# A documentary analysis of the welfare state, technological unemployment and social innovation in Mexico

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Abstract

The adverse effects of the opening of the economy during the 1980s and 1990s in Latin America brought about a debate about the reform of the welfare state. However, the path to follow is still uncertain. This scenario has forced the emergence of socio-technological innovations to tackle problems such as socioeconomic inequality and technological unemployment which neither the market nor the state have been able to solve. The aim of this paper is to review the way in which the Mexican welfare state has impeded the alleviation of poverty and technological unemployment making, in consequence, the creation of an enabling technology-based social innovation environment a priority. For that purpose we carried out a documentary analysis as part of a broader research study which assesses empirically the role of the Mexican state in creating a technology-based social innovation environment as a way to alleviate social illness such as poverty and technological unemployment. We conclude that empirical approaches to the links between social innovation, the labor market and poverty are indispensable to advancing the discussion about the design of the provision of welfare in the twenty-first century.

Key words: welfare state, poverty, unemployment, social innovation, Mexico.

## Introduction

The 1980s were a break point for Latin American countries, among other important aspects the decade brought about a debate on the reform of the welfare state. However, the path to follow was still uncertain. This scenario forced the emergence of socio-technological innovations to tackle problems such as poverty and technological unemployment which neither the market nor the state have been able to solve. A crucial aspect of social innovation is the participation of the different social actors in the solution of social problems, especially the most disadvantaged groups (Becerril-Velasco, 2023). We argue that the most important challenge for the Mexican state is to create an enabling technology-based social innovation environment which will help workers and companies to adapt to technological revolutions and avoid social diseases.

Accordingly, the main question which we address in this paper is '¿How has the Mexican welfare state impeded the alleviation of poverty and technological unemployment making, in consequence, the creation of an enabling technology-based social innovation environment a priority?' The paper is divided into four sections. In the first, we explain the methodology we used in order carry out our documentary analysis. In the second, we review the theoretical framework which will enable us to carry out our analysis. In the third, the discussion and results are introduced, and in the fourth section, brief concluding remarks are presented.

## Methodology

Our methodology consisted of a documentary analysis. Prior (2014) identified at least four approaches to the study of documents, namely, those which focus only the content of the document; those which, from an archaeological point of view, focus on how the content of the document originated; those which focus on the way in which human beings use documents as a resource to meet their ends; and those which focus on the function and impact of documents on the organization and interrelation of society.

For the purposes of our research, we used the first approach. That is, we treated our documentary sources as an informant and carried out a systematic literature review. Aguilera (2014) stated that a systematic literature review collects and synthetizes information about a specific topic in an unbiased way with the aim at answering a specific research question. This type of research could be carried out qualitatively or quantitatively (meta-analyses). Aguilera (2014) went on to explain that both qualitative and quantitative reviews present evidence in a descriptive way but the latter rely mainly on statistical and/or mathematical techniques.

Perhaps the main challenge of a systematic review is the appearance of bias in the selection of the studies to be reviewed. In order to minimize the selection bias problem, it is necessary to define the tools to search for the studies, the inclusion and exclusion criteria to assess them and the plan to synthetize and analyse them (Nightingale, 2009; García-Holgado et al., 2020). We selected four electronic databases, EBSCO, ELSEVIER, JStor and Taylor and Francis, since they were accessible through the web page of our institution and their searching configurations (logical expressions/filtering options/fields) are similar.

For the inclusion criteria, we selected works written in English or Spanish related to the topics which are discussed in this paper, specifically, those published in peer-reviewed journals, conference proceedings and books in the five years previous to writing the paper (2017-2022). However, we chose to expand the search since there were seminal papers such as that of Frey and Osborne (2013) which was an important reference for more recent works and we also realized that we needed older documents which would help us clarify the theoretical roots of our discussion and/or the Mexican context.

During the search, we used different synonyms in both languages. For instance, "estado de bienestar en México" OR "estado interventor en México"; "Mexican welfare state" OR "Mexican intervening state" and so on. The search produced almost two hundred results, which we classified into four main topics: the welfare state; social innovations; the labor market; and the ICTs. After having read the titles and abstracts of all of them, we also selected the papers listed in the reference section at the end of this document. We complemented this information with official documents and surveys which we came across while reviewing our final list of bibliography.

