the Pontifical Academy of Social Sciences

The Foreseeable Impact on Sociability and Solidarity in Labour Relations, in the Incoming 4th Industrial Revolution

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From the remotest times of which we have knowledge, humanity has been inclined to, if not forced to, obtain the resources required for subsistence, through effort and work, which mankind has always been capable of: “In toil shall you eat its yield all the days of your life (…) By the sweat of your face shall you get bread to eat” [Gn. 3:17-19].

This being the case, it is no less true, according to the testimonies that have filtered through to our times, that man has continually sought to reduce the effort associated with the work that would enable him to eat. And he has done so by using the creative capacity with which he is endowed as a rational being, assisting himself with his discovery of the means of production – tools – which made the productive endeavour he undertook more bearable – cultivating the land, or hunting and fishing.

Therefore, since the origins of man there has been a nexus between human work and the material means of production, which human work itself and the ingenuity of man has been shedding light on in order to facilitate the task of production and, thus, obtain the sustenance required for the family unit for which he is responsible.

This nexus, in addition to being beneficial, is also necessary. The origin of this nexus lies in the desire to lighten the work burden and is determined by the intelligence and rationality of man. By virtue of these very innate faculties, man opts to postpone the immediate fruits of his labour in order to devote effort and intelligence in the present time to the creation of those instruments that will help him to achieve greater fruits, with less effort, in the near future.

Thus, it can be stated that, in its remotest origins, the concurrence of human work and capital, itself the result of human work applied to natural resources, occurs harmoniously, without even the smallest hint of conflict between them.

In the same way, as a natural tendency of the state of things, an incipient indication of specialisation also began to emerge. Two activities are to be found at the origin of what we might call economic function: cultivation of the land – agriculture – and the hunting of species present in the place and time of each specific case. This specialisation was in accordance with personal working skills and the conditions of the natural environment in which one lived at a given time.

From that scenario to the world of today there is obviously a gulf replete with circumstances, complexity, and distance in time and space in terms of producing those rudimentary tools. Those tools have now been replaced by complex processes and capital goods, which are used, by whomsoever might implement them, with the greatest possible efficiency for the purpose of obtaining optimum results.

I. Introduction. Without wishing this statement to appear excessively radical, if we review human history, I would dare to contend that there is one element worth highlighting because it is present century after century as a constant in human behaviour.

This element is the aspiration of man, from his first origins to the present day, to live better and better, surrounded by the greatest welfare for himself and the people of his environment; with this environment being determined by a very broad area of society and co-existence, and, I would dare to say, without defined boundaries. At the end of the day, everything that affects humanity is of interest to man and it is specific characteristic of mankind.

We can say that, owing to the materialist tendencies to which man is exposed, this objective of living better has, on occasions, manifested itself in the possession and enjoyment of material goods, in a leisurely enjoyment of existence. On other occasions, however, occasions rich in thought and spiritual values, it has been clearly perceived that the life objectives of man, with evident virtuosity, include goals that are within the framework of a transcendental dimension of his very being; without concealing the presence of material goods in order to satisfy these types of necessities too.

In this aspiration, in this objective, man, as could not be otherwise, appears as the protagonist of both present and future endeavour, whilst also being the beneficiary of the undeniable wealth inherited from past generations. Not only does he enjoy the leading role that is his by right as a being created in the image and likeness of God, endowed with reason, freedom and responsibility, but he is also the cause of that desired or sought-after wellbeing.

We cannot forget that man is the subject of work and that the ultimate origin of the creation of value is human work; whether it is carried out at the present time, or it is the result of accumulation of work carried out in previous stages of the value chain – creation of capital equipment. From this, it can be deduced that man is the decisive actor in the provision of value to a community, through the economic processes of the production and distribution of good and services.

