

Effects of trends in the digital economy and technological factors in the Mexican labor market, (2011-2017)

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Received September 07, 2017; Accepted December 17, 2017

Abstract

The digital economy has come to remain a convergent trend and a people-centered approach, with the multi-purpose of boosting productivity, innovation, growth and employment; although it is estimated that it is detrimental to jobs and the labor market. The objective of the article is to analyze from a theoretical and empirical perspective, the effects of technological factors on labor structures in Mexico as well as areas of opportunity to consolidate the labor market and achieve goals that are useful for the country's economic development. Under a qualitative methodology with an explanatory and correlational approach that allows determining the causes and conditions that generate the labor detriment before the validity of the digital economy. Finally, the implications of ICT in the digital economy and the labor market are determined by the link between people and digital processes according to their status of work activity. In addition, with national statistics data, presents itself evidence of the basic indicators linking ICT with the labor market and their correspondence with the ICT activities carried out by employees in Mexican companies with 20 employees.

Digital Economy, Technological Factors, Labor Market, Mexico

Citation: INZUNZA-MEJÍA, Patricia Carmina. Effects of trends in the digital economy and technological factors in the Mexican labor market, (2011-2017). ECORFAN Journal-Republic of Paraguay. 2017, 3-5: 31-51.

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1. Introduction

From a digital economy perspective, citizens of the world have seen the birth and development of various information and communication technologies (ICT) that have almost immediately become part of their daily activities. ICT have opened the door to a new way of working and relating in the economy and in a society that skips borders and hierarchies in the effort to transmit information. The use of ICT in general; and in particular, the use of the computer and the internet, occurs more frequently in work activities, in educational processes, and as a means of entertainment and leisure.

It is recognized; for example, that there is a positive relationship between the access and availability of a computer or a telephone line connected to the Internet, and the welfare situation of economically active persons, by virtue of which they facilitate work activities, while maintaining family communication and the timely attention of emergencies that minimize and identify risks for workers and their families.

Despite the constant and overwhelming concern about the prospect of the future work before the arrival of technologies and robots, ICT drastically modify the ways of relating of workers, employers and customers. However, it is important to highlight that the main benefits of the use of ICT to the economically active population (EAP) in developing countries such as Mexico, is the digital inclusion approach that is generated under the influence and development of digital competencies.

In this sense, the ILO (2017: 48), emphasizes that the skills and abilities of the future, includes not only generic competences that will allow the daily use of ICT.

But also specialized skills in products and services based on digitization and technologies, in addition to a wide range of complementary competencies such as information processing, data analysis, problem solving, statistics, research, communication and strategic planning.

Institutional pronouncements are given with clarity and strength to highlight the competencies and skills for the 21st century labor market, to generate conditions for competencies that allow the development of skills and abilities for the creation of sustainable societies, based on equality and inclusion, as well as respect for the care and protection of the environment, accompanied by certification processes that validate learning and the benefit of the use of ICT.

Cristofani (2017: 94) also highlights that the working class that concentrates the EAP, are the first recognized sources of influence and contagion for labor cohesion in direct work relations, given that "the benefits of ICT among work collaborators, consists of the simplification and automation of processes, optimization of management times and decrease in the load of operational tasks".

Also for Mexico, Hernández Rodríguez, et al. (2017: 45), considers that "the development of ICT work skills, became a nodal and strategic aspect, where employers allow their workers to be part of the intellectual capital that adapts, learns, competes and generates market value through of the use of ICT". Therefore, it is considered that the use of ICT in the EAP, means the development of digital competencies under a strategic field that potentiates functional networks and allows the identification of collaboration benefits in diverse labor contexts that generate knowledge.

Hence, Medina and Ortigón (2006), recognized that the development of ICT skills as strategic and functional knowledge at work, generate value of knowledge from the economic and digital inclusion approach under a social approach, since they provide opportunities and benefits for the welfare and quality of life of workers.

One of the greatest benefits associated with the use of ICT is the growth of the labor market through the application of digital platforms; given that, they generate value on the basis of network economies, on the side of demand (network effects), in the context of multilateral markets (multi-sided markets). This business model allows them to move quickly from local businesses to expansions on a global scale, reaching sizes that open up more employment opportunities. According to ECLAC (2016b), the United States has the largest number of digital platforms (including Apple, Google, Facebook, Amazon, Microsoft and Uber), whose market capitalization value is 3.35 billion. of dollars to 2016. Likewise, a labor platform based on the OECD (2016), is defined as a means that allows employers and workers to connect with each other; through the digital platform.

A recent report by the International Labor Organization (ILO) and the Economic Commission for Latin America and the Caribbean (ECLAC, 2013) warns us about a structural crisis for labor markets in the digital economy for 2016-2017, which It forces us to reflect on How are we doing in the labor market? and how competitive are we? This means that the labor market is a link in the labor value chain of the digital economy. In relation to this, a study of the OECD (2016) is restated, which states that the technological specialization and the digitalization of the organizations will set the pattern of the main niches of qualified employment during the next ten years.

However, the global information technology report of the World Economic Forum (2016) is not so optimistic in making it clear that more jobs will be lost than those generated. Although, worldwide, there is a widespread demand for ICT specialists in all economic sectors, at present, it is committed to new occupations for the future, so that an adequate training process would allow the vast majority to find employment; hence, studying the effects of ICT in the labor market, is increasingly relevant and effective because of the important contribution of ICT to employment, since according to the report of the OECD (2016), in the sector of ICT work more than 14.2 million people, a figure that is equivalent to almost 3% of total employment of the OECD, generating a great labor polarization.

In short, there is one of the greatest revolutions in the way of working, which affects senior executives, qualified professionals, certified technicians, and young people just graduated from higher education who are looking for their first job. Although Mexico ranks 76 out of 139 OECD countries that use ICT, there are 1.9 million unemployed in the second quarter of 2017 (INEGI, 2017), the National Population Council (CONAPO) estimates that by the year 2030 600,000 jobs that could be left uncovered by the ICT sector will be required.

It is also observed that from the second decade of the 21st century, the demand for new professionals in areas such as Big Data, Smart Cities or cybersecurity are growing. With the exponential growth of technological factors, processes, data, objects and subjects connected to the Internet, digital transformation has the potential to restore labor structures and recreate the labor market with surprising immediacy.