## The welfare state, social innovation and the labor market

In order to be able to answer our research question, we first have to contextualize the concept of social innovation and clarify its relationship with the welfare state and the labor market. During the first half of the twentieth century, most of the developing countries across the world built their welfare state in order to

tackle social problems such as unemployment and poverty, which had been brought about by the opening up of the economy at the end of the nineteenth century.

Therefore, there are as many classifications of the welfare state across the world as there are types of democratic-capitalist states. For instance, Esping-Andersen (1990) identified three different welfare regimes with similar configurations of political ideologies, resource mobilization and institutional structures. He argued that Canada, the US and Australia were examples of the liberal type which presents usually minimal state intervention, strong participation of the private sector in public spending, and where citizens are understood as individual actors who must seek their own well-being in the market.

Germany, France, Austria and Italy, on the other hand, were said to be examples of the conservative type in which state intervention happens only when the capacity of the family to solve welfare problems is exhausted, and there is a strong involvement of the civil society in the bargaining of social rights, which brings about a rigid labor market. Finally, the Scandinavian states were an example of the social democrat type, in which state intervention is pervasive in terms of equalizing the economic opportunities of the citizens and promoting full employment.

Within the developing world, we can also identify at least two different regimes, namely insecurity regimes and informal security regimes. The main difference between these states is also the way in which welfare is produced and distributed between the state, the market and the family. However, in middle-income countries, state intervention has, to different degrees and levels, failed (Ortiz, 2018).

In insecurity regimes, there used to be great dependence on international aid to finance their welfare systems, since the weakness of their states prevented them from channelling the interests of the different actors of the social structure in favor of the public interest. This usually brought about political conflicts and economic instability which used to block the emergence of stable informal mechanisms to mitigate adverse effects (Wood & Gough, 2006). Most sub-Saharan African countries developed this type of system. In recent years, some authors have argued that the recent processes of democratization which these countries have undergone brought about a related increase in public spending. However, government corruption and inefficiency force citizens to rely on social networks to satisfy their needs, which might seem to be a move from an insecurity regime to an informal security regime (Amoah, 2020).

In informal security regimes, on the other hand, people used to rely heavily on social networks to solve their welfare needs, which typically resulted in the exclusion of the most vulnerable groups, and these can be divided into two types: those in which there is an effective state intervention, as is the case in Japan, South Korea and Singapore in East Asia, and those in which there is an inefficient state intervention, as in the Latin American countries (Wood & Gough, 2006). Democracy has also hit the East Asian countries recently, allowing the emergence of political parties and social actors which have challenged the dominance of economic theory in the formulation of social and labor policies. This has allowed them to introduce public policies against technological unemployment and universalize the provision of health services and pension systems, among other aspects (Fleckenstein & Lee, 2017).

As for the Latin American countries, in the last two decades the region has experienced significant improvements in its social indicators, especially in the reduction in income inequality, attributed to a

significant increase in social spending (Ocampo & Gómez-Arteaga, 2018) and the democratization processes which this region has experienced in recent years with left-wing political parties which have put pressure on an existing regime or come to power with the promise of solving social problems such as poverty, technological unemployment and the violation of human rights (Garay, 2016; Fairfield & Garay, 2017).

Developed nations, on the other hand, reduced their social spending after the 2008 financial crisis since the importance of welfare states around the world was questioned (Ocampo & Stiglitz, 2018). Consequently, the well-being of citizens has outstandingly worsened, especially in the liberal and conservative regimes (Polaski, 2018).The Scandinavian welfare states are the ones which have been able to cope with the crisis (Ocampo & Stiglitz, 2018).

Even so, they have had to reduce important social benefits as well, such as the duration of unemployment insurance and the stratification of the pension system. Most importantly, not even the Nordic countries have been able to give an adequate answer to how to mitigate the negative effects of the introduction of the ICT revolution on labor markets, which is one of the most important challenges of welfare states all over the world (Ocampo & Stiglitz, 2018; Polaski, 2018; Hiilamo, 2021; Ostberg, 2021).[1]

The lack of solutions to this issue has forced the appearance of social innovations to tackle problems which neither the market nor the state have been able to solve. Schumpeter (2012) argued that the impulse which keeps capitalism moving comes from the opening of new local or international markets, the introduction of new methods of production or transportation, and the novel forms of organization which are created over time.

