

FIRST PART

GENERAL SECTION

SOCIAL SECURITY AND INDUSTRY 4.0

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SUMMARY: I. *Introduction*. II. *Conceptual Framework*. III. *Advantages and disadvantages of Industry 4.0 in social security*. IV. *Analysis of Industry 4.0 in social security systems*. V. *Is social insurance possible in light of Industry 4.0?* VI. *Conclusions and proposals*. VII. *Research sources*.

I. INTRODUCTION

Throughout history, different forms of production of goods and services have marked economic development, a large proportion of the relations between people, and relations between employers and workers. With the emergence of social insurance as the main work-related social security mechanism, it is possible to say that social security has also been influenced by production and economic processes.

It is therefore appropriate to analyse social security in the light of a new worldwide form of production: Industry 4.0. In other words, this new model of organization features the indispensable use of information technologies (digitalization), the control of the value chain during the product's whole life cycle, and the substitution of manpower in the process, to a large extent.

This chapter addresses several aspects of the analysis of social security in light of Industry 4.0. Afterwards, a second section follows, with a deductive research method and presents a conceptual framework that helps understand how the traditional figures of insurance, labor, worker, and so on, require different profiles when linked to Industry 4.0's needs. Only then can we speak of a 4.0 worker, 4.0 work and, naturally, 4.0 social security.

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A third section analyses the advantages and disadvantages that Industry 4.0 can convey to workers, employers and social security institutes. Section IV is devoted to the specific analysis of Industry 4.0 in social security systems from the perspective of the main social insurance systems in the Western world: the pay-as-you-go system and the individual capitalization system. An analysis on the changes and needs in each of the branches of social security is included before going on to the final topic: the theoretical discussion on whether social insurance is possible in Industry 4.0 and if so, what aspects it should include.

Lastly, the chapter closes with a few brief reflections reaching for a conclusion and the relative research sources.

II. CONCEPTUAL FRAMEWORK

To speak of Industry 4.0 –also known as the Fourth Industrial Revolution– means to immerse oneself in a phenomenon of a global nature, which affects many areas of life; and of course social security is not an exception. In this order of ideas, this conceptual framework will make it possible to define the main concepts which will serve as a guide for the analysis of this chapter's main topic. These terms include Industry 4.0, social security, 4.0 employment, 4.0 worker, among others, to stimulate the debate about the current development of these concepts and to establish a position in the course of this work.

1. *Industry 4.0*

From primitive to modern man, forms of work have mutated because of the technological advances that have taken place at given times in history. These major changes, also known today as Industrial Revolutions, tend to translate into abrupt and radical changes that have an impact on movements in a country's economic systems and social structures.¹

Throughout history, different authors coincide (Arnoldo Martínez Ramírez, Klaus Schwab and Giovanni Stumpo, among others) that four industrial revolutions can be identified because they have broken paradigms

¹ Cfr. Schwab, Klaus, *The Fourth Industrial Revolution*, Debate, 2017, p. 1.

within different aspects of people's lives around the world; also, undoubtedly, in the field of labor and social security.

- The First Industrial Revolution emerged in the 18th Century (1760–1840) with the invention of the steam engine and the construction of the railroad;
- The Second Industrial Revolution appeared in the late 19th and early 20th Centuries and was marked by chain or mass production;
- The Third Industrial Revolution began in the 1960s with the invention of the computer and the Internet;²
- Today we are facing the Fourth Industrial Revolution, also known as Industry 4.0, marked by the digitalization of the industrial world through manufacturing processes and the interconnection of the Internet of Things.³

The term Industry 4.0 appeared in 2011, officially established by the German government to refer to *a new model of organization and control of the value chain through the life cycle of a product and throughout manufacturing systems, supported and made possible by information technologies*.⁴

Simply put, digital technologies enable the interaction of physical elements (raw materials, machinery) with the digital world for a more effective and efficient production.⁵

Digital technologies are typically the famous *clouds* (data cloud), Big Data, cyber-physical systems, sensory and robotic technologies, additive or layered manufacturing 3D printers, robots, telework, remote payments, collaboration on shared documents, mobile communication, augmented reality, geolocation, apps⁶ and many more being developed day by day.

² Cfr. Departamento de Geografía e Historia, *Las revoluciones industriales*, Spain, <http://perseo.sabuco.com/historia/revolucionesindustriales.pdf>.

³ Fernández, Miguel Ángel, Pajares Roberto, *La digitalización del mundo industrial*, Spain, p. 41.

⁴ Conferencia de Directores y Decanos de Ingeniería Informática, *Industria 4.0: la transformación digital de la industria*, Spain, p. 3, <http://coddii.org/wpcontent/uploads/2016/10/Informe-CODDII-Industria-4.0.pdf>.

⁵ Blanco, Raúl, *et. al.*, *La industria 4.0: El estado de la cuestión*, Spain, p. 151.

⁶ Kahale Carrillo, D.T., *La formación (española e italiana) en la Industria 4.0*, Universidad a Distancia de Madrid, Spain, 2016, p. 45.

The Fourth Industrial Revolution consists, therefore, in the application of new technologies in production processes in such a way that their operation is automated, intelligent and efficient.