Given this scenario, the Mexican government is increasingly aware of the needs of the development of the digital economy, to extend its benefits and respond to its fundamental challenges such as reducing unemployment and reducing poverty; Therefore, the importance of conducting this research lies in the fact that an information gap was detected that records the analysis of the use of ICT in work activities in different professional areas and jobs, since at this level of studies is where more money is invested to obtain a better performance in the labor market.

1.1 Link between the digital economy and the labor market

With the aim of analyzing (in the context of the digital economy) the current conditions of employment in Mexico, and the effects of technological factors on labor structures, the link between people and labor processes with ICT and labor market will be reviewed. Due to the above, the central questions are: What are the implications of ICT in the digital economy and the labor market? What are the technological factors central to the new labor structures? What will be the patterns of labor specialization for the next ten years?

The problem is not limited only to theoretical analysis, but to the study and observation of economic and social activities that are constantly changing, which makes it necessary to have knowledge of digital metamorphosis as a determining factor in the future of work and the labor market. On the other hand, the narrow and fragile economic base that the country has, slows down the pace of job creation. In this sense, given that technological change is a non linear and progressive process that affects employment, it is understood that the link with educational aspects would be the basis that would potentiate the benefits of this technological changes, affecting the digital economy in the labor market.

Therefore, the labor and educational perspective goes back to the effects that ICT now has on people's work and well-being, recognizing their strong penetration in robotization and automation of processes that affect people's future work. Hence, despite the mismatch of the labor market, it is estimated that the development of ICT skills will be useful for job placement. For this reason, it is important to have information about the change of the working environment in the medium and long term to make decisions about the future of many professionals, given that the information technology services, together with the telecommunications sector, have a 80% of employment in the ICT sector among OECD member countries.

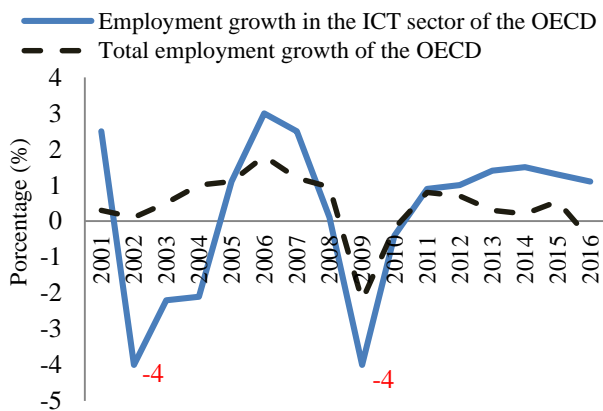
1.2 Structural elements of the employment-economy digital relationship

The structural elements play a central role in the incidence of job creation. Poor economic growth limits the generation of quality and well-paid jobs. In Mexico, there are several structural obstacles that prevent the creation of quality jobs and salary increases. Among the most noteworthy are the reduced productive and technological investment and the deep socioeconomic inequalities that, based on information from the ILO (2017), are a powerful barrier for people to access decent work and achieve a stable employment relationship through productive employment, quality, with better income, access to rights and social protection.

Structural constraints, such as inequality in income distribution, limit productivity growth to have a direct impact on increasing job opportunities and reducing poverty. Well-paid employment is especially important in the majority of the poorest households in Mexico.

1.2.1 Context of the digital economy and the labor market

As can be seen in graphic 1, the growth of employment in the ICT sector of the OECD countries marks a downward trend, this can be explained because the contribution of ICT in the labor market declined in countries with a large ICT sector and increased in countries where its dimension is smaller. One possible explanation for these events is that the crisis led to technological rationalization in countries with large ICT sectors and favored ICT companies located in countries with low labor costs.



Graphic 1 Year-on-year growth in the ICT employment sector in the OECD

Source: OECD (2017a): www.oecd.org/ilibrary.org/statistics. Note: Database information of national accounts of 27 countries that had complete data series, Mexico is not included due to lack of that report

The evidence from the OECD (2017a) shows that while developed and highly productive countries such as Germany, the Netherlands, Norway and Denmark, resort to a lower number of hours worked throughout the year; Mexico is the country in which the highest number of average hours are used per worker, which explains that the repercussions of technological progress and globalization in the Mexican labor market in the last two decades, has focused on the polarization of employment and deindustrialization.

These events have generated concern among entrepreneurs, academics and union leaders in Mexico, which justified that in September 2016, the Expansion Forum "Digital Economy 4.0" was held, where Mexico's challenge to access the digital economy and the immersion of the fourth industrial revolution, which will lead to change and rethink the concept of labor specialization, since INEGI (2017) records that in Mexico there are more and more Internet users, considering that individuals of or more years, that in an eventual or daily basis, and independently, they have carried out some activity on the Internet in the last three months.

Year	Total		Economically active		Economically inactive	
	Absolute	%	Absolute	%	Absolute	%
2001	6 760 703	100.0	3 175 231	47.0	3 585 472	53.0
2002	10 305 883	100.0	5 111 245	9.6	5 194 638	50.4
2004	12 137 273	100.0	6 698 005	55.2	5 439 268	44.8
2005	15 325 621	100.0	8 246 984	53.8	7 078 637	46.2
2006	17 198 302	100.0	9 273 968	53.9	7 924 334	46.1
2007	19 239 971	100.0	10 222 797	53.1	9 017 174	46.9
2008	20 715 302	100.0	11 259 149	54.4	9 456 153	45.6
2009	22 930 093	100.0	13 705 446	59.8	9 224 647	40.2
2010	27 041 220	100.0	16 048 777	59.3	10 992 443	40.7
2011	30 374 791	100.0	17 925 677	59.0	12 449 114	41.0
2012	33 202 186	100.0	20 170 912	60.8	13 031 274	39.2
2013	37 082 542	100.0	22 814 795	61.5	14 267 747	38.5
2014	37 930 086	100.0	23 047 648	60.8	14 882 438	39.2
2015	51 247 320	100.0	32 070 094	62.6	19 177 226	37.4
2016	52 456 769	100.0	35 315 851	67.3	17 140 918	32.7

Source: INEGI (2017). From 2001 to 2014: INEGI. Module on Availability and Use of Information Technologies in Homes. From 2015 to 2016: INEGI. National Survey on Availability and Use of ICT in Households, NSAUICIT.