Going back to the Classic School, although it was not a uniformly consistent theory of this school, David Ricardo stated that "The value of a commodity, or the quantity of any other commodity for which it will Exchange, depends on the relative quantity of labour which is necessary for its production, and not on the greater or less compensation which is paid for that labour".[1] The author acknowledges a little later that there are goods whose value is determined solely by their scarcity, because no work can increase the quantity of these goods; this is the case of certain *statues, rare paintings, books and coins, wines of an unusual quality*…

Along the same lines, albeit with less finesse than in the Ricardian distinction between articles that can and cannot be increased in terms of quantity through work, Marx follows Ricardo[2] by considering that the value of any good is determined by the work required for its production. He says: "… which determines the magnitude of the value of any article is the amount of labour socially necessary, or the labour time socially necessary for its production. Each individual commodity, in this connexion, is to be considered as an average sample of its class. Commodities, therefore, in which equal quantities of labour are embodied, or which can be produced in the same time, have the same value. The value of one commodity is to the value of any other, as the labour time necessary for the production of the one is the necessary for the production of the other. «As values, all commodities are only definite masses of congealed labour time»".[3]

From all of this it can be deduced that the history of economic thinking demonstrates this man to us, the man who contributes, through the ages, his best efforts in the routine activity of daily work. And it also demonstrates to us, man, at certain times, contributing his marvellous creativity in the form of inventions and discoveries … aimed at achieving the common good of the community, and collaborating, as he does in his routine stages of daily work, in the exalted work of the Creation.

Routine work and creative work, primitive work and highly specialised work, all have man as the privileged subject of their execution, "… in speaking… of labour, as being the foundation of all value, and the relative quantity of labour as almost exclusively determining the relative value of commodities, I must not be supposed to be inattentive to the different qualities of labour, and the difficulty of comparing an hour's or a day's labour, in one employment, with the same duration of labour in another. The estimation in which different qualities of labour are held, comes soon to be adjusted in the market with sufficient precision for all practical purposes, and depends much on the comparative skill of the labourer, and intensity of the labour performed. The scale, when once formed, is liable to little variation. If a day's labour of a working jeweller be more valuable than a day's labour of a common labourer, it has long ago been adjusted, and placed in its proper position in the scale of value".[4]

Since man decided to devote some hours of the work of today to producing a silex axe or a bow and some arrows in order to be more effective in the hunting activity of tomorrow, the necessary meeting of work and capital seems decisive. Work and the nature of what is created constitute the only primary means of production, and all others are derivatives of them.

Capital is nothing other than accumulated work on one or more natural factors. For this reason, capital, which has its origins in work, would be nothing if it did not have work at its disposal in order to operate in the chain that generates economic and social value.

Analogously, some would say that the different qualities of work to which we refer are determined by the amount of work involved in achieving these qualities, in obtaining the knowledge, the competence and the skills. Therefore, it is not surprising that, in recent times, these qualities have become known as *human capital*.

This being said, it seems difficult to accept the argument of the so-called natural conflict between work and capital, which has been put forward on so many occasions down through history. Work originates from capital and makes use of capital for productive activity. Capital would not exist without work and can do nothing without the concurrence of work.

It is true that, on not a few occasions – above all at times of economic crisis – capital has been identified as the reason for the unemployment of the labour factor, but it is no less true that the cause of economic growth could not be explained without the concurrence of capital – the product of inventions and discoveries – and the work that played a part in the existence of capital and which played a leading role in its use to achieve an optimum result with the minimum use of resources, which are scarce by nature.

It is at times of economic depression when capital is regarded as competing with work, with both struggling to occupy a single space. In such a way that, far from cooperating in the productive function, work and capital appear to be mutually exclusive, creating the dilemma of work or capital, or if you like, work versus capital, or capital versus work.

Manuel Alejandro Hidalgo is expressive in this regard when he says: "… the race of man against the machine has been present since the very emergence of the latter, long before any of the industrial revolutions that have been experienced. But in opposition to these «luddite» stories, the truth is that from Neolithic times, since *Homo sapiens* renounced nomadism and settled to keep livestock and cultivate grain, the development of humanity and its wellbeing has gone hand in hand with technological progress".[5]

Technological progress, with all it implies, apart from reducing the fatigues associated with work, has enabled greater health and safety in the workplace, production today with fewer resources and less time than yesterday, as a result of increased productivity, in addition to the capacity to produce goods and services that could not be produced with the technology in existence yesterday.