In this context, Industry 4.0 can be construed as man–machine interaction in a different way, stemming from the fact that communication goes from being solely between humans to being established between humans and machines or –more characteristically for this revolution– only between machines, without the intervention of the human hand.⁷

It should be noted that it is extremely complicated to have only one specific definition that applies to Industry 4.0. It is sufficient to say that in 2015, Carolina Castresna pointed out that there were more than 134 definitions to explain this global phenomenon.⁸

What is clear is that each of these concepts have certain similar components, worth analysing:

A. *New organization model*

This is a new model that breaks traditional work patterns between people or man–machine interaction. Now, this pattern stands out mostly because of its machine–machine relationship.

B. *Automated Systems*

To have an automated system, two very important aspects are involved: digitalization and the Internet of Things.

a) Digitalization is a process that began with the transformation of analogue information to digital information, which has many advantages. For instance, files are more compact and can be detected and measured by sensors, including, say, sound recordings, video recordings, documents, images, environmental data such as temperatures and wind speeds or magnetic fields, and so on. Therefore, information can be used, processed, reproduced, stored and distributed through data processing systems for a long

⁷ Mendizábal Bermúdez, Gabriela, *et. al.*, “¿Nuevo modelo de seguridad social en el contexto de la industria 4.0?” *Revista Internacional y Comparada de Relaciones Laborales y Derecho del Empleo*, Italy, Vol. 6, Year 2018, No. 1, January–March 2018, pp. 298-327.

⁸ Castresna Saenz, Carolina, *et. al.*, *Industria 4.0*, Universidad de la Rioja, Spain, 2016, p. 12, https://biblioteca.unirioja.es/tfe_e/TFE002004.pdf.

time and without any loss of quality. Nowadays, digitalization also generates *the process by which a message is converted into a series of electrical impulses responding to combined digits*⁹ in order to transmit a specific instruction and/or action to a receiver (a robot, machine, computer);

b) The Internet of Things, also known as connected smart devices, consists of *the integration of sensors and devices in everyday objects that are connected to the Internet through fixed and wireless networks*,¹⁰ producing autonomous communication (without the intervention of man) among said objects to achieve a specific objective. This means that the interaction is based on machines (objects) and almost completely eliminates human intervention. In this way, an autonomous system is created in production chains. Therefore, digitalization through intelligent production processes with Internet interconnection between objects can increase productivity and efficiency.

C. *Information and Communication Technologies (ICTs)*

ICTs are an essential part of the development of automatic systems in the Fourth Industrial Revolution. These are understood as *the technologies*¹¹ *needed to manage and transform information*;¹² that is to say, the medium through which a given action is intended to be carried out, notably computers, programs, and so on, that allows information to be created, modified and stored.¹³

D. *Efficient production*

The main objective of this industrial revolution is the production of goods or services in a shorter time and at a lower cost, but with higher quality, thus benefiting both companies and customers in such a way that

⁹ Multimedia, *Digitalización*: <http://www2.udel.cl/~lsalazarv/digitalizacion.html>.

¹⁰ Fundación de la innovación Bankinter, *El internet de las cosas en un mundo conectado de objetos inteligentes*, Accenture, 2011, p. 6.

¹¹ According to the RAE [Royal Spanish Academy], technology is the set of industrial instruments and processes of a given sector or product. <http://dle.rae.es/?id=Zj2KRZZ>.

¹² Sánchez Duarte, Esmeralda, “Las tecnologías de información y comunicación (TIC) desde una perspectiva social” *Revista Electrónica Educare*, Costa Rica, vol. XII, 2008, Special Issue, pp. 155-162.

¹³ *Cfr. Idem.*

efficient production is paramount in Industry 4.0. Unfortunately, with this efficient production, the worker can be a part of the losers in the process.

E. *Direct customer interaction*

One feature of this revolution is the client's direct intervention in the production process of the good and/or service (on-demand economy). From the comfort of their home and using information technologies, users can order a product, characteristics and features they want with a single click. This makes it possible not only to consider individual customers' wishes, but also to develop completely new industrial products and business models.

In this sense, we can say that Industry 4.0 is a new organizational model that relies on automated systems – made possible by information and communication technologies – to allow the efficient production of goods and/or services, including the customer's direct interaction amidst what is produced and what is done to produce it.

2. *Social Security*

Tomandl states that social security is every area of law that deals with covering the risks of illness, maternity, unemployment, age, disability, occupational accidents, family burden and death of the family's provider, within the framework of insurance, prevision or prevention, as well as the various processes that are instituted by the State or at least supported and controlled by said State.¹⁴

There is an endless number of definitions because there is no definition that adapts to the needs and the development this figure has in each country. It is a dynamic concept that is transformed by economic crises, social changes, the new needs of the population to be met and the tools developed to do so.

Notwithstanding the above, we can point out that social security today is a human right embodied in the benefits that the State must guarantee, in an orderly fashion, to all individuals in society with the aim of protecting them from social risks and meeting their basic needs.

¹⁴ Author's translation of: Tomandl, Theodor, *Grundriss des österreichischen Sozialrechts*, Austriaverlag, Wien, Austria, 1992, p. 4.

In other words, along with the social dimension of social security – which is enshrined in the protection of a society’s economically weak class – we can find the protectionist principle of solidarity to assist all the individuals in every population, in the event of any social risk. Therefore, in Mexico the main instrument to achieve this are social insurances, although the scope of some complementary measures that provide social assistance and public or private charity should not be undermined.

A. *Social Insurance*

In Mexico, social insurance is the instrument through which workers and the State combine their efforts to protect the rights of the working class against the rights of the employers and entrepreneurs, with the goal of enabling a better quality of life.