Chart 1 Internet users, according to the condition of economic activity, 2001 a 2016

The activities can be, among others, to perform school tasks; those related to work; of communication, including emails or written conversations (Chat); training or distance training through videoconferences; of entertainment, such as downloading or playing video games or computer programs on the web, such as music. In table 1, it can be observed that of 6 million 760 thousand 703 registered users to 2001, it has gone to 52 million 456 thousand 769 users for the year 2016, increasing in this way slightly more than 12% in recent years the total of users of this TIC.

We also see that the incidence of ICT in the labor market is recorded by the users who are part of the economically active population (EAP), who are persons of 15 years of age or older who during the reference period carried out an economic activity in the labor market (employed population) or actively sought to do so (open unemployed population), as long as they have been willing to work at least one hour of work in the reference week. As can be seen, the EAP indicator, the number of Internet users increased from 2001 to 2016, from 3 million 175 thousand 231 Internet users of the EAP to an absolute number of users of 35 million 315 thousand 851 Internet users of the EAP.

In this approach that allows us to contrast with the theory, the general hypothesis can be verified and we observe that to the extent that the EAP increases its use of ICT to develop some economic activity, communication, commerce or information, related with work activities or not, it is understood that ICT and internet are a means that relates the digital economy to the labor market, allowing the development of a collaborative economy that generates positive implications for workers, which increases their ICT skills and generates more benefits economic

The Survey on Information and Communication Technologies (ENTIC 2013), aims to obtain information on the availability and use of information and communication technologies in companies during the year 2012, to generate statistical information on labor and other matters related to business activity. In table no. 3, 11 basic activities are required that are related to the activities carried out by employees of companies with 20 or more employees. As shown by the ENTIC (2013), the most representative activities are the work activities in which the use of the computer is required in a total of 50 thousand 195 companies that represent 97.5% of the total of mining activities, manufacturing, construction, electricity, services and commerce.

While for 2012, the number of companies analyzed reached 138,881, this is explained given that companies with 10 or more employees were considered for the activities of mining, manufacturing, construction, electricity, transport and communications, services and commerce, which represented 88.7% of the total number of companies.

Likewise, the other representative activity is in which the internet is used, registering for 2012 a total of 48 thousand 266 companies, corresponding to 92% of the total number of companies consulted; as well as for 2012 there were a total of 132 thousand 573 companies that represent 84.6%.

The third most important basic activity corresponds to the use of fixed broadband internet, with 26,818 companies in 2008, and 124,272 in 2012, corresponding to 55.6% and 93.7% respectively. As it is evident, with these data it is certain that the link between people and digital processes within the labor market is determined by the use of ICT and especially by the use of the Internet, with which one can verify one of the hypotheses raised about the fact that the internet is a means that links the digital economy with the labor market, allowing the development of a collaborative economy, given that there is a greater number of people who use the internet, and that it generates positive implications for workers in their work activity.

Indicator	Total bussiness		2008 ^a	2012 ^b
	2008	2012	%	%
Use computadora ^c	50,195	138,881	95.7	88.7
Use Internet ^c	48,266	132,573	92	84.6
Have web page ^c	26,126	64,920	49.8	41.5
Use intranet ^c	20,014	46,135	38.1	29.5
Sell on Internet ^c	4,555	11,407	8.7	7.3
Buy on Internet ^c	7,068	22,224	13.5	14.2
Narrow band internet ^{d,e}	17,745	21,159	36.8	16
fixed broadband internet ^{d,f}	26,818	124,272	55.6	93.7
mobile internet broadband ^{d,g}	8,927	29,758	18.5	22.4
LAN ^c	39,609	103,126	75.5	65.8
Extranet ^c	4,319	10,781	8.2	6.9

^a The information refers to companies with 20 or more employees of the activities of mining, manufacturing, construction, electricity, services and commerce.

^b The information refers to companies with 10 or more employees of the mining, manufacturing, construction, electricity, transport and communications, services and commerce activities.
^c The percentage figure refers to the total number of companies in the target population.
^d The percentage figure refers to companies that use the internet.
^e Includes analog modem (Dial Up) and RDSI.
^f With download speed equal to or greater than 256 Kbit / s (Includes ADSL, cable modem, satellite and wireless networks (WLAN, Wi-Fi, WiMAX, LMDS). For 2008 includes cellular and excludes wireless networks.
^g With download speeds equal to or greater than 256 Kbit/s through cellular telephony. For 2008 includes satellite.

Table 2 Basic indicators that relate ICT to the labor market (2008 y 2012)

Source: INEGI (2013) National Survey on Availability and Use of ICT in Households, NSAUICT

We can also see it in the following graph 2, which shows the evolution of the indicator of Internet users who are part of the economically active population. It is clear that its displacement in the annual percentage indicator tends to be increased. To identify what is the link between people and digital processes within the labor market, we can see that the Internet is present every day in the largest users and in practically all aspects of daily life. ICT and properly the internet is an outstanding and widely used tool to stand out in the labor market, favoring the growth of entrepreneurs (self-employment) and companies of all types and sizes, which implies a strong and growing link between people and companies. ICT and digital processes.

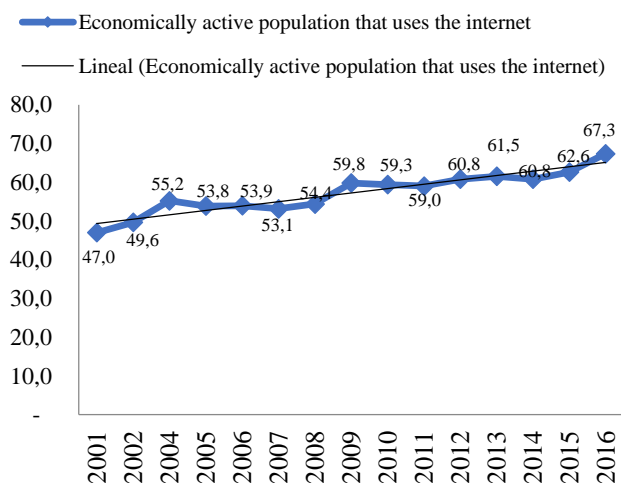


Figure 2 Mexico: Internet users of the Economically Active Population (2001-2016)
 Source: INEGI (2017) NSAUICT

2. Theoretical and empirical discussion

The demand for ICT specialists has continued to increase in all economic sectors, in the face of technological disruption. With the digital strategy of Mexico, it is intended to place the country "as the first country in digitalization in Latin America, with a level similar to the OECD average in 2018." This strategy is aimed at fostering innovation and entrepreneurship in the digital economy, raising the quality of education through ICT, contributing to the transformation of public administration, guaranteeing universal access to health services and promoting participation. citizen under the following strategies proposed by the OECD (2016).