This process of creative destruction in which a new economic structure replaces the existing one later became known as innovation. In this line of thinking, innovation can only be considered 'social' if it is aimed at improving the well-being of the most vulnerable groups in the society (OECD, 2005). In other words, 'social innovation' implies implementing measures to tackle social problems such as unemployment, poverty or violence, which are increasingly complex and can hardly be solved only by nation-states, the market or any other social agent.

In consequence, international, national and local social innovation systems have to include the different actors in society to jointly solve social problems, especially the most vulnerable groups. Bernaloa (2016) argued that social innovation is not limited only to social and exclusion policies, nor to entrepreneurship, technology or social enterprise, but can include intangible forms such as institutional, organisational and commercial innovation. In this sense, social innovation must be understood as a multi-dimensional phenomenon and must consequently be approached from a range of perspectives. Its main objective, then, is social cohesion.

In short, social innovation is the combination or configuration of solutions to social problems which have not been able to be solved either by the market or the state and in which the different social actors involved participate, especially the most vulnerable or disadvantaged groups (Domanski et al., 2016; Guaipatin &

[1]Freeman and Perez (1988) pointed out that there have been five techno-economic paradigms: the mechanization of industry, steam engines, electricity, mass production with petroleum derivatives, and ICTs. The latter include computers, internet, smart phones, data science, artificial intelligence, machine learning among others. For the purposes of this paper, we adhere to this definition.

Schwartz, 2016). Consequently, a social innovation must be able to produce new social practices which have to be accepted, disseminated and institutionalized by society.

It is important to note, however, that the concept of social innovation is constantly changing like society itself. Monge and Allamand (2016) pointed out that social innovation is not an invention but rather a process of behavioral change which generates an effective solution to a social problem. This process can be led by any of the actors involved, that is, the government, the community, the private sector or non-governmental organizations, but it is important that the community is at the center of the solution so that the problem can be defined correctly.

Unfortunately, in most developing countries, social problems have been approached from an assistance or aid perspective in which there is a subordinate relationship between who assists and who receives assistance or aid (Domanski et al., 2016). Social innovation implies a change of focus or paradigm and moving from an aid culture to one of innovation, participation and collaboration (Monge & Allamand, 2016). Millard et al. (2016) stated that the study of social innovation has been led mainly by developed countries but it is becoming increasingly important in developing countries.

The importance of social innovation to cope with technological unemployment, especially in developing countries lies in the fact that, as Lee and Malerba (2017) pointed out, when a new technological paradigm emerges there are four phases in the process of catching-up which developing countries must follow: entry, gradual catch-up, forging ahead, and falling behind. Andreoni, Chang and Labrunie (2021) stated that in order for developing countries to be able to reach the forging-ahead phase, they have to be able to first build what they called 'foundational capabilities'.

As Andreoni, Chang and Labrunie (2021:5-6) said "capabilities to learn new technical and organisational solutions, integrate them into production, organise and commit resources over time for the effective deployment of these new solutions". In order to develop them, changes must be made during the entry and gradual-catch-up phases on three levels. First, the development of sector-specific production and technological capabilities; second, the development of organizational capabilities and structures; and third, institutional changes (Andreoni, Chang & Labrunie, 2021).

In order to analyse whether the foundational capabilities of a state enable it to tackle problems such as impoverishment and social inequality, it is necessary to first examine the way in which the ICTs have affected the labor market. Frey and Osborne (2013) found that there had been a decrease in routine jobs, that is, jobs which follow well-defined procedures, since they can be easily carried out by computer systems. In addition, employment was transferred from the industrial sector where it had been mainly concentrated during most of the twentieth century, to the service sector (Becerril-Velasco, 2019). But it will not stop there; Brynjolfsson and McAfee (2014) predicted that technological innovation will continue to increase and pervade not only the manufacturing and service sectors, but all kinds of jobs.

It is therefore necessary to know the patterns of change in the labor market with the intention that social innovations can be concentrated there. This is especially so because the poor of the current technological revolution are characterized, among other things, by limited freedoms regarding the appropriation of ICTs with a view to achieving the life they want (Sen, 2010). Furthermore, it is predictable that they will resist adopting new technologies to the extent that their skills become obsolete and their income declines. However, if the benefits of technological progress are properly distributed, they will gradually benefit an increasing proportion of the workforce.