Social insurance is an instrument of social security; it is the organized and systematized knowledge of this legal field that allows it to define its precise application.¹⁵

For Gustavo Arce, social security is:

the instrument of workers’ rights, by which a public institution is obliged, through quotas or premiums paid by employers, workers and the State; or by only one of them, to provide the policyholder or his beneficiaries, who must be economically weak members, with a pension or subsidy when any professional risk or social accident occurs.¹⁶

B. *Social Assistance*

Mexican context requires that we understand social assistance as an important social security tool, since 60 per cent of the economically ac-

¹⁵ It is imperative that social insurance be seen as an instrument of social security and not erroneously confused with the IMSS (Mexican Social Security Institute). The results of surveys conducted in 1994 for the undergraduate thesis “Internationalization of Mexican Social Security” yielded surprising data: 60 percent of the people surveyed associate the concept of social security with social insurance and therefore with the Mexican Social Security Institute. *Cf.*: MENDIZÁBAL BERMÚDEZ, Gabriela, *Internacionalización de la Seguridad Social Mexicana*, Undergraduate thesis, School of Law, UNAM, 1994, p. 167

¹⁶ Arce Cano, Gustavo, *De los Seguros Sociales a la Seguridad Social*, Ed. Porrúa, Mexico, 1972, p. 15.

tive population works in the informal sector¹⁷ and therefore does not enjoy the benefits of social insurance. For them, social assistance programs established term to term by federal and state governments are important, and in many cases are only a mitigating factor to problems originated from the lack of insurance. Examples of this are *Seguro Popular de Salud* (People's healthcare insurance) and *Pensión para adultos mayores* (Pension program for the elderly), which are poor substitutes for health and old-age insurance. Even then, they should not be downplayed because *Seguro Popular de Salud* is the only form of healthcare available to many Mexicans and, for other Mexicans the pension program is the only economic income available in their old age. According to the Mexican Legal Encyclopaedia, social assistance consists:

of the instruments at the State's disposal to remedy or protect those who suffer from a certain degree of social precariousness or who are economically weak because they do not have any type of social protection or who receive insufficient benefits to meet their needs.¹⁸

In other words, social assistance is the legally organized aid provided by the State for the economically weaker classes or vulnerable sectors within a society.¹⁹

3. 4.0 Social Security

We contribute to the discussion on this last topic, social security 4.0, an initial – albeit still incomplete – reflection: 4.0 Social Security is the set of social programs (PPS), social insurances (labor law benefits) and mandatory public and private services, integrated in a network along with various mechanisms of legal enforceability, that positivizes and materializes the human right to social security in a society ruled by Industry 4.0.

This concept's construction responds to the objective of attaining social security in the face of Industry 4.0, more than to what it is today. To reach this concept, it is necessary to consider other factors that change in the pro-

¹⁷ Murayama Rendón, Ciro and Gómez Tovar, Rosa, *El mercado de trabajo en México. La opinión social sobre la precariedad laboral, encuesta nacional de economía y empleo*, UNAM, Mexico, 2015, p. 132

¹⁸ Cited by Mendizábal Bermúdez, Gabriela, *La seguridad social en México*, 3^a. Ed. Porrúa, Mexico, 2018, p. 95.

¹⁹ *Idem*.

cess of Industry 4.0, such as workers, labor, and so on; factors that are analysed within the following lines.

A. 4.0 *Work*

The Fourth Industrial Revolution and the important technological developments that have a direct impact on the world of work caused a transformation in the ways of working and normal work patterns are no longer being followed. As a result, the traditional concept of work is mutating to adapt to the current facts and realities seen in today's work environments.

In two books published by the Ministry of Labor and Social Affairs: the Green Paper (2015) and the White Paper (2017) on "4.0 work", the German government states that the term should be understood as:

changes taking place in the whole of the working world and their implications for society. 4.0 Work does not describe today's normality, but future perspectives, scenarios and opportunities to shape labor in a way which benefits people and advances our economy.²⁰

In view of the above, "4.0 Work" aims to break with the traditional patterns in the world of work by promoting labor led and accompanied by the use of new technologies, providing opportunities for flexible work through the use of digital networks and the cooperation between people and machines, which not only transforms the way goods are produced, but, in turn, creates new products and services to benefit people.²¹

Certainly, the term "4.0 Work" is closely related to the current Fourth Industrial Revolution, where the forms of work and employment are at the centre of everything, not only in the industrial sector, but in all aspects of the world of work.²²

²⁰ Mendizábal Bermúdez, Gabriela, *et. al.*, *op cit.* p. 305.

²¹ *Cfr.* Bundesministerium für Arbeit und soziales, Weiss buch Arbeiten 4.0, Bundesministerium für Arbeit und Soziales Abteilung Grundsatzfragen des Sozialstaats, der Arbeitswelt und der sozialen Marktwirtschaft, Berlin, 2017, p. 3

²² Author's translation of Bundesministerium für Arbeit und soziales, Weiss buch Arbeiten 4.0, Berlin, 2107, p. 198.

B. 4.0 Worker

The technological advances of Industry 4.0 undoubtedly have a direct impact on the fundamental subjects of the world of work, i.e., workers.

As stated above, these technological revolutions not only modify production processes, but they also include all the actors in the workplace.

In this context, the evolution of a worker into a 4.0 worker responds to the new needs of the world of work as a result of the technological wave it entails. The truth is that the evolution of labor has always been affected by the invention of new technologies, which has led workers to adapt to the changes brought by these developments.