Replicating the analysis made by Torres García (2016), documented in economic theory, it is understood that human capital is in need of incorporating this reality, given that the skills of people to use ICT, determine their insertion into the market labor in better or worse conditions; and even, they determine the type of work and its remuneration, in virtue that the digital economy is developed through the use and access to ICT.

Area	Objective Prosoft 3.0
Digital Market	Stimulate the market, linking the demand of economic sectors with the supply of ICT goods and services in Mexico.
Business Innovation	Promote the culture of innovation and specialization among companies in the ICT sector.
Talent	Promote the development and identification of skills, skills of personnel in the ICT sector.
Globalization	Promote local business opportunities abroad and attract investments in the ICT sector.
Financing	Expand the options and possibilities of access to financial resources for companies in the ICT sector.
Intelligent Regionalization	Encourage smart specialization to consolidate competitiveness based on specific niches of high value in the ICT sector.
Legal Framework	Facilitate the adoption of a legal framework that encourages the production and adoption of ICT.
Governance	Coordinate and integrate the actions and the actors of the ICT ecosystems.

Table 3 Strategic areas of the Mexican program Prosoft 3.0

Source: Own preparation with information from the Ministry of Economy

The Mexican government, to reach the objectives set in the digital agenda, focuses its actions on these eight strategies with specific objectives by 2025; However, these objectives have not been fully met. In this regard, the argument of Lombardero (2016) is shared, explaining that the digital economy does not correspond only to one sector, but to the incorporation of digital activities in a transversal way, and to the organizations of the different economic and social sectors to promote the growth of GDP and the generation of employment.

As can be seen, some national digital strategies emphasize the use of open data whose main benefit is greater interoperability. In this sense, Arntz, Gregory and Zierahn (2016), argue that a substantial part of jobs is in "computerization risk" due to the so-called interoperability of the fourth revolution that will change the concept of labor specialization in the digital economy from Mexico .

For his part, Marc Fortuño (2017) states that we are witnessing a new era, in which robots and computers will be the main actors of routine activities, replacing physical work, much more efficiently than human beings, which will lead to the interoperability and automation of production processes.

In this sense, the technological specialization and the digitalization of the companies will mark the guideline of the main niches of qualified employment during the next ten years, foresees a study of the OECD (2016); hence, as has been demonstrated throughout history, with the different industrial revolutions, technological advances have offered a greater degree of productivity, implying improvements in social welfare, which has meant fewer hours worked annually.

2.1 Digital strategy and employment

In the analysis of the digital economy and the labor market, it is generally highlighted that since the 20th century, and especially in the last decade, we have sought to link information and communication technologies with employment, productivity and labor specialization patterns. At the international level there is more evidence, while for Mexico, it is very scarce; Although, on an international level there is considerable discussion on the subject in particular, in Mexico there are few occasions that have been treated in a scientific and comprehensive manner.

However, with this review of the state of the question, the different perspectives that academics, businessmen, politicians and union leaders have about the technological factors that determine the future of employment are analyzed. In this regard, Novo-Corti and Barreiro-Gen (2017: 392), argue that "digital communication and social networks have become crucial elements in socialization" and are expected to continue in force in the next ten years. that people in conditions of digital isolation, lose the possibilities of staying able to find a job, due to the loss of "digital skills".

On the other hand, Graham, Hjorth, and Lehdonvirta (2017: 136-137), based on a study of several years with digital workers in Southeast Asia and sub-Saharan Africa, state that "governments and organizations turn to the economy smart and digital work, as a strategy of economic development to create jobs in places that need them ", recognizing that the digital economy is important to better understand how it could influence the means of working life of workers. In addition, four main concerns of the workers stand out: 1. bargaining power, 2. economic inclusion, 3. intermediate value chains, and 4. updating-training, the latter two being those most linked to the labor market.

Graham, Hjorth, and Lehdonvirta (2017), show that although with the digital economy, there are important and tangible benefits for a number of workers, there are also a series of risks and costs that unduly affect the livelihoods of digital workers. On the basis of these concerns, they conclude with a reflection on four general strategies: 1. certification schemes, 2. the organization of digital workers, 3. regulation strategies and 4. democratic control of online work platforms, strategies that could be implemented to improve the conditions and livelihoods for digital workers.

Similarly, for Boes, et. to the. (2017: 133), "the strategies of cloudworking and crowdsourcing revolutionize the world of work and assume that its development has a significant impact on work and society"; by virtue of which, they represent a global information space that allows companies to expand the scope of their value production, far beyond their physical and formal limits, influencing the integration of forms of work.

These researchers put on the table discussion, the relationship of employment with the digital economy, highlighting a new stage of capitalism "Landnahme". The novelty of this type of colonization strategies in the information space (cloudworking and crowdsourcing), is that they strive to make the work mutually interchangeable inside and outside the formal limits of the organization (government, family or company), on the basis of computerized and industrialized production structures. For its part, Postigo (2016: 334), analyzes the socio-technical architecture of digital work and redefines the concept of "digital work architectures." The concept draws attention not only to the social practices involved, due to the activities of position between work and leisure in a commercial framework, and also to technological platforms that make it possible in a seemingly invisible way.

Gleeson (2016), highlights that social media based on platforms such as Facebook and Twitter are increasingly used by women around the world as a way to capture and take advantage of a wider audience and draw their attention to campaigns and individual promotions that approach social problems. Her study is based on data from interviews with representatives of three contemporary feminist campaigns based in Australia in order to demonstrate that feminist activists within online feminist campaigns can undertake a form of digital work and examine the effects of this human resource and manpower. With respect to the labor market, it is observed that these works are framed in activist activities as a form of digital work, where those changes that trigger the labor market, are needed.

