Chapter 8 / Capítulo 8

The Role of ICT in Strengthening the University-Company-State Triad in Colombia

Las TIC en el fortalecimiento de la tríada Universidad-Empresa-Estado en Colombia

Adriana Patricia Cújar Gómez

Abstract

This chapter contains a review of the literature surrounding the principal research studies and considerations of Information and Communications Technology (ICT) in the contexts of education, the company, and the State. It examines their relationship and their importance in contributing to improved competitiveness which, ultimately, is a decisive factor for the country's development in the now globalized world economy.

ICT and its indicators are analyzed in productive sectors such as industry, trade, services, and micro-establishments, looking at how they relate to the country's degree of development. Most authors cited here indicate that ICT has been a catalyst for globalization and the much-talked-about information age, thus becoming an instrument that can strengthen the University-Company-State triad. This, in turn, boosts the country's economic and social development by raising indicators of competitiveness and productivity, enabling it to survive in a new competitive and globalized setting where technology and innovation are determining factors.

Keywords: education, the State, ICT, university.

Resumen

El objeto de este capítulo es presentar una revisión de literatura alrededor de las principales investigaciones y consideraciones que pretenden ubicar las TIC en el contexto de la educación, la empresa y el Estado; cómo se relacionan y la importancia de ellas para la contribución al mejoramiento de la competitividad que, en últimas, es el factor decisivo para el desarrollo del país en la actual globalización de la economía mundial.

Por otra parte, se analizan las TIC y sus indicadores en sectores productivos como la industria, el comercio, los servicios, los microestablecimientos, relacionándolos con el grado de desarrollo del país. Además, muestra que la mayoría de los autores mencionados señalan que las Tecnologías de la Información y la Comunicación (TIC) han sido las gestoras para la globalización y la famosa era de la información, haciendo que ellas se conviertan en los instrumentos que permiten el fortalecimiento de la tríada Universidad-Empresa-Estado, el cual, a su vez, contribuye en el desarrollo económico y social de la Nación al incrementar los índices de competitividad y productividad, para sobrevivir en este nuevo escenario competido y globalizado, en el cual la tecnología y la innovación son factores determinantes.

Palabras clave: educación, Estado, TIC, universidad.

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Introduction

It is important to consider the use of Information and Communications Technology (ICT) in society today, as it is undergoing changes brought about by a globalized world.

The university acts as the linchpin for guaranteeing the country's competitiveness in processes that revolve around new ICT (Espinoza, González, & Loyola, 2011). This, in turn, allows improvement in education, the economy, health, culture, and especially in the organizational context, in which the effects are obvious. Consequently, companies should analyze their business processes and integrate ICT to optimize them to increase productivity, as they are able to produce more and better products in less time (competitiveness). It is here that the university should focus its efforts in order to contribute to development in the country's productive sectors.

Various documents, research studies, and considerations were used as a starting point for the analysis. These deal with ICT in the context of education, the company, and the State; the way they relate to each other; and their importance in contributing to improved competitiveness, a decisive factor for the country's development in the now globalized world economy.

ICT is defined first, and then the University-Company-State triad is established along with the way in which value is added to every productive process in the country to build the social capital essential for national development.

Information and Communications Technology (ICT)

To better understand this subject, it is useful to start with a definition of information and communications technology. According to Aragón (2008), it is "the convergent set of innovations based on microelectronics, information technology (software and hardware), and telecommunications, whose purpose is to improve mechanisms of storing, retrieving, transmitting, and handling information" (p. 42).

Likewise, its indicators are associated with the development of a region or, more specifically, a country, since it is combined with research and development, vital elements for building a nation in its fields of power (economic, political, and social) (Aragón, 2008).

ICT has been evolving rapidly due to the commitment between the State and private businesspeople who have dedicated themselves to science- and technology-based innovation. The speed of change makes it hard to predict how ICT will evolve in the medium term (Aragón, 2008).

Nevertheless, discoveries and innovations have tended towards miniaturization, the convergence of ICT and the media, and the creation of systems that can learn and evolve, along with the connection between ICT and other fields of science and technology (Aragón, 2008).

In this context, certain tendencies can be seen, including mastering complexity and scalability in three dimensions: very small, very large, and the sophistication of advanced cognitive systems. A second trend is related to enriching research with other fields of science and technology, especially nanotechnology, metamaterials, biosensors, and neuroscience. A third relates to creating intelligent environments, and the last of these trends looks at promoting innovations in the use of ICT in the different settings where it is applied, such as education, organizations, and companies, among others (Villegas, 2002).