The great paradigm that has shaken the Fourth Industrial Revolution has been the short transition time between this revolution and the previous one, as well as the digital technologies that are being implemented every day. These technologies cannot be compared to the ones from past industrial revolutions, where, although man was most certainly substituted in carrying out certain work activities, the human hand was indispensable to perform work, unlike what is seen today.

Thus, the 4.0 worker, the worker of the future, will most absolutely be one who has the skills needed to perform the new jobs or transformations that arise from Industry 4.0.

The 4.0 Worker will be versatile and capable of having a variety of skills, not just in a specific field, but he or she will be able to master and adapt to the needs the world of work calls for, or else the worker will become obsolete because of this century's technological developments.

The fact is that 4.0 Worker must have digital literacy²³ that allows him or her to be competent, flexible and indispensable to the work challenges he or she might face in this technological revolution.

To think otherwise or to refuse to do so would mean that traditional workers would be left out of the labor market, preventing them from acquiring the necessary means that would allow them to enjoy a dignified quality of life and, naturally, preventing their access to social security.

²³ Digital literacy is the knowledge and skills to deal with new technical devices and hence formed the necessary information and communication networks, https://www.bmas.de/SharedDocs/Downloads/DE/PDF-Publikationen/a883-weissbuch.pdf?__blob=publicationFile, p. 199.

III. ADVANTAGES AND DISADVANTAGES OF INDUSTRY 4.0 IN SOCIAL SECURITY

Any process of change brings advantages and disadvantages, as well as challenges to face. Labor and social security aspects of the process of Industry 4.0's change have the following benefits and shortcomings:

- The advantages of Industry 4.0 for social security include the following:
- A reduction of occupational risks: the use of intelligent safety models integrated into machines (automobiles, robots, etc.) reduces the risk of human error so that accident prevention is greater.
- Flexibilization of work: the use of technologies can assist the easing of work by reducing the time spent on performing an activity, and thus being able to allocate the remaining time to leisure, professional or personal training activities, which directly benefit workers' physical and mental health, as well as encouraging a balance of work, social and family life.
- Higher productivity gains: the use of technologies can lead to an unlimited number of economic possibilities.²⁴

At the same time, the disadvantages of Industry 4.0 are present in the following aspects:

- Rising unemployment: in producing a given good or providing a given service, new technologies like robots, sensors or computers will be used, running the risk of eliminating some or several jobs performed by human beings; therefore its direct impact on social security would be through the use of unemployment insurance.
- Wage reduction: reducing working hours will also reduce workers' wages and thus affect social security contributions, reducing pension amounts in turn.
- Transition from labor contracts to professional services contracts: going from labor contracts for an indefinite period to project contracts means that possibilities to access an old-age pension are lost under the current regulations as they imply shorter contribution times.

²⁴ Packaging, *Ventajas de la Industria 4.0*, 2017, <http://www.packaging.enfasis.com/notas/77824-lasventajas-la-industria-40-el-sector-alimentos-y-bebidas>.

- Greater burden on social assistance or aid: with a high unemployment rate, people will lose their main source of income and therefore will not be able to cover their basic needs, thus obliging the State to intervene through social assistance programs and not by strengthening social insurance.
- Increased psycho-social risks: Considering increased levels of work-related stress, the advancement and development of new technologies play an important role, since the pressure exerted by the environment to be up-to-date and master new technologies sets a rhythm and tension that may be difficult to overcome by oneself.²⁵
- New diseases: these are related to the direct collaboration of people with machines or robots, facilitating a person's isolation and restricting the person to act as a simple operator.

However, the main challenges are linked to the fact that *the future of work will be made up of jobs that still do not yet exist in industries that use new technologies*.²⁶ Therefore, provisions need to be made for training and capacity building for new jobs, as well as for new occupational risks or illnesses arising from said positions, which will need to be addressed. In addition, the challenge lies in finding a balance between technological development and the respect for workers' rights, as well as implementing the protection needed for work in the digital era.

The freedom and flexibility that workers gain with 4.0 Work should not be countered by the constant need of training or by the increased workload related to the loss of personnel or the displacement of human work by robots.

IV. ANALYSIS OF INDUSTRY 4.0 IN SOCIAL SECURITY SYSTEMS

1. *Pay-as-you-go system vs. individual capitalization system*

Given the technological advances in the world of work and the consequences of people being replaced by machines in production chains, the following questions should be considered: How will the right to social security

²⁵ Prado Sagera, A., *Nuevas tecnologías y nuevos riesgos laborales: estrés y tecnoestrés*, <http://rabida.uhu.es/dspace/bitstream/handle/10272/3414/b15756531.pdf?sequence=1>.

²⁶ Díaz, Viviana., *Revolución Industrial 4.0, inflexión para la fuerza laboral*, 2017, <http://www.prensariotila.com/19524-Revolucion-Industrial-40-inflexion-para-la-fuerzalaboral.note.aspx>.

be guaranteed to those who are displaced from their jobs by machines? How will protection be granted in the event of a work-related risk for 4.0 Workers? Or better yet, which insurance system will guarantee the benefit of a pension in old age?

At this point, concerns arise when it comes to determine how social security financing systems can be adapted to the demands and needs that Industry 4.0 implies for workers through the new transformations of labor.