The balance between employment generation and technological progress therefore reflects the balance of power in society and how the gains from technological progress are distributed (Frey & Osborne, 2013). In fact, as time has passed, the costs of ICTs have been reduced and with it the salaries of routine tasks through ICTs, which has expanded qualified employment. This has resulted in a polarized labor market, between high-income cognitive occupations and low-income jobs, in many developed and developing countries (Aboal et al., 2020).

The problem, as Keynes (1933) realised, is that the discovery of the means of economizing the use of labor exceeds the rate at which we can find new uses for labor. Consequently, government intervention is required to minimize technological unemployment, especially because, as Frey and Osborne (2013) pointed out, most of the occupations in the service sector, specifically in the areas of transport and logistics, along with most of the office and administrative support workers and the productive labor force are at risk. This means that low-skilled workers will be reassigned to tasks which require creative and social intelligence.

Autor (2015) stated that automation can not only replace routine labor, but also complement it, thereby increasing production and generating at the same time a greater demand for labor. An example of this can be seen in the implementation of automated teller machines (ATMs). Bessen (2015) said that it was believed that bank tellers would be replaced by ATMs, but, contrary to this assumption, their hiring was maintained and even increased, since by reducing cash-handling tasks, banks diversified their services requiring more banking executives.

Aboal et al. (2020) stated that the example of ATMs shows us that when innovative companies are successful and expand, they will typically require more human employment. However, it might also be the case that companies innovate their products or processes and displace others in the same market, which would bring about an increase in unemployment. This will happen, at least, when the displacing company expands its production as a result of the cost reduction produced by the innovation introduced.

Autor et al. (2003) identified two difficult tasks affecting digitizing. In the first place, tasks which require the ability to solve problems, such as intuition, creativity and persuasion, and these are characteristic of occupations such as medicine, law, financial analysis and programming languages in which high levels of education and analytical capacity are normally required. The second type includes manual tasks characteristic of the service sector jobs, such as food preparation, cleaning and janitorial jobs, security and protection services, and even agricultural work in the fields.

This would imply, Autor (2015) maintained, that the digitization of the labor market brings with it an increase in wages for higher education jobs and for manual tasks at the expense of some routine jobs. Hirsch-Kreinsen (2019), on the other hand, pointed out that the digitization of employment in the industrial sector has implied a path-dependent process of transformation. That is, it has followed a route largely predetermined by the existing organizational structure and worker experience and skills. Consequently, it is difficult to think of an absolute break with the organizational structures of the company and with the skills of the workers, as has been assumed by some commentators.

In summary, for Hirsch-Kreinsen (2019) the current digitization process is about a moderate pattern of technological and social innovation through which companies implement new technologies and develop qualifications and competencies in proportion to the existing forms of organization of the plant and jobs, but without substantially changing its structures. More than that, Aboal et al. (2020) maintained that

technological change is not linear but because there are not only companies and workers, the productive system is much more complex, so there are markets, value chains, unions, cultural norms and regulations.

## Discussion and results

### The Mexican welfare state, ICTs and social innovation in Mexico

In this section, we shall analyse and discuss the way in which the Mexican welfare state has impeded access to ICTs in the labor market and, in consequence, has forced the appearance of socio-technological innovations. Although the Mexican Constitution of 1917 laid the foundations for social rights to be included in the Mexican legislation and since 1970 they started to be incorporated into the legislation, the problem is that no project for their incorporation has ever existed (Valencia, Foust & Tetreault, 2012). Moreover, it is not clear how to demand them and the way in which the state has to fulfil them, which raises the fact that social rights are not an explicit guide for government plans and programs (Becerril-Velasco, 2020).

Cossio (2010) argued that the problem is that in Mexico, the legal culture envisions those rights more as programs than as rights so that they cannot be demanded. Barba (2004) stated that during most of the first half of the twentieth century, welfare in Mexico was produced and distributed between the state, the market and the family following a dual logic. That is, there were two objectives: the political control of the population and the achievement of economic growth. That being the case, resource mobilization privileged urban areas in order to encourage the industrialization of the country by protecting domestic manufacturers from international competition, and the rest of the population was left unprotected.