In summary, ICT is currently at the heart of technological innovation processes. Its central role is linked with the ability of its effects to pervade the set of activities that make up the production of goods and services, as well as the growing spheres of social life (social networks) (Villegas, 2002).

In the view of Vargas (2004), ICT has been one of the major catalysts of the globalization process that the world is currently experiencing, to the point where it can now be considered a global village.

Accordingly, and following on from the ideas of Jouet and Coudray (1993), the development of ICT has brought about the creation of a new economic sector that did not exist 20 years ago; now, however, it is a major generator of employment and continues evolving towards new economic blocs. These authors analyze ICT and its indicators in productive sectors such as industry, trade, services, and micro-establishments, linking them with a country's degree of development. Colombia's National Administrative Department of Statistics (DANE) was then able to draw its inferences in its studies and indicators on ICT in the home, the State, and the education sector (DANE, 2005).

In this regard, D'Adamo (2007) states that in the existing relationship between economic growth—expressed through Gross Domestic Product (GDP)—and employment generation, demand is not considered the best indicator of economic growth and the well-being of society. Other indicators should therefore be taken into account such as the improvement of human capital and the environment. Accordingly, ICT indicators have been created that emphasize improvement to human capital and thus quality of life.

D'Adamo (2007) also mentions that economic models in terms of the labor market are measured with indicators that refer to job creation, the rate of employment, and the rate of unemployment.

In analyzing the ICT sector and the job market, however, attention cannot be focused solely on the creation of jobs in the ICT services sector—which consists of internet, mobile phone services, telecommunications industries, the IT industry, and the audiovisual services industry, among others—as the technology is present in all sectors of the economy. Its effect on the job market also depends on other variables such as its level of development, which modifies company processes and procedures, and the size of the workforce willing to enter the ICT sector, that is, to undergo training in order to access this kind of work (D'Adamo, 2007).

Additionally, there are approaches to the contributions of ICT in the technical and operational areas of education, which in one form or another affect (but do not determine) the administrative area. Nevertheless, some educational institutions create innovative combinations that end up influencing their policies of technology, administration, and management (Barbero & Mirada, 2000).

In this sense, Barbero and Mirada (2000) mention that while most of these policies seek to maximize the competitiveness of educational institutions to improve profits, they are valued above all as tools that contribute to young people's cognitive process and the instilling of values in the entire education community. They thus represent a major contribution to citizens' humanistic education, which is the prime objective of educational establishments.

Similarly, the majority of authors cited here indicate that ICT has been a catalyst for globalization and the much-talked-about information age that has made the knowledge society possible. ICT has become a useful instrument for the process of technological development and innovation that allows organizations, including the University-Company-State triad, to become more competitive.

Fernández, López, and Rodríguez (2007) conducted a study with the aim of determining the impact that effective use of ICT has on the technical efficiency of Spanish companies. They point out that it is not only important to acquire or implement this type of technology, but that it must also be combined with other strategies such as redesigned processes, staff training, and changes to organizational structures to achieve greater efficiency, productivity, and performance in organizations.

Rodríguez (2011) also stresses the importance and benefits of ICT in business processes, especially in reducing operating costs, increasing sales, and improving customer satisfaction and global presence, among other things. But MSMEs, which represent 99.3% of companies in Colombia, use ICT in only 7% of their productive processes (Rodríguez, 2011). According to the Global Entrepreneurship Monitor (GEM), due to their lack of innovation, more than 40% of these companies fail or liquidate in less than five years. Created out of necessity and not through the

development of a business idea, they lack a business plan backed by institutions (SENA, Finagro, IFI, etc.) to achieve their goal.

Elsewhere, Acevedo (2004) notes that the role that ICT plays in development is based on its excellence as a tool for managing information. If information is a determining factor in human development, then ICT represents a basic tool for achieving this objective. The author thus concludes that ICT must be included in aid and human development policies as a tool that helps improve productivity and competitiveness in organizations, in order to combat poverty and suffering in the world. It is also vital to recognize its contribution to the University-Company-State triad, given the role of this relationship in economic and social development in regional areas.

It is therefore essential to work in great depth on establishing the University-Company-State relationship, as well as its contributions to countries' economic and social development, especially in Colombia, where productivity and competitiveness must be improved in today's globalized world.

University-Company-State

According to Gutiérrez (2011), we must revise the true relationship that currently exists among these institutions, but especially between the university and companies, in order to identify the points where they converge and diverge as a result of these organizations' autonomy in the absence of State intervention to bring them together.

The author assesses the institutional setting of companies and universities taking into account their autonomy, with respect to their interaction, based on interests and differences, and their contribution to the triad's development.