Therefore, it is necessary to analyse the two main and polarized financing systems: pay-as-you-go and individual capitalization:

a) The “pay-as-you-go” system: Also known as the public system, is financed on a tripartite basis (worker, employer, State) and is marked by the established benefits at the time of earning the right to a pension. In other words, the amount of the pension *is not necessarily related to what was contributed during active life, but to a different designation that can be calculated in a number of different ways.*²⁷ In the case of a pay-as-you-go scheme, the contributions made by active workers will be used, for instance, to pay the pensions of older adults, while these active workers’ pensions will be financed by future generations, giving rise to the so-called intergenerational solidarity.²⁸

Considering the fact that one of the consequences of people being displaced by machines is the disappearance of jobs, then there will be no active workers to take up the intergenerational chain, which is in turn preventing the implementation of this type of pay-as-you-go system in the context of Industry 4.0.

Even then, the general tendency of the public pension system revolves around the Universal Basic Income²⁹ as *the right of each citizen to regularly receive an amount to cover their material needs, without any limitations.*³⁰ In other words, for the mere fact of existing, the State must provide the necessary (economic) means to guarantee the social welfare of the people.

This trend is somewhat utopian, especially for developing countries like most of those in Latin America. Social security systems in these countries

²⁷ Solange Berstein J., *Sistemas de capitalización individual (AFP) y de reparto (antiguo)*, Chile, 2013, https://www.spensiones.cl/portal/institucional/594/articulos-10300_recurso_1.pdf.

²⁸ Cfr. Hernández Cervantes, Aleida, *La seguridad social en crisis*, Porrúa, Mexico, 2008, p. 73.

²⁹ The distinction must be made between Universal Basic Income and Vital Minimum. The first consists of granting an amount of money to everyone, all people for simply being born in a certain country. Meanwhile, the vital minimum is the last rung of social protection to protect only the neediest.

³⁰ Iglesias Fernández, José, *La renta básica contra la renta básica*, Spain, p. 2.

are not fully consolidated and this does not allow them to bear the financial burden of complying with this proposal, since the economic systems of these States are not designed to provide unconditional economic benefits to their entire populations.

b) Individual capitalization system: This system is basically the *accumulation of workers' contributions in individual accounts*.³¹ This system means that:

Each affiliate contributes a fixed percentage of his or her income, to form a capital, which when invested in the account, combined with the financial returns generated, determines the value of the individual pension at the moment of retirement.³²

At first glance, this one seems to be the most *ad hoc* pension system that meets the requirements of the Fourth Industrial Revolution. But in order to do so, workers must adapt to the new forms of employment in this digital age.

Continuous training to acquire new skills and abilities will be essential for people who do not want to become obsolete in the new world of work; otherwise, workers would be left on standby and no longer desirable for employers because of the lack of qualifications to work with the new technologies applied to improve the production processes.

This individual capitalization system *places the individual and his or her decisions at the heart of the solution to the problem on how to finance retirement income*³³ and prepare for the future in old age.

2. *Analysis of the effects on insurance branches*

This section presents some of the effects that Industry 4.0 will have on each of the insurance branches that traditionally constitute social insurance and have been the cornerstones of social security since its creation in 1883.

³¹ Mendizábal Bermúdez, Gabriela (coord.), *El trabajo y las pensiones de los académicos en las universidades en el siglo XXI*, Fontamara, Mexico, 2012, p. 21.

³² *Idem*.

³³ Cox, Alejandro, *Las tendencias del mercado laboral y su interdependencia con los Sistemas de Pensiones de Capitalización Individual*, Federación Internacional de Administradoras de Fondos de Pensiones, 2012, Chile, p. 33.

A. Occupational risks

Technological changes in the world of work undoubtedly have an impact on occupational risks that can occur as a result of doing a work-related activity.

It is worth mentioning that the eventualities covered by this branch of insurance are divided into two types: occupational accidents and occupational diseases.

1. Occupational accidents. Although it is true that one of the advantages of Industry 4.0 is a reduction in occupational accidents in the workplace because the interaction between collaborative machines and humans is safer than those interactions among people only. This is due to the fact that the sensory programming from robots should be able to detect collisions that could cause an accident and put the worker at risk, as well as to control their speed, power and range of motion on their own.³⁴

At the same time, it should be noted that, despite the great technological progress a machine might have, there is always the possibility of a flaw in the machine's programming or perhaps a computer attack on interconnected robots' systems,³⁵ endangering the physical safety of the workers who are in the same area.

Therefore, industries' computer security systems must be on guard to avoid work-related accidents caused by new intelligent machines.

2. Occupational diseases. Unlike occupational accidents, work-related diseases in Industry 4.0 can have a significant impact on worker's lives.

From a psychosocial point of view, the uncertainty of the future job scenario can directly affect workers, causing psychosocial risks derived from work's social context.

Specific risk factors include:

- a) The lack of human interaction: interaction among people will be limited since co-workers will be robots and workdays will be shared

³⁴ Cf. Full Audit, *Prevención 4.0 ¿Cuáles serán los riesgos laborales de la cuarta revolución industrial?*, Spain, 2017, <http://www.fullaudit.es/prevencion-4-0-cuales-seran-los-riesgos-laborales-de-la-cuarta-revolucion-industrial/>.

³⁵ Cf. European Parliament, *Draft report with recommendations to the Commission on Civil Law Rules on Robotics*, European Union, 2016, p. 4.

with machines instead of people, an impending change in this Industry 4.0.³⁶

- b) Job instability: there is a doubt on whether at some point a worker's job will be filled by a robot that would be more profitable for the industry.
- c) Stress: this might happen when the work demands are greater than the workers' capacity, hindering his or her performance at work,³⁷ in view of this new industrial revolution that requires very specialized skills to hold such jobs.