The main argument, Barba (2004) explained, was that the industrialization of the country would bring about economic growth, employment generation, socio-economic equality and the integration of the unprotected population. In short, social policy consisted of passive labor market policies which privileged the formal sector, the quasi-universalization of basic services such as education and health and the exclusion of the rural and informal sectors. Different writers (for example Székely, 1998; Hernández Laos, 1992; Altimir, 1993) have argued that during this period the Mexican economy was, to some extent, stable and growing at around 3.0 per cent per year and poverty – understood as nutritional – was decreasing.

However, social innovation and the appropriation of technology were not taken into account since they were also seen as a consequence of the ISI policies. The ISI system was supposed to enable the Mexican state to produce its own technology and to compete internationally (Cypher & Pérez, 2013). Nonetheless, in spite of the fact that most of the merchandise which was traded was produced locally, the machinery and technology of the enterprises was imported and the only products imported were commodities.

During the 1990s, Mexico suffered a high debt crisis, brought about by a fall in oil prices, which inflicted high levels of inflation, unemployment, socio-economic inequality and poverty. In this context, following recommendations from different international organizations (International Monetary Fund, World Bank, Inter-American Development Bank), some structural reforms were implemented by the Mexican government with the purpose of achieving macro-economic stability, decreasing unemployment and alleviating poverty (Robertson, 2007).

The main market-oriented ideas were simple: to open up the economic sectors and to reduce the size of the state so that the markets could adjust to the new global order. Since then, fiscal discipline, the control of

inflation, trade liberalization, the privatization of state-run companies and the flexibilization of the labor market have become the main objectives of the state (Barba, 2004). In consequence, the welfare regime was also reformed and the focus of the social policy of the Mexican state has been poverty alleviation rather than social protection as it was in the previous periods. Consequently, the Mexican welfare regime went from a two-level regime to a residual and compensatory one (Ordóñez, 2009).

On that account, there have been two different stages of state intervention to alleviate poverty (Ordóñez, 2009). The first occurred at the end of the 1970s when the objective was to reduce poverty mainly in rural areas. However, the logic of those programs was merely to satisfy the needs of the people, who had not been covered by the social protection system which had been implemented to complement the industrialization of the country.

Therefore, the results were barely positive. Since 1988, social policy has sought to equalize the responsibility of the market and of the state as welfare suppliers. The first program of this second stage was PRONASOL, the main objective of which was to provide universal basic services such as health, education, housing and urban services to the poorest who did not have income-earning capabilities. However, PRONASOL was accused of being a clientelist and populist program and its existence could not prevent poverty from increasing during the monetary crisis of 1994-1995.

In this context, the first Conditional Cash Transfer (CCTs) program was launched and it was more focused on the causes rather than on the consequences of poverty. The successive PROGRESA (1997) - OPORTUNIDADES (2002) initiative was intended to break the inter-generational cycle of poverty and had as its main innovation the participation of the poor as a way to overcome poverty. The rationale of the CCT programs was to provide an income to the poorest families on condition that their children attended school and that the whole family had regular health checks.

Under this logic, children would grow up educated and healthy, which would enable them to continue earning an income in the labor market and to leave poverty by their own efforts (Levy, 1991). The only problem was that the CCTs were never part of a broader development strategy which included public policies which could complement it and enable the poor to achieve a sustained income by their own efforts (Becerril-Velasco, 2015).

In 2000, after 70 years of dominance by the center-wing political party PRI, the right-wing PAN took over for two different periods until 2012. However, they were unable to put forward an alternative welfare proposal and decided to continue with the social policies of the PRI. They renamed PROGRESA as OPORTUNIDADES and expanded the program and the enacted the first Law of Social Development in 2004 (Barba, 2004).

PRI took over again in 2012 and set about dismantling Mexico's CCT program understood in this paper as a social innovation. OPORTUNIDADES was renamed in 2015 as PROSPERA and the intention of breaking the inter-generational cycle of poverty was removed, although efforts were made, unsuccessfully, to link it with other programs to promote labor and productive inclusion, as well as the generation of income and financial inclusion. PRI also started to support young people who were studying for a BA. During all these periods, the CCTs had many positive effects on the well-being of the poor and in particular they helped to reduce the number of unskilled workers in Mexico.