2.2 Development of labor polarization

The OECD (2017b) states that in recent decades, almost all member countries have experienced labor polarization; that is, a decrease in the percentage of total employment attributable to semi-skilled jobs with medium-level salaries, which is offset by increases in the percentages of both skilled jobs and low-skilled jobs, where a third of the increase in labor polarization it reflects a change in employment, the manufacturing industry is left to integrate into services; while the other two thirds reflect the occupational changes within industries as a product of technology, which means a strong relationship with polarization and deindustrialization. In this regard, Rosa Soto (2017), says that technological advances in the robotics sector have not only generated the polarization of employment, but have also allowed the development of machines capable of carrying out heavy mechanical activities, typical of chains of mounts, but also more complex ones that require greater precision and risk, such as surgery.

Hence, the ICT sector will be led by robotics. The introduction of robots in the labor market puts in check the low-skilled or repetitive jobs, while the most creative professions would be, for the time being safe. The impact of robots on the economy and in various professional sectors detonate labor polarization, although the economic precariousness is increasing, the demand for employment in qualified sectors is increasing. It is expected that this disruptive technological trend will continue during 2018 in demanding organizations of more and better skills.

Coinciding with Lombardero (2016), the application of science, technology, mathematics and engineering, will be basic skills to work in the next ten years, giving rise to new professions with diverse profiles that feed back from a broad knowledge of technologies, to develop digital cities and smart factories, in addition to hiring statistical data scientists, algorithms, marketing, digital content and cybersecurity.

The changes in the dynamics of the labor market are denoted demographic and socioeconomic, being the changes in the nature of the digital and flexible work, the most significant by the impulse of the technology in the cloud, the mobile Internet, the increase of the force of the "big data" and the internet of things. Given this, in the immediate future it is visible that three major job profiles will govern the labor market over the next three years (2020), engineers, ICT professionals and specialists in data analysis (big data). However, under consideration that technology is a determinant of new jobs, in counterpart, the discussion of the World Economic Forum in Davos, a turn around the destruction of professions and the uncertainty that this is much greater than the capacity that exists worldwide to generate new jobs, World Economic Forum (2017).

What the report reveals is that technological and demographic changes will destroy more than seven million jobs by 2020, of which it is estimated that two thirds would correspond to jobs and jobs related to office activities and business administration. It was also discussed that the jobs related to industrial production will have a tendency to decrease, but it is also considered that they would have a little more margin to improve their qualification, so they could opt for a conversion through the use and management of the TIC.

On the other hand, it was also highlighted that those who minimize scientific procedures and practices will see a crude and inaccessible working future, given that it is estimated that there are four main occupations that will be hired in the near future. One of the main occupations will be the scientific data expert (data analyst), standing out the scientist in the statistical management, expert in the management of algorithms, expert in digital marketing and cybersecurity expert.

Therefore, organizations (government, companies and families) will increasingly demand digital-oriented capabilities. Thus, the market will follow the main labor trends, for example, in 2016, 23% of job seekers, were already looking for engineers, although with an increasing orientation in the digital processes. In this way, companies will continue to demand developers, Java and dot-com analysts, and telecommunications and computer engineers..

2.3 Implications of ICT in the digital economy and the labor market

ICTs are changing the sectors of the economy at an accelerated rate, having an important impact on the labor market. The current time we are living is marked by apprehension and uncertainty, given the interference of ICT in the activities that people develop in their working life.

Which leads to a demotivation of the use of ICT in the workplace; that is, faced with the fear of being replaced, people are reluctant to use ICT in the labor market. However, in line with what was reported by Arreola (2017) and the World Economic Forum (2016 and 2017), at the international level the fall in unemployment in some countries is also influenced by the fact that some people give up finding a job because of their digital illiteracy.

The impact of ICT in the labor market has marked a trend in its use and fundamental access in the digital economy, which has unleashed the labor market has inherent uses from supply and labor demand, experiencing pressure points in workers, mainly due to the automation and technological evolution that is forcing employees and companies to continuously change.

According to Arreola (2017), if there is no change towards the use of ICT, one of the parties (employees or employers) will open labor gaps and gaps in relevant labor skills and competences. This fact, sometimes connected with unemployment and others with the digital economy, shows that the lack of qualified people for certain positions specialized in the use of ICTs is outside the labor market.

Undoubtedly, these aspects are significant when looking for and developing a job, given that they mark the trend of new professional training and the development of job skills, which forces us to rethink the restructuring of plans and programs of study, in function of the questions with a futuristic technological perspective What will be the jobs of the future? What demands will the labor market have?

Among the main answers, are the arguments and approaches of the World Economic Forum (2016 and 2017), ECLAC (2017a), Graham, Hjorth and Lehdonvirta (2017), Boes, et. to the. (2017), Volpentesta (2017), the H. Chamber of Deputies (2017), Mahmoudi, and Levenda (2016), Postigo (2016), Ruberg (2016), Valerio, Castro López, and Herrera Murillo (2016), García Irigoyen, Torres García (2016), Tabares (2016), Krull (2016), Palos Sánchez (2016), ECLAC (2016), Mokyr, Vickers, and Ziebarth (2015), Mochón, Gonzales, and Calderón (2014), among other scholars of the digital economy and the labor market, arguing that it can be verified that "ICT and the Internet are central elements of technological change under digital interoperability that determines the context or environment of a digital economy", highlighting that digital ecosystem It imposes a new way of working and a new structure of the labor market.

Therefore, it should be noted that the changes that force us to use ICT in an increasingly digitalized economy, emphasize that we will live more quickly and there will be shorter technological updates. For the person with scarce economic resources, the most important technological change will be around the concept of digital skills and competences.

While currently seeking the highest number of professional credentials (documents that recognize and testify the authenticity of knowledge, skills and competencies). These professional credentials are considered as the official titles and certifications to perform a job with certain order and systematics, business area, labor structure, and business title; However, in a few years (we consider that no less than ten years), having such professional credentials will not be enough to apply the requirements of the labor market; therefore the search and development of a good job will be more challenging each day.

