 'presence of an IT department' and 'hiring of IT experts' were selected. The variables that represented internet use were: proportion of enterprises that have used the internet by type of activity in the last 12 months, proportion of enterprises with websites, proportion of enterprises with websites by resources offered in the last 12 months, proportion of enterprises with their own social networking accounts or profiles, proportion of enterprises with their own social networking accounts or profiles by type of social networking activity in the last 12 months, proportion of enterprises that have used e-government services in the last 12 months (interactions), proportion of enterprises that have used e-government services in the last 12 months (information searches), proportion of enterprises that have made sales on the internet in the last 12 months.

A factor analysis was conducted to identify possible patterns and reductions of some variables in the study. This was followed by logistic regression analyses to determine how much each variable contributed to the presence of a specialized labor force in the enterprises and how much the presence of an IT department and hiring of IT specialists contributed to a variable.

## **RESULTS**

The study investigates the relationship between specialists working in Brazilian enterprises and internet use. Specialist labor is defined in this study as the presence of an IT department and the hiring of IT experts. These are two of the indicators in the ICT Enterprises study. Regarding internet use, the following variables were selected:

Table 1: Indicators and variables used from ICT Enterprises survey

Indicator	Variables
B5- Proportion of enterprises that have used the Internet by type of activity in the last 12 month	Sending and receiving emails
	Searching for information on products or services
	Making bank payments and check
	Market monitoring
	Carry out other types of financial transactions via the Internet
	Searching for information on governmental organizations or public authorities
	Using instant messaging
	Interacting with governmental organizations or public authorities, making online payments and solicitations
	Offering customers buying services such as product price lists via email and sales support
	Recruiting internal or external staff
	Delivering products in digital format via the Internet
	Training staff
B6- Proportion of enterprises with website	
B7- Proportion of enterprises with website by resources offered in the last 12 month	Institutional information (contact, address, maps)
	Product catalogues
	Post-sale support /Client Support
	Product personalization or customization for customers
	Price lists
	Ordering or reservations system (shopping cart)
B13- Proportion of enterprises with their own social networking accounts or profile	
B14- Proportion of enterprises with their own social networking accounts or profile by type of social networking activity in the last 12 month	Posted news about the enterprise or topics related to its area of operations
	Promoted products or services
	Answered customer comments and doubts
	Posted institutional content about the enterprise
	Launched products or services
	Offered product or services promotions
	Sold products or services
C2- Proportion of enterprises that have used e-government services in the last 12 month - interactions	
C2- Proportion of enterprises that have used e-government services in the last 12 month - interactions, by type of services	Paying taxes, fees etc. online
	Enrolling enterprise in e-tendering / e-trading
	Acquiring goods or services from government bodies (bidding)
	Other type of government transaction
C3- Proportion of enterprises that have used e-government services in the last 12 month - information searches	
C3- Proportion of enterprises that have used e-government services in the last 12 month -	Checking the State Registry database
	Searching for information on taxes
	Checking the enterprise's PIS /PASEP and the Labor fund for time of

Indicator	Variables
information searches, by type of services	employment
	Checking fiscal status and active debt
	Searching for information or obtaining licenses and permits
	Checking the National Social Information Registry (CNIS)
	Checking the Annual List on Social Information (Rais)
	Searching for information on loans for micro and small enterprises
	Checking information on e-tendering
	Searching for information on imports and exports
	Other type of search for government services
E2- Proportion of enterprises that have sold on the Internet in the last 12 month	

The factor analysis that was conducted did not suggest a reduction in the variables and for this reason no dimension was created. The adjusted models for the study were therefore constructed based on previously determined indicators and will be examined by considering the indicators of the IT department and the hiring of IT experts separately.