Even so, there is little evidence to prove that the program was achieving its main goal. Moreover, poverty continued to grow over the years. According to the National Council for Evaluation (CONEVAL), there are

more than 40 million poor people in the country and the fall in oil prices of 2015 and the Covid-19 pandemic have clearly shown that the welfare regime is highly vulnerable to shocks to the economy.

In 2018, the left-wing political party MORENA took over in Mexico. This government labelled itself as non-neoliberal and it closed down the CCT program based on the argument that conditionalities were a neo-liberal way of allocating resources, and four similar programs were implemented in its place. The first of these was the 'Programa Nacional de Becas para el Bienestar Benito Juárez' (National welfare scholarship program), which was aimed at pupils at pre-school, elementary and middle or secondary school levels in poverty who were under fifteen years of age. The second was the 'Becas Benito Juárez para jóvenes en educación media superior' (Scholarship for students in extreme poverty in high-school education).

The third program was 'Jóvenes escribiendo el futuro para jóvenes en educación superior' (Scholarships for BA students in extreme poverty). The fourth was the 'Programa Jóvenes Escribiendo el Futuro' (Program for young people writing the future) directed at people aged between eighteen and twenty who were not studying or working in order for them to receive job training. The federal government gives them a scholarship and health insurance for a year to be trained in private sector companies, public institutions and/or NGOs so that they can receive training to develop skills which will enable them to join the labor market.

This fourth program has been the most important social innovation in terms of welfare since it is intended to redefine the relationship between the state, the market and workers by driving the insertion of young people into private companies. However, it is still too early to know whether the program has worked or not or if it has achieved some level of social cohesion. Most importantly, the new government not only separated the health from the educational component to directly alleviate poverty, but also did not replace the conditions for receiving the grant with any kind of mechanism to have the recipients involved in the solution of their problems.

However, it has been thought that by opening up the economy, ICTs would be easily accessible and appropriated, even by the most vulnerable groups of society. As a matter of fact, the Mexican state started the reform of the telecommunications sector with the aim of boosting competition, which would bring about poverty alleviation by privatizing the state-run company in charge of this sector – TELMEX – to the Mexican private company América Móvil, so that a fibre-optic network was developed in order to increase internet connectivity (Becerril-Velasco, 2019).

Mariscal and Rivera (2005) argued that the privatization of TELMEX to América Móvil enabled the government to meet the interests of the different actors involved, mainly the union, since in this way it would keep its unity and consequently its strength to survive. The reform increased the penetration of fixed and mobile telephones and tariffs were reduced. Nonetheless, this was concentrated in urban areas and América Móvil was the predominant player until 2013 since it was guaranteed that it would face limited competition for seven years so that it could adjust to the new global order (Ortiz-Mena & Rodriguez, 2005).

In 2013, a new telecommunications reform was approved to boost competition and to expand the infrastructure in order to equalize access to the different services. Among other important aspects, the reform established access to ICTs as a human right and empowered the governmental telecommunications institutions to impose regulations in order to enhance competition (OECD, 2017). Appropriately, América Móvil was declared the predominant player and it was forced to share its infrastructure in the sector free of

charge to increase internet and mobile telephone access. In addition, charges for nationwide long-distance phone calls were eliminated (IFT, 2014; Ayala et al., 2017).

In spite of all these advances, however, charges were still high vis-à-vis the marginal costs and América Móvil is still the predominant player (OECD, 2017). Moreover, in the poorest towns, internet providers have no motivation to invest since people cannot afford their services. In addition, América Móvil was able to postpone the resolution of the Federal Institute of Telecommunications due to the pervasively weak law enforcement of the Mexican institutions and the threats of the Union to go on strike if Telmex was to be divided (OECD, 2017).

The current government (2018-2024) has as its main priority the expansion of the coverage and penetration of broadband and internet. In order to do that, it has implemented new programs and given continuity to some old ones. First, it created the Social Coverage Program intended to increase the penetration and coverage of telecommunications and broadcasting services including broadband and the internet, under conditions of availability, affordability and accessibility in zones which lack those services, especially the most marginalized constituencies.