Shorter workdays: since automated processes require fewer people to perform tasks, shorter work days will be forthcoming in certain jobs in which people can be easily replaced by machines.

The combination of these factors is reflected in the rise in psychosocial risks in this Industry 4.0, which leads to a greater increase in occupational diseases; these risks generate dangerous working conditions, which can result in work-related accidents.

The need to regulate psychosocial risks in labor and social security law is necessary to address future problems in the lives of workers by anticipating that the development of technologies can be detrimental to people's health in the workplace.

B. *Diseases and maternity*

The evolution of technology brings health challenges. Aspects such as food and its new forms of processing, environmental pollution, new lifestyles, more sedentary habits and stress are factors that influence the emergence of new diseases and an increase of existing ones, such as:

- a) Cardiovascular diseases. These are the set of heart and blood vessel disorders. They are classified into hypertension (high blood pressure), coronary heart disease (myocardial infarction), cerebrovascular disease (stroke), peripheral vascular disease, heart failure, rheumatic heart disease, congenital heart disease and cardiomyopathies.³⁸

³⁶ *Cf. Idem.*

³⁷ *Cf. European Agency for Safety & Health at Work.*

³⁸ World Health Organization, *Enfermedades cardiovasculares*, <http://www.who.int/mediacentre/factsheets/fs317/es/>.

- b) Cancer. It can occur anywhere in the body. *Normally, human cells grow and divide to form new cells as the body requires them. When normal cells age or become damaged, they die and are replaced by new cells.*³⁹ It should be noted that cancer is the second leading cause of death in Latin America.⁴⁰
- c) Eating disorders. These can range from an obsession with healthy eating, not eating or eating only specific foods. The most common disorders are: bigorexia, anorexia, polydipsia, pica (an irresistible desire to eat or lick unusual or non-nutritive substances like soil, chalk, etc.), bulimia and obesity. They have reached epidemic dimensions worldwide. Although it was previously considered a problem confined to high-income countries, obesity is now prevalent in low- and medium-income countries as well. According to data provided by UNICEF, Mexico ranks first in the world in childhood obesity and second in obese adults just behind the United States.⁴¹
- d) Pollution diseases. The most common are respiratory diseases (pneumonia, bronchitis, etc.) and viral diseases (dengue, hepatitis), which tend to increase because of the effects that new production processes in industries might produce.
- e) Mental disorders. These are the ones reflected in mental health: disorders that affect mood, thinking and behaviour. Examples of mental disorders are depression, anxiety disorders, schizophrenia, eating disorders and addictive behaviours.⁴²

Updating social insurance catalogues of diseases and ailments is essential to provide coverage to those who may require the necessary care to treat these possible diseases at any given time, with the understanding that curbing technological evolution is impossible. Even so, we can be prepared to deal with the implications of this transformation.

As for maternity, this fourth technological revolution's technologies could play a positive role in this branch of insurance since said technologies

³⁹ Instituto Nacional del Cáncer, ¿Qué es el cáncer?, NIH, Spain, <https://www.cancer.gov/espanol/cancer/naturaleza/que-es>, Date of consultation: July 24th, 2018.

⁴⁰ Pan American Health Organization, Programa de cáncer, United States of America, 2016, https://www.paho.org/hq/index.php?option=com_content&view=article&id=292%3Acancer-programa&catid=1872%3Acancer&Itemid=3904&lang=es, Date of consultation: July 24th, 2018.

⁴¹ UNICEF, *Salud y nutrición*, Mexico, <https://www.unicef.org/mexico/spanish/17047.html> Date of consultation: July 24th, 2018.

⁴² Salud es, *Trastornos Mentales*, Spain, <http://www.salud.es/trastornosmentales>, Date of consultation: July 25th, 2018.

would be applied in surgical procedures, pre- and post-natal care during the entire period of maternity, thus reducing the risks that may arise during this stage of a woman's life, as well as a better recovery and quality of life for the mother and the newborn.

The issue of job stability is still on the table in view of the fact that Industry 4.0 shows a tendency for replacing men with machines. If this tendency continues, it will result in the lack of the necessary social security contributions and, consequently, the right to receive not only the prerogatives of the maternity branch, but also all those provided by social insurance will cease to exist.

C. *Disability and life*

Some of the positive effects of Industry 4.0 in this branch of insurance are the developments and innovations in health, which have allowed workers with a disease or non-occupational accident to receive a quick recovery and rehabilitation from diseases and ailments suffered. As a result, workers can return to their positions sooner and with a lower chance of suffering from the consequences of the illness or accident.

Some advances are:

- Telesurgery; which are surgical procedures performed remotely by a surgeon who is kilometres away from the patient,⁴³ providing timely attention in emergencies, performed by specialists who are not physically available when their services are required.
- Telemedicine; with the use of communication technologies, medical assistance can be provided at a distance without having to go to a specific place,⁴⁴ saving the patient from the physical and psychological strain associated with going to doctors' offices and thus averting further suffering.
- Digital medical files; storing patients' medical files through Big Data and clouds is a reality. This information can now be shared with other health care specialists to obtain a more accurate diagnosis and establish the corresponding treatment that benefits the patient.

⁴³ Telemedicina, *Telecirugía*, Colombia, 2014, <https://telemedicina3.webnode.com.co/telecirugia/>.

⁴⁴ TopManagement, *Industria 4.0 en el sector salud*, Mexico, 2018, <http://topmanagement.com.mx/industria-4-0-sector-salud/>.