3. Methodology: materials and methods

This descriptive and correlational research begins with the description and contextualization of the link between the digital economy and the labor market, highlighting the problem of the lack of decent and well-paid jobs, and the labor perspective that will be faced with the dizzying technological changes, reaching Address the impact of the digital strategy on employment and the prevailing labor polarization.

Statistical data were analyzed from the National Survey on Availability and Use of ICT in Households and the Survey on Information and Communication Technologies to correlate the use of ICT by the EAP and its correspondence with labor activities of business units that use ICT from different activities linked to work to identify their correspondence with the digital strategy of the country.

The study of the issue related to the central theme was developed and the different inferences of analysis were determined, emphasizing that in the face of the discouraging scenario of unemployment in positions that demand technological competences, and in face of the threat of the possible replacement of people by ICT In the labor market, it is important to determine the link between people and digital processes within the labor market.

It is recognized that the world population is immersed in the digital revolution, connected by all corners of the world, thanks to systems and technologies that allow it to reach the link of globality. Hence, this link is strengthened from the moment we use information and communication technologies to be informed and communicated. The new generations are born driving smartphones and connecting to the Internet from an early age, thus marking the pace of technological progress for the rest of the generations.

3.1 Technological factors of labor structures

Innovations in technology, in particular the technological factors of labor structures and the application of digital media, are increasingly changing the way ICT is used in companies and in work processes. More than this, technology as a factor that determines the labor and organizational structure in companies and organizations, alters the very structure of work and business life. However, by identifying the technological factors of the new labor structures, it was possible to identify that ICTs work as a tool that would favor the development of labor actions, in addition to determining the form and systematized structure of how to work. ICT represent the essential conditions to develop many administrative and operational tasks in companies and other organizations.

A framework to explain these facts that suggests the fourth industrial revolution, within which certain key technologies have been identified as technological factors that impact on labor structures. These factors are identified as digital strategies, depending on the need of the company or organization and the job offer of the employees, according to their digital capabilities.

According to the World Economic Forum (2017) technological factors are identified as the digital pillars in the economic and social order: 1. Artificial intelligence, 2. Internet of things, 3. Robotics and mechatronics, 4. 3D printing and in advance and 4. Virtual Reality, factors that have affected not only the labor market, but also in the digital economy and in all the structures of society. The surprising thing is that these areas of innovation have existed for a long time, and certain advances of recent years unleashed their potential.

When applying these technologies, the key to production goes beyond the development and labor exploitation, since in the work includes the entire value chain that goes from the conception of the idea, the diagnosis of needs, scientific research, processes of design, production, purchase-sale, delivery, collection and consumption. This substantially alters the labor structures and the traditional business model; as well as the speed of the technological changes, it is surpassing the capacity of adaptation of the workers and of the population in general.

However, the strategies that determine the labor structures are very much related to the digital economy; since ICT, influence determinantly in the ways of acting and even in the determination of commercial policies of purchase, sale, credit and online collection, which create an environment and digital thinking.

In this context of continuous advances in the use of ICT within the labor market, there are not many alternatives, or companies and workers adapt to the digital economy and the use of ICT; or adapt. Those workers who do not adapt to the technological needs of the company, the customers and markets of the company, will be condemned not to be hired and therefore will be jobs that will be lost. Therefore, it is crucial to understand the functioning of technological factors and their real impact on the labor market, business, the competitiveness of companies and the productivity of workers.

The World Economic Forum (2017), emphasizes that the adaptation of workers to technological factors (due to the demands of online customers, the offer of competitors through the network, market strategies through the Internet, among others), will represent the progress and development of workers and entrepreneurs. It also involves breaking down the obstacles that surround the use of digital media in the work structure.

As we can see in the following table no. 4, it is observed that of the total number of employees consulted by the companies determined by the Survey on Information and Communications Technologies (2013), in 2008 there was a structure of 2 million 620 thousand 996 employees in companies of 20 employees plus mining activities, manufacturing, construction, electricity, services and commerce, increasing for 2012 to a total of 3 million 421 thousand 427 companies with these characteristics, which represented 26.4% to 30.5% respectively for those same years.

Indicator	Total employees		2008 ^a	2012 ^b
	2008	2012	%	%
use computer ^c	2,620,996	3,421,427	26.4	30.5
use Internet ^c	1,769,034	2,793,463	17.8	24.9

^a The information refers to companies with 20 or more employees of the activities of mining, manufacturing, construction, electricity, services and commerce.
^b The information refers to companies with 10 or more employees of the mining, manufacturing, construction, electricity, transport and communications, services and commerce activities.
^c The percentage figure refers to the total number of employees of the companies in the target population.

Table 4 Uso de TIC por los trabajadores (2008 y 2012)
Source: INEGI (2013). Survey on Information and Communications Technologies

More and more workers are located in companies with 20 workers or more that develop activities related to the use of ICT (use of computers and internet); showing that part of this research is aimed at analyzing the digital environment in society, with the purpose of emphasizing the basic activities that include opportunities offered by ICT to the labor market.

In this report of results, it is verified that the impact of ICTs in the digital economy and the labor market in Mexico has been achieved through research strategies that allowed to establish a theoretical and empirical debate about the importance of technological factors; as well as.

The limits and perspectives of the digital economy in labor activities, in such a way that the relationship of ICTs with the digital economy and the labor market can be identified, to the point of also pointing out the possible negative consequences that need to be addressed in subsequent investigations.

It has been shown that, with the proper use of ICT, companies are allowed to produce more work, of better quality and more flexible over time. For workers, this translates into more free time. In the same way, the use of ICT has a direct impact on customers, suppliers and workers and their relationship with the company. Thus, all those involved are favored with the use of ICT in a company, as long as it uses them in a good way. In the following graph 3, you can see the main activities by internet use to 2016 in Mexico.