Second, the Connectivity Program in Public Sites was established, which was intended to generate a database of public sites through which internet access and availability would be facilitated. The government also continued the *Red Compartida* program which had started after the reform of 2013 and seeks to build infrastructure in the so-called last mile of poor localities so that internet providers can offer their services. Despite these efforts, information about the availability of the services which have been provided through the new programs is still scarce. Moreover, in 2013 when the telecommunications reform was carried out, it was established that by the end of 2018, at least 70% of Mexican households and 85% of all SMES would have access to the internet with a speed in accordance with the average of the OECD countries (Secretaría de Gobernación [SEGOB], 2013, par. 9).

Nevertheless, according to the National Survey of the Availability and Use of Information Technologies in Households (ENDUTI H is the acronym is Spanish) which is conducted annually by the Mexican National Institute of Statistics and Geography (INEGI is the acronym is Spanish), by the end of 2020 internet access had reached only 60.6% of Mexican households (INEGI, 2020). In relation to the SMEs the situation is even worse since there is no available data.

The government also continued PROSOFT, a successful program whose principal objective is to contribute to the development of processes, products and services in the software industry through innovation in the priority sectors of the national economy. However, it has no links with anti-poverty programs. Most importantly, all these efforts have yet to reach the labor market so that the poor can gain access to the so-called Information and Knowledge Society by leading their economic destiny through the ICTs.

Moreover, the probability of most of the employment across the world being digitalized is very high and Mexico is no exception. Actually, there have been a significant number of studies assessing the probability of the digitalization of employment in Mexico. Most of these investigations have followed Frey and Osborne's (2013) work. They explain that routine jobs are the ones which are more exposed to digitalization, that is, jobs which follow well-defined procedures, since they can be easily carried out by computer systems.

Cebreros et al. (2020) for example, suggested a list of occupations which could be easily automatized, including tax accountants, library technicians, customs specialists, mathematical technicians, telemarketers, insurance sellers, catalogue sellers and tailors. They estimated that 65 per cent of employment and 57 per

cent of formal employment in Mexico is at high risk of being digitized and that less experienced (younger) and less educated workers are the ones who could be more subjected to displacement by technology. As far as gender is concerned, they argued that male jobs are more exposed to digitalization since 69 per cent of jobs occupied by men are at risk of automation whereas for women the number is 59 per cent.

A similar exercise was conducted by Minian and Monroy (2018) using Frey and Osborne's (2013) methodology; they estimated that 63 per cent of the total employment and 64.5 per cent of the employment in the manufacturing sector is at high risk of being digitized. Equally, they found that less educated workers are the most vulnerable to being displaced by technology. They stated that 70 per cent of the low-skills jobs are at high risk of digitalization since most of them are routine jobs or occupations, whereas only 40 per cent of the high-skills jobs or occupations are in this situation.

Even so, as Autor (2015) pointed out, digitalization cannot just replace routine labor, but can also complement it, thereby increasing production and generating at the same time a greater demand for labor. This would therefore imply that the digitization of employment brings with it an increase in wages in higher-education jobs and in manual tasks at the expense of some routine jobs. The Covid-19 pandemic, which the world experienced, showed this to be accurate, at least in the case of Mexico.

In order to survive, micro and small enterprises in the service sector had to move their activities to online sales, especially in large urban zones. Chiatchoua and Lozano (2022) surveyed two hundred micro and small enterprises in Mexico City and estimated that at least 63 per cent of them did not use online sales before the Covid-19 pandemic, but they found that at least 30 per cent of the total number of enterprises surveyed had changed their sales model and product delivery to online, 22 per cent had changed their business model in order to survive and 26 per cent had had to close it: the rest had losses of income but survived.

In the industrial sector, on the other hand, the adoption of ICTs in Mexico has proved Hirsch-Kreinsen's (2019) prediction to be correct. Hirsh-Kreinsen (2019) pointed out that the digitization of employment in the industrial sector follows a route mainly predetermined by the existing organizational structure and worker experience and skills. Unfortunately for Mexico, it has been shown that firms present weak technical and institutional capabilities for integrating digital technologies into their production processes (Casalet & Stezano, 2020; Casalet, 2020).