Meanwhile, with the pharmaceutical development that this Fourth Industrial Revolution may bring, a person's life expectancy might be considerably prolonged. Furthermore, the quality of life he or she will enjoy will probably be even greater than today, by preventing an early death.

D. *Old-age severance, old age and retirement*

One central issue that has engulfed in this Fourth Industrial Revolution is old-age insurance and retirement of people who finish their productive stage of life, in terms of what will happen to workers' pensions with the changes brought by Industry 4.0.

The invention and implementation of new technologies in the world of work are observed in the automation of production processes in industry that involve the substitution of human labor by robots.⁴⁵

Both the proliferation of machines and an aging population mean that social security systems⁴⁶ tend to be unsustainable for any State, thus directly affecting unemployment, old-age and retirement insurance.

Regardless of the type of pension system a person may have (individual or pay-as-you-go), displacing people from their jobs will have repercussions directly on old-age severance, and on old age and retirement insurance.

Without a source of employment, it is assumed that people will no longer contribute to the social security system. Therefore, they will no longer be entitled to receive the benefits that stem from said branch of insurance, the most important being economic income in the form of a pension.

In order to deal with this issue, several proposals have been put forward, including the following:

- a) Employers should make social security contributions for the workers who were replaced by a machine. In other words, the machine will be subject to contribute on behalf of the worker, allowing the worker to have access to the benefits derived from social security and hence the branch of old-age severance, old-age and retirement.

⁴⁵ El economista, *La máquina sustituirá al hombre: los empleos mas amenazados en España por la automatización*, Spain, 2018, <http://www.economista.es/economia/noticias/8128422/02/17/Donde-la-maquina-sustituira-al-hombre-los-empleos-mas-amenazados-en-Espana-por-la-automatizacion.html>.

⁴⁶ El independiente, *Pensiones sin futuro en la era de los robots*, Spain, 2018, <https://www.elindependiente.com/economia/2018/01/20/pensiones-sin-futuro-en-la-era-de-los-robots/>.

- b) Another proposal that has been voiced is that of granting a minimum subsistence income; that is, to give the necessary economic resources to people who do not have the means needed to satisfy their basic needs like health, education, housing, income, recreation and so on. This would allow them to fully develop and enjoy a dignified quality of life.

The pioneers of these proposals come from Europe, through the European Parliament's Legal Affairs Committee, in a draft report with recommendations to the Commission on Civil Law Rules on Robotics, which suggests that:

consideration should be given to the possible need to introduce corporate reporting requirements on the extent and proportion of the contribution of robotics and AI to the economic results of a company for the purpose of taxation and social security contributions;⁴⁷

It has also been shown that, as a result of the effects that robotics can have in the displacement of people in the workplace, Member States should consider the adoption of a general basic income⁴⁸ to avoid leaving thousands of workers in helplessness because of this Fourth Industrial Revolution.

Both proposals are too complex to implement in the real world, especially in countries in the American continent where social security systems are not usually a State priority and when combined with other factors like informal employment, they affect a smaller insured population compared to those in the European regions.

The truth is that the creation of a *specific legal statute for robots, so that at least those that are autonomous and more sophisticated acquire the status of electronic persons with rights and obligations*⁴⁹ is necessary in order for them to be subject to social security contributions.

⁴⁷ European Parliament, *op. cit.*, p. 10.

⁴⁸ *Idem.*

⁴⁹ Saiz, Sergio, ¿Deben cotizar los robots como si fueran trabajadores?, Spain, 2016, <http://www.expansion.com/juridico/actualidad-tendencias/2016/12/26/585d681aca4741ec378b45e4.html>.

V. IS SOCIAL INSURANCE POSSIBLE IN LIGHT OF INDUSTRY 4.0?

In the generation of workers retiring now and that of their parents, it was possible for workers to remain employed throughout their working lives in only one or very few workplaces, be they private companies or public establishments. This offered job stability and made it possible to generate rights to obtain social security benefits while working and later receive such benefits in old age, for workers and their families.

When the term “flexicurity” was coined in the last decade of the 20th Century and with the increase in life expectancy, the aforementioned situation became a rare exception. People’s professional lives have changed and are marked by frequent interruptions or changes in work with very little job stability and, even worse, with the increasing preference of using private contracts over labor contracting.

In this sense, and because there is yet again an asymmetry on this issue in countries like Germany, Sweden, Italy and so on, developing countries should anticipate the plurality of lifestyles and the new reality of work through legal reforms and changes in public policies, using innovative ideas to increase social security coverage in the face of the imminent changes brought by Industry 4.0.

Hence, we find that the main challenges for social security in Industry 4.0 are:

- Increasing coverage without making it exclusively a feature of formal employment;
- Extending protection against new health and safety risks at the workplace and health care;
- Developing new mechanisms to grant unemployment subsidies, job training subsidies and old-age pensions;
- Expanding regulations to provide mandatory coverage based on the carried out activity and not only through what is established in labor law.
- Ensuring the protection of workers’ data;
- Extending international social security law conventions, as migration is a growing factor in Industry 4.0;
- Rethinking national and international standards from the perspective of glocalization and not only globalization.
- Reforming private law legislation if new forms of On-Demand

Economy are governed by private law, so that these provisions also include protection guarantees, if necessary, through private pension, life and health insurances. If there is a law that governs insurance regardless of whether it is public or private, we would face new forms of social insurance through privatization.