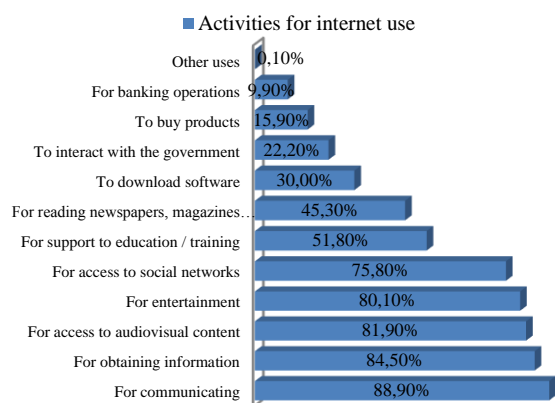


Figure 3 Activities for internet use by the EAP, 2016
Source: INEGI (2017), *Survey on Information and Communications Technologies 2016*

In this part, it can be highlighted that ICTs have not only determined the ecosystem of the digital economy; but they have changed the environment of the labor market, from the perspective of communication between all the integrated elements of the labor market (worker, work, employer, salary).

Which go beyond the production process and which increases its importance in other areas of professional and personal life. This confirms that the concepts and categories of the digital economy, as well as the representation of empirical regularities, confirm the hypothesis that ICT and internet are means that are increasingly used by the economically active population, however, their main use is to communicate with 88.90% of the population by 2016, to obtain information with a record of 84.50% of the population; however, there are activities that are properly of interest to people from 18 to 55 years of age and over.

These activities are: support for education and training with 51.80%, to buy products with an intervention of 15.90% of the population and to carry out banking transactions with 9.90% of the population at the end of 2016; what we assume are activities carried out by those people who are part of the economically active population.

Category SCIAN	Productive Sector	Average
21	Mining	4 410
22	Generation, transmission and distribution of electrical energy, water and gas supply by pipelines to the final consumer	4 219
23	Construction	7 406
31-33	Manufacturing Industries	113 697
43-46	Commerce	64 793
48-81	Services	188 627
	Total	383 153

Table 5 Use of ICT by workers (2008 y 2012)
Source: INEGI (2013) *Survey on Information and Communications Technologies*

On the other hand, with the information presented in Table 5, it is possible to corroborate the hypothesis, that the letter states that "ICT and the internet are a means that is used optimally to find work, since it offers jobs, services, business and in general to connect companies with workers (crowd working)".

For this, the average of the total number of employees (dependent and non-dependent) of the productive sector that performed remote work, by type of SCIAN classification in the country during 2012, is presented. We see that the sector that most employ workers to carry out activities remotely and commonly online is the service sector, followed by the manufacturing sector. In the table we can see that the activity with the fewest workers that carry out activities in the distance, was the services sector, followed by the manufacturing industry.

The results help in the construction of the empirical evidence and the theoretical discussion, giving the nuances that were found in the statistical data, in correspondence to the methodological strategy, for which a document that shares the ethos of scientific research is recorded which means the production and generation of knowledge that has been generalizable to facts, events, historical aspects, concepts and processes of the behavior of the digital economy.

4. Analysis of results

The digital tendencies for the search and development of a work, guide the answer to the research question: What use is given to the TIC for effect of the search and development of a work? We find that the International Trade Organization estimates that before 2020, up to 500 million jobs will have been created, which will be occupied mainly by young people -the generation with the highest unemployment rate- that, at the same time, would be concentrated in the majority population group of the productive force.

According to the Report on the future of jobs of the World Economic Forum (2016), the effects that are already felt and some that are about to reach the business models and impact on the labor market are:

- a. The current geopolitical volatility, cloud technology and mobile internet, advances in processing capacity and Big Data, shared economy through digital platforms, increase in interconnected youth, increase in Internet users, increase in job performance, more workers communicated, more online training and multimedia classes in emerging markets, rapid urbanization, change in the working environment and labor flexibility for its realization, in the transformation to an increasingly digital economy.
- b. Since the last three years, great inventions have been observed in terms of energy supply and technology, internet of things, cutting-edge manufacturing, slow decline and longevity of society, new consumer concerns about cyber security issues, data protection and privacy, and increase in the aspirations and empowerment of women in the economic and productive order.
- c. It is specified that the next five years, we will see among us advanced robotics and the autonomous transport and free of use of carbon fuels. It is considered that in the near future, employment trends will be marked by artificial intelligence and automated and remote-controlled learning, an environment where advanced materials prevail, a weakening of biotechnology and a resurgence of genomics and nanotechnology.

Thus, the labor requisition in the characteristics of digital competence, will be given by a multitude of skills that require the generation and application of knowledge, social peculiarities and useful qualities difficult to automate, hence, strategies such as social networks as integrated platforms that include everything to give the service of purchase and sale (XaaS everything as a service, workplace as a service, cybercrime as a service, analytics as a service), will require data analysis, management of digital platforms and cybersecurity services as new digital trends.

According to the report of the World Economic Forum (2016) and the CEPAL reports (2017a), the most important skills and competencies that the labor force will demand for the development of a job in the year 2030 will be: Resolution of complex problems, critical thinking, creativity and innovation, people management, administrative coordination, emotional intelligence, decision making, service orientation, negotiation, cognitive flexibility and use of ICT.

On the other hand, all jobs will have a minimum digital component, which in the words of the operating business center of Microsoft does not mean that all people have to have a computer training or automated systems; rather, even the low-skilled population will have to manage and operate ICT. Successful organizations will be those that have a business model that allows them to go through all the options of technological factors and continuously move the work as necessary. Hence, many "new jobs", including international business, fiscal public accounting, agro-technology business, business graphic design, and other executive areas, will be generated and developed through the digital platforms that drive the economy "gig". This implies that flexible and short-term contracts prevail in the labor market and that permanent or basic jobs (freelancing) tend to disappear.

With all this, there will be both supply and demand for labor with characteristics of ubiquity in time and space for different organizations, at different times and from different places to the place where they are employed. In addition, most jobs will be made through the use of ICT and interaction with employers, customers, colleagues and other economic agents at the same time, which means that people connect with a workforce and a labor market that neither they were not even imaginable 10 years ago. This means that the search and generates.

5. Conclusions

This document is a modest approach to the study of ICT and its relationship with the digital economy and the labor market. It is aimed at the student, academic, labor and business sectors, hence the importance of doing it; It allows to be a bridge to travel through the intersectorial digital strategies of Mexico, which by their nature, are designed and applied to boost the competitiveness, economic growth and social welfare of the country.