### Presence of an IT Department

The adjusted model for the type of activity that the enterprise conducted in the last 12 months, in accordance with the activities, had a global adjustment of 71% on all the variables. The logistic regression, conducted in eight steps, showed the following variables at the end of the model:

Table 2: Logistic Regression

Results	Variables
<b>No statistical significance to explain the presence of an IT department</b>	Sending and receiving emails
	Searching for information on products or services
	Market monitoring
	Using instant messaging
	Offering customers buying services such as product price lists via email and sales support
	Social network activity: posting news about the company or items related to the company field
	Social network activity: divulging products and services
	Social network activity: answering customers' questions and clearing up doubts
	Social network activity: posting institutional content about the company
	Social network activity: launching products or services
	Social network activity: promotion of products or services
	Social network activity: selling products or services
	Social network activity: after sales service or customer services
<b>Statistical significance for the presence of an IT department</b>	Making bank payments and check
	Other types of financial transactions online
	Seeking information about government organizations or public authorities
	Interacting with governmental organizations or public authorities,

Results	Variables
	making online payments and solicitations
	Recruiting internal or external staff
	Delivering products in digital format via the Internet
	Training staff
	VoIP calls/ videoconference via Internet

In contrast, after we identified the activities that made the greatest statistical contribution to the existence of an IT department, we found the contrary. When considering to what extent an IT department contributes to these activities being conducted, the following results were obtained, with an 86% adjustment:

*Table 3: Variables contribution with an IT department*

Variables	Contributions to IT
<b>Internet activities</b>	
Searching for information on products or services	41%
Market monitoring	63%
Carry out other types of financial transactions via the Internet	78%
Searching for information on governmental organizations or public authorities	90%
<b>Internet Presence</b>	
Own Web site	50%
Post-sale support /Client Support	47%
Product personalization or customization for customers	22%
Own profile or account on online social network	54%

The presence of an IT department makes it six times more likely that payments will be made and bank statements will be obtained via the internet.

In terms of recruitment and training, the fact that an enterprise has an IT department doubles its chance of hiring internal and external staff using the internet. It also triples the possibility of providing training to staff.

Unlike some of the resources offered on a company website, what the company does with its profiles on social networks was not statistically significant when it came to explaining the presence of an IT department.

Another indicator that was statistically significant in explaining the presence of an IT department was online sales. When determining the influence of the presence of an IT department at the company on this activity, a percentage of 28% was observed, one of the lowest among those related to the IT department.

### **Hiring Specialists**

The same analysis was conducted separately for the hiring of IT specialists. When companies attempted to and succeeded in hiring specialists, the following contributions to activities that were shown to be statistically significant to the existence of an IT department were observed:

*Table 4: Variables contribution with IT specialist hiring*

Variables	Contributions to IT
<b>Internet activities</b>	
Recruiting internal or external staff	81%
Market monitoring	61%
Carry out other types of financial transactions via the Internet	61%
Searching for information on governmental organizations or public authorities	78%
<b>Internet Presence</b>	
Own Web site	50%
Post-sale support /Client Support	30%
Product personalization or customization for customers	42%

Concerning presence on the internet via social networks, the same behavior shown in relation to the presence of an IT department was observed. Whereas the hiring of specialists has a positive influence on the existence of enterprises with their own profile or account on an online social network, no statistical significance was identified for the model with variables related to activities conducted through these channels.

On the other hand, online sales were more sensitive to the presence of IT specialists than they were to an IT department. Hiring specialists increased by 74% the chances of a company selling goods and services online.

## CONCLUSION

The present study analyzed the relationship between the presence of qualified specialists and the use of the internet in Brazilian enterprises with over 10 employees, i.e., small, middle size and large companies. The initial idea that motivated the study was to examine to what extent specialist personnel, as one of its fundamental features, contributes to a more intense and advanced use of new technologies. In light of studies that highlight the importance of ICT to social and economic development, the study set out to examine the human factor in this equation.

The results did not establish a direct relationship between the presence of specialists in enterprises and the more advanced use of new technologies, especially internet resources. In spite of this, hiring specialists increases the chances of this being done. In most cases, the contribution is over 50%, which indicates a significant relationship. Furthermore, the activities in question require a certain degree of complexity due to their interactive nature and strategic potential. Therefore, it could be suggested that hiring specialists is important for the performance of the enterprise in terms of ICT.

In any case, the study reveals that there remains a considerable gap concerning the role of the labor force in the use of ICT. Many contemporary studies have shed light on the issue of ICT and their contribution to economic and social development, especially in developing countries. In this context, the private sector also plays a crucial role. Therefore, it is essential to this field to conduct more studies regarding the role of human capital and the relationship with ICT, specially in enterprises, in order to promote development.

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