Gutiérrez (2011) concludes that developed countries have focused their strategy on science and research with the help of technology, adding value to all of their production processes. Colombia, on the other hand, has been solely concerned with finding new market niches, without having a clear idea of the goods and services to be offered.

Accordingly, the only experience in Colombia with respect to the triad involves the National Training Service (SENA), which contributes scarce resources towards research in companies, along with the social extension programs of universities that seek to link the communities where they operate and boost development through business observatories, preferably with training activities.

Meanwhile, Ramírez and García (2010) examine the importance and impact of the University-Company-State Committees (UCSC) in Colombia. They describe

the context of the committees based on the experience in Bogotá led by Pontificia Universidad Javeriana through the Grupo CINNCO. They also offer the example of Chile with regards to strengthening investment in research, development, and innovation projects. They conclude with a prospective analysis of the steps to be taken in the years ahead to help improve productivity and competitiveness in Colombia. In summary, the authors point to the importance of the work of the committees in Antioquia and Bogotá, where they have created a research needs inventory for Colombia in sectors such as tourism, agro-industry, metalworking, food, textiles, and ICT.

Ramírez and García (2010) also highlight that, based on the models of Sábato and Botana (1968, as cited in Ramírez & García, 2010) that led to the triple helix model of Etzkowitz and Leydesdorff (1997, as cited in Ramírez & García, 2010), it is essential that the university, through its research processes, create transformations that are of use to companies. Companies, in turn, must apply the research in innovation to develop goods and services with the support of the State. Likewise, in line with the triple helix model III, technological innovation companies must be strengthened.

Ramírez and García (2010) assert, however, that there is no consensus between universities and companies so as to permit the latter to invest in areas of research that are of specific interest to them and that will allow them to improve their processes, productivity, and competitiveness based on innovation and development. Support for university research is therefore urgently required from companies and the State to improve the productive sector, which will result in development and improved quality of life for the nation, in line with the different needs that arise in the regions.

The research conducted by Mena and Salazar (2011) contrasts the relationships between the university, society, and the company to construct a model that identifies the links promoting appropriate, quality, and competitive professional education by means of a correlational study. These authors concluded that the university is often not coordinated with the interests of companies or the society in which it is a part, as there are no studies on the needs of the communities or the companies where the higher education institution operates. As a result, universities do not train professionals who can support the population's productive processes.

They therefore do not contribute to the formation of a social capital that enables the nation and its regions to increase their level of competitiveness. Nor do they contribute to the companies and productive sectors in the spheres where the universities might be called on to contribute to improving companies' productivity (Mena & Salazar, 2011)

Similarly, Gutiérrez (2012) conducted a study in Lima on the fostering of student entrepreneurship in university business incubators. This was done with a view to more deeply exploring the interplay of elements and the implications that might determine their applicability; that is, analyzing the impact of the entrepreneurship produced by the incubators on the nation's development through the knowledge generated and research conducted by the university, leading to the creation and implementation of new business ideas based on innovation.

In the research, Gutiérrez (2012) analyzed the most important theories that deal with entrepreneurship and business incubators, as well as experiences in developed countries and in Latin America, comparing them to identify the most significant differences and their contribution to the countries' economic development. Subsequently, the author found that in order to implement an entrepreneurial culture in universities, a systemic and comprehensive approach must be used, affecting the form of teaching, research, and social extension.

As business incubation in Latin America is in an initial phase of development, it requires greater support from the State and greater commitment from young people, who must be bold and take on risks to achieve the projected results. Universities, meanwhile, must create inter-institutional networks to exchange information (Gutiérrez, 2012).

In her study, Almario (2008) points out that today's society demands organizations in which knowledge, more than capital and work, is the main resource. She states that it is here that the university plays an important role in consolidating a knowledge society, by being involved in knowledge generation through research and development, as well as innovation. Accordingly, Almario considers and cites the triple helix model put forward by Etzkowitz and Leydesdorff (1997, as cited in Almario, 2008), which mentions that within specific local or regional contexts, universities, the government, and companies are learning to promote economic growth by transferring knowledge and technology through generative relationships and interactions.

This development therefore requires that innovation be viewed as a spiral, with the helices consisting of the three institutional spheres: public, private, and academic, commonly referred to as government, company, and university, respectively. Likewise, the relationships among the helices should be determined by the influence of one helix on another, the emergence of a new "trilateral" layer of networks and organizations based on the interaction among the three helices, and the recursive effect of this interaction on each helix and on the society as a whole (Almario, 2008). Almario (2008) concludes that in countries where development

is based on science and technology, universities play a leading role in business creation and innovation, contributing knowledge with support from the State.