In general terms, the analysis confirms that digital identity in the labor market implies great challenges for society. The social system of work undergoes a reconstitution process that violates the foundations of our current labor regulation system, both in society, in school and at the company level; since the most representative activities are the labor activities in which the use of the computer and the internet are required, with an international business graph of 97.5% of the total of mining, manufacturing, construction, and electricity activities, services and commerce.

From the trends of the digital economy it is concluded that ICT for the labor market brings benefits and offers areas of opportunity for jobs with high technological demand, this in comparison with traditional jobs.

However, on the other hand, the propagation of digital business models and the digital scenario that exists in the labor market, has far-reaching effects that could be unhelpful, as in the case of the labor market where most of the jobs the "gig" economy (new form of employment) does not offer the benefits or the essential social security offered by traditional jobs.

In addition, that technological changes alter the economic and social life of people, where the country's digital agenda is one of the main elements to promote economic and social growth, and thus promote employment and electronic inclusion in the workplace, It is recognized that educational systems must adapt their training processes and guide them to the demands generated by the accelerated changes of the fourth revolution, which require the development of ICT competences and skills.

In this sense, the country's digital agenda would be the guideline to extend the benefits of the digital economy and ICT at work; in such a way that the citizens receive an education, formation and qualification in the matter of TIC that allows them to develop capacities of answer and adaptation to the technological advances, and at the same time generate the necessary competences to use these technologies and to manage the risks that the development implies of own online economic and social activities.

From the tendencies of the digital economy and the labor market it has been argued that there are different discussions about this, mainly about the transformations in the organizations and in the realization of the work, given that advances in robotics, artificial intelligence, reality virtual are linkages that have changed everyone's daily life.

However, the main changes are to begin by preventing it from being called "the new economy", given that the digital economy has ceased to be a novelty in order to be part of people's daily lives, and in the labor market benefits and offers areas of opportunity for jobs of high technological demand, this compared to traditional jobs. Moreover, the spread of digital business models and the digital scenario that exists in the labor market, has far-reaching impacts that could be unhelpful, such as:

- a. In the labor market, most jobs in the "gig" economy do not offer the benefits or the essential social security offered by traditional jobs.

This means new challenges for the government, since it represents facing a series of challenges that would imply a great effort for the labor secretary and the institutions related to the country's labor market to close the social protection gap as deemed necessary; therefore, public policies that contemplate digital environments and ecosystems for the benefit of Mexico's economic and social sectors would have to be redesigned. The possible government policies should include a new legal structure that orients and orders the labor market, from the consideration of a social security infrastructure that contemplates ICT, a general minimum income that is estimated based on skills and competencies, and labor laws that give workers benefits, protection and collective bargaining rights. New generations of the labor force, among them the Millennials and the Generation Z, will take control of the decisions from the year 2030, so they will bring in their thinking and culture, that to develop their work, they will not need to be seated in an office or doing heavy work for a full day of 8 hours, otherwise, in their mentality will bring pre-conditions that encourage them to work for more than 8 hours, but they will require freedom and work flexibility in time, space and time.

However, for some people, this will seem to have a job, meaning that activities or tasks of other people should be integrated into the production processes (loading and unloading maneuver, displacements, purchases, sales, marketing, compensation, consultancies, others), which will generate a collaborative labor market, in which commissions or fees will be charged, instead of fees or salaries and salaries. For other people, the labor market in the digital ecosystem means that basic and full-time jobs will be extinguished with a schedule of 8 to 10 hours, to be used in short-term jobs that will be carried out at any time, even these digital environments will provide conditions for traditional employers to become micro entrepreneurs or entrepreneurs who fix and adapt their working hours, work space and income.

Of course, these workers must have technological knowledge and skills to gain respect and build on the resolution of a problem, which will generate an expectation in their customers and thus negotiate better working conditions and collaboration. Regarding vocational training for the labor market, it must correspond to a digital ecosystem; that is, to the digital economy. It is a new issue that encourages us to continue with topics of study like this, given that ICTs mark an insurmountable trend not only in the economy, but also in education. The recent current educational model promotes with greater emphasis the development of static skills, where the student is the passive part and it is only the teacher's educational work that prevails, to later apply dynamic activities; therefore, it is necessary to adapt to an educational scheme by research-oriented competencies, where the student is the active and dynamic part, as well as in the case of the modular system by object of transformation that is developed and applied in the Faculty of Economic, Administrative and Technological Sciences of the Autonomous University of Sinaloa.

It is clear that from basic education, an instruction is required focused on the development of scientific competences about fields of study such as mathematics, humanities and computer science, but also on developing soft skills to compete in the new digital markets. For what could be analyzed with this research, to orient the learning processes towards scientific research, is undoubtedly one of the most important resumes that the educational system has and the new generations that will have to prepare themselves to satisfy the skills raised previously, for what, in addition to formal education, they will have to think about a permanent and proactive training that allows them to have multidisciplinary and different professional profiles throughout their professional life, as well as different simultaneous work positions; in order to achieve professional and job adaptation in the digital economy.

Finally, the effects of the relationship of ICT in the digital economy and the labor market represent the signs of a constant labor change, due to its strong involvement in the labor market. A high weighting of work activities is done with the use of ICT, where the technological factors central to the new work structures are the Internet of things, big data, cloud computing and social networks, highlighting that the future professional that aspires to insert in the labor market, must have a technological expertise, scientific, statistical and resilient knowledge.

In short, it was verified that people with skills and abilities in ICT management have greater opportunities to find a job in the labor market, so the supply of skilled labor has as a consequence the increase in salary bases. However, it is also recognized that in a short future, employment and the labor market will suffer changes in the loss of thousands of jobs, but also when new labor demands arise.

For all this, considering that Mexico is a country with a fairly fragmented productive structure, limited investment in innovation, growing levels of informality in employment, high socioeconomic inequalities coupled with the constant technological changes that condition the improvement of working conditions for workers, the obligation and concern to continue investigating aspects that refer us to the serious reflection of How to adjust the educational and work conditions to the new technological realities and demands generated by the activated metamorphoses of the fourth industrial revolution, remains? What skills and tools will be necessary for young people to be authentic agents of productive change and promoters of sustainable development?

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