- Establishing the required infrastructure for citizens to have access to the Internet and the networks that are indispensable in a digitized society. Social media on the Internet, comparison and evaluation portals, search engines to find data and information, sharing platforms for services and products, app stores, online marketplaces and media platforms increasingly impact our daily digital lives, as well as our work lives.
- Providing training and capacity-building to all members of society so that they can become 4.0 Workers, 4.0 Consumers and, in general, 4.0 Citizens.

There are not many proposals on how to contribute to the insurance of workers and their families facing Industry 4.0. The truth is that, regardless of whether the worker is a wage-earner, subordinate, independent; or an entrepreneur of a micro, small, medium or large enterprise, the world is changing for everyone. One consistent feature of such change is that, as the access to employer benefits decreases, more workers will need new ways of accessing benefits traditionally provided by employers and/or the State. We will start seeing that, as more workers find that work (or available work) is not enough to sustain a stable standard of living, the social security network must address these workers' needs.

Some of the proposals analysed by governments like Germany or drawn up by academics are the following:

- The simplest one that has been under discussion for over a decade is that of the “delaborization” of social security, separating social security protection from formal labor activities to simply recognize it as a human right and financing it through general taxes. It is easily said, yet so complicated that not a single country has managed to make the transition from an individual capitalization system to a delaborized social security.
- Other researchers offer future solutions like taxing the displacement of workers by robots, a universal public ownership of the shares of

new companies that produce goods by means of automated work.⁵⁰

- One proposal currently under discussion is that of the vital minimum or minimum income. It consists of guaranteeing each member of society a basic income, also known as a minimum income that allows them to live above the poverty line or within the welfare line (depending on the country being analysed). This would make it possible to reduce inequality and poverty, in addition to dismantling conditional economic transfers established through assistance programs that alleviate poverty and have certain negative effects like clientelism or political manipulation.

These proposals contain a neoliberal side that goes even further, suggesting – from a budgetary point of view – a low-level safety net at the expense of completely eliminating the existing social security systems, including the suspension of employer contributions that sometimes also reduces other social expenses. In other words, this proposal seeks to replace public pensions and other social insurances, as well as other public programs, with a UBI [Universal Basic Income] model, coupled with private insurance.⁵¹

VI. CONCLUSIONS AND PROPOSAL

To conclude, it can be stated that the direction Latin American governments need to take in their public policies should aim to:

- Achieve social insurance by transforming social security. To do so, it is necessary to uphold its basic principles in the new forms of insurance: solidarity, universality, the integration of benefits, mandatory nature, legal enforceability and internationalization.
- Legally coordinate the protection of each person in society by expanding the possible means for doing so, establishing a network made up of social programs (SOCPRO) social security (labor law benefits) and compulsory private services, a network where each

⁵⁰ Valenzuela, José Luis, *Cuarta revolución industrial: Llega el futuro*, Filosofía Política, 2016, p. 5, <https://arielenlinea.files.wordpress.com/2016/11/cuarta-revolucion3b3n-industrial.pdf>.

⁵¹ Cfr. Author's translation of Ortiz, Isabel, et. al., *Universal Basic Income proposals in light of ILO standards: Key issues and global costing*, Social Protection Department International Labour OFFICE, GENEVA, 2018, pp.26-29, <http://www.social-protection.org/gimi/gess/RessourcePDF?action?ressource.ressourceId=55171>.

person, whether privately or publicly, has insurance coverage for health and maternity, occupational (and non-occupational) risks, old-age and dependency, and a minimum income.

- Coordinate the digitalization process in public or private companies, as well as public services at State level, so that both workers and employers can profit from these changes for the benefit of the community without it being yet another factor of job insecurity.

Regarding Mexico, one possible proposal to address the negative consequences of Industry 4.0 in terms of social security would be the creation of a new social security system that would allow all people to be protected through social insurance. While it is true that describing a new social security model would be too extensive to include in this work, it is possible to mention its primary characteristics as follows:

- a) Delaborization of social security. The first important element of this new system would be the separation of social security from labor. In speaking of delaborization, we mean that the indispensable requirement of having formal employment in order to have access to social security should not exist, but that social security should be considered a human right and not a right derived from work, thus allowing all people to have access to social security.
- b) Obligation. Another feature that needs to be stated is the obligation of being insured by law and that this obligation must be shared. First, all people should be insured with at least a basic coverage that protects health, maternity, work-related (or occupational) risks, old age and dependency. Meanwhile, the State's obligation is to ensure that the people have the minimum insurance established by law, and if they do not, to insure them automatically through public insurance, by financing it from taxes or other mechanisms.
- c) Public and private insurances. Insurances may be public or private, thus giving the person the possibility of choosing themselves an insurance, based on their possibilities and needs. It is important to stress that both insurances, regardless of their nature (public or private) will have the obligation to offer at least the basic coverage required by law, that is, the mandatory insurances mentioned above.
- d) Social assistance. As the social security system's last safety net, this assistance shall be exclusively for those who do not have the resources needed to access social security benefits by themselves. This assis-

tance would aim to provide them with the necessary tools to access them.

By fulfilling these conditions, it is possible to head towards Social Security 4.0, made up of a set of social programs (SOCPRO), social insurance (labor law benefits) and mandatory private services that, incorporated into a network and diverse legal enforceability mechanisms, positivize and materialize the human right to social security in a society governed by Industry 4.0.

Therefore, the general conclusion is that the structure of labor changes, therefore the social security model must also change.

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