Garduño (2021) surveyed employees of manufacturing companies in the electronics sector in Mexicali, Baja California, to determine their maturity level of Industry 4.0 and concluded that those enterprises had barely an intermediate digital maturity level since technology was known and used only in the processes in which engineers with high digital skills were involved. Contrastingly, workers in operator positions not only were not able to use new technology due to their low digital skills, but also their jobs were highly vulnerable to being automated.

Martínez (2021) similarly surveyed private companies located in Guanajuato and found that even the Covid-19 pandemic has not been able to accelerate digitalization since the main strategies which most of the companies had implemented were focused only on home-working and marketing. Some might argue that digitalization strategies and the types of jobs required depend on the sector to which they belong in terms of size, the technological complexity of the product or service provided and the leadership capacity.

Casalet (2020), however, found that even in the automotive, aeronautical and computer services sectors – national leaders in the adoption of technology – digitization is incorporated as an incremental process (as in previous technological revolutions) but that the global cross-sectoral disruptive nature of digitalization and

its effects and impacts have not yet been fully understood. In addition, as discussed above, technological change is not linear since there are markets, value chains, unions, cultural norms and regulations among other significant factors (Butollo, 2020).

In this context, different socio-technological innovations have sought to tackle social which neither the market nor the state have been able to solve. Cano, Bello and Barba (2011), for instance, found out that in the river sub-region of the municipality of Balancán, Tabasco, an invasive species of fish (*plecos*) had negatively affected the economic capacity of fishing cooperatives. They found that only the strongly institutionalized and technified cooperatives were able to come up with social innovations to: 1 create technological methods of removing *plecos* from the nets without hurting their hands; 2) look for options to diversify production and; 3) form a federation of fishermen.

Jaramillo et al. (2019) researched the key elements for setting up a social innovation laboratory with the purpose of generating solutions to social problems through the application of innovation and technology processes for social appropriation. López-Barberena (2018), on the other hand, identified some crucial aspects of creating a technological observatory for the wine sector in Mexico and found that there are many common problems which wine producers face and which neither the state nor the market have been able to solve, such as price fluctuations and the excess of laws which obstruct the flow of the production processes.

López-Barberena (2018) stated that a technological observatory could importantly contribute to solving those problems by generating information (economic data, exports, products and services offered) to help the management and the decision-making. Rivera et al. (2018), on the other hand, reported how the local Ministry of Employment in Mexico City had proposed a social innovation to generate employment which involved one of the most important Mexican universities, the National Polytechnic Institute (IPN is the acronym in Spanish), and cooperative societies, which are organizations whose members have common interests and aim at achieving collective goals through economic activities of production, distribution and consumption of goods and services.

The proposal of the Ministry of Employment was to provide financial support to the cooperative societies for purchasing machinery and equipment and, with the help of the IPN, education and training in cooperative development and the professionalization of their production and commercial processes. Nevertheless, most of these previous studies have failed to determine the different causes which prevent technology from being accessed by the vulnerable groups and contributing to generating social innovations to solve societal challenges such as poverty and technological unemployment. In this context, the challenge facing the state would then be to create an enabling technology-based social innovation environment through the generation of foundational capabilities which help workers and companies, especially SMEs, to adapt to technological changes and appropriate new technologies.

## Conclusion

We have made it clear that the Mexican welfare state has severely affected the reduction of poverty and technological unemployment since the appropriation of technology has been barely taken into account within its structure. Consequently, the foundational capabilities of the Mexican state needed to close the existing digital divide in the labor market are weak and feeble on at least three levels: productive sectors, the

organizational structure of firms and the institutional framework of the state. In this context, different socio-technological innovations have been introduced to tackle social problems which neither the market nor the state have been able to solve.

Previous studies reported in the literature have failed to identify the different causes which prevent technology from being appropriated by the vulnerable groups and from contributing to generating social innovations to solve societal challenges such as impoverishment and technological unemployment. The most important challenge for the state is to lead the creation of an enabling technology-based social innovation environment by developing sector-specific, technological and organizational capabilities and an institutional framework which will help workers and companies to adapt to technological revolutions and contribute to reducing poverty and technological unemployment. We conclude that empirical approaches to the links between social innovation, the labor market and poverty are indispensable to advancing the discussion about the design of the provision of welfare in the twenty-first century.

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