In his study, Arroyave (2008) first analyzes the importance of knowledge in today's society, then considers knowledge in the economy and particularly in the company in order to establish the university's contribution to generating knowledge. To do this, the author conducts a revision of the current situation in the country. He concludes that in the 21st century there is an "information society" predetermined by the use of ICT, as well as a "knowledge society" based on the knowledge economy, in which knowledge is a factor in creating wealth. Likewise, Arroyave states that knowledge is attained by analyzing past experiences or simply something new that can be transmitted, manipulated, consumed, and commercialized, like any factor of production.

The need thus arises for universities to help generate this useful and innovative knowledge and thereby contribute to countries' economic development. In the case of Colombia, innovation-based research is required to respond to the needs of today's society (Arroyave, 2008).

It follows that the interaction between company and university allows knowledge and innovation to develop, boosting and strengthening the country economically. The synergies that result from closer partnerships and joining forces can be utilized to resolve specific day-to-day situations in this global village. Arroyave (2008) also recognizes the initiative of creating the University-Company Committee in the department of Antioquia in 2003, dispensing with the view of only training human capital for the different tasks that are carried out in organizations; rather, it proposes strengthening the interaction between these two institutions in order to form a new knowledge society. The functions can be summarized as follows: the university generates knowledge that the company then takes advantage of to optimize competitiveness and improve quality of life for society.

As mentioned by Blanco (2008), the technology parks created in the U.S. and Europe, based on the relationship between university and company, are showcases for one of the main drivers of national economic development. This is shown in his study on knowledge management in companies in these centers of science and technology. Blanco defines technology parks as

> physical spaces that maintain formal and operative ties with universities. Designed to encourage the formation and growth of knowledge-based companies, they have a stable managing body that drives technology transfer and promotes innovation between the companies and organizations that use the Park (p. 77).

Following this line of thinking, Blanco (2008) reaches the conclusion that the technology parks contribute 3.4% of the Basque Country's GDP and generate 3% of the total employment in this region. Additionally, 70% of the companies that make up the business center were created in the same project, and 26% of the workers are dedicated exclusively to research and development, a part of the project that falls to the universities. All in all, the transfer of knowledge and information between universities and companies appears to produce truly excellent results in regional economies (Blanco, 2008).

In Colombia, Robledo (2008) analyzes the contribution of the University-Company-State relationship based on the experience of the UCS Committee in Antioquia, which seeks to generate and transform scientific and technological knowledge into economic wealth, social well-being, and human development. In short, he declares that "the university is confronted by the need to explicitly and decisively take on the challenge of creating a new science and a new technology committed to progress, peace, and development in society and for society" (p. 132). To this end, it must transform its organizational structure and strengthen university extension and research to identify the needs of its environment and formulate proposals to build a better future, a future in which a culture of transforming research results into innovation will be vital.

Robledo (2008) also insists that the State must provide resources for technological studies, which are no less important than scientific studies and are essential for achieving regional competitiveness in a globalized world where technology is a determining factor.

Likewise, the Cauca department is leading a proposal founded on the Regional System of Science, Technology, and Innovation (SRCTI) to build a knowledge society that enables local social and economic development. The proposal is based on endogenous development theories and systemic competitiveness guidelines that highlight the importance of networks and social stakeholders such as the organizations, public institutions, and universities that form the triad, to consolidate a growth process with equality and social inclusion (Plazas & Sánchez, 2008).

For Ramírez and García (2010), the three stakeholders must remain committed, with a clear vision to support the management, entrepreneurship, and innovation initiatives of researchers and entrepreneurs, who have entered into these projects to create joint developments. It behooves us to support and encourage these regional efforts, which are growing stronger due to the benefits they bring to sectors of the economy. The phase of international recognition that is now beginning should be strengthened, as it produces surprises through useful research, development, and innovation projects for the company, and consequently, for society as a whole.

At this moment, Colombia has eight University-Company-State Committees (UCSC). Those currently recognized are: Bogotá, Antioquia, Valle del Cauca, Santander and Norte de Santander, Eje Cafetero, Costa Caribe, Tolima-Huila, and Nariño-Cauca (Salazar & Mayor, 2012).

In summary, Information and Communication Technology (ICT) becomes an instrument that helps strengthen the University-Company-State triad, which, in turn, contributes to the country's economic and social development by raising indicators of competitiveness and productivity. This enables the country to survive in the new competitive, globalized world, in which technology and innovation are determining factors.

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