As a result, it has enabled a reduction in the working day, without in any way reducing the wherewithal of the worker and society as a whole. On the contrary, it has increased these resources. Moreover, the introduction of new technologies has improved the knowledge and skills of workers, thereby increasing their expertise for the function demanded by technology at any given time.

Nonetheless, every technological innovation causes a reaction of resistance to its implementation in many people. Perhaps this is natural, although for many, it is not so much an independent reaction of the labour factor as an ideology based on the class struggle, according to which the machine does not co-exist with the worker to lighten his workload, but rather exists to exploit him and eliminate him in the event of resistance.

Therefore, any innovation, and more so a generalised technological change, i.e., a change that merits classification as an Industrial Revolution, causes a certain feeling of panic because of its potential threat to jobs and the workers who occupy these jobs. And this occurred in the First Industrial Revolution – which lasted almost a century, from the middle of the 18th century until the middle of the 19th century – with such significant breakthroughs as the steam engine, the internal combustion engine and electricity, both for industry and for the transport of goods and people – railroads, vehicular traffic on roads and steamships that brought continents closer.

Subsequently, the same would happen with the Second Industrial Revolution – from the middle of the 19th century until the outbreak of the First World War – and, to a lesser degree, with the Third Industrial Revolution, known as the Revolution of Intelligence or the Scientific-Technological Revolution, which saw important breakthroughs in the field of energy, its use and its storage.

What do we expect will happen in the Fourth Industrial Revolution? What seems evident, *prima facie*, is that the acceleration with which the three previous revolutions took place will be repeated in the incoming Fourth Revolution, the revolution of Artificial Intelligence and mass automation of economic activity and, indeed, a large portion of human activity.

Is the turmoil caused by these revolutions surprising? Are disruptions not also the result of small changes in instruments of work? What significance did the introduction of the typewriter have? How did calligraphers, the craftspeople of writing, view this instrument? How did typists subsequently feel on seeing their good professional work, the clarity and tidiness of their documents, converted into anonymous, standardised works coming out of word processors?

II. The dimensional wealth of human labour. Man is not only the subject of work. Part of his human dimension lies in work, but his capacity, and even more so, his potential encompasses areas with unimaginable boundaries. In any case, it cannot be forgotten that in his personal dimension, man is unique and unrepeatable; similar, it is true, to any other human being, equal in the eyes of God and the possessor of the same irrevocable human rights and obligations as all other men but, with the exception of this, different from everybody else in the remainder of what his humanity entails.

Human work should be an opportunity for man to bring "… many aspects of life enter into play: creativity, planning for the future, developing our talents, living out our values, relating to others…"[6] A man who, since

his birth, has within him this repertoire which God the Father wished him to have, thus distinguishing him from all other created beings: a life endowed with rationality, freedom and, with it, responsibility. With all this, despite the greatness encompassed by these gifts, his potential to give up what is and what shall be, his entire capacity for the good of the community shines through from the moment of his birth. From this stems, out of necessity, the good of society and the good of the worker himself.

In accordance with what has been said, together with John Paul II we can state, that "… work is seen as a great reality with a fundamental influence on the shaping in a human way of the world… it is a reality closely linked with man as the subject of work… In the normal course of events this reality fills human life and strongly affects its value and meaning. Even when it is accompanied by toil and effort, work is still something good, and so man develops through love for work".[7]

From that helpless new-born child to the old person battered by time and circumstances, there is a series of vital sequences that turn what initially manifested itself as potential into reality, the result of an infinity of opportunities for greatness and for good, although the alternative of despondency and neglect is also afforded by all of these opportunities.

The existence of these two alternatives in man means that the differences between men, hardly perceptible at the outset, become progressively larger until they manifest themselves in distant worlds and attitudes. And the later the decision to change is taken, the more difficult it is to return. It would seem that man is born in an environment in which all the options are open and man himself, in his life's journey, closes off some and leaves others open.

It is this process of, let us call it, training that configures man as the owner – possessor – of the capabilities, attitudes, yearnings, skills… disposition to put all his best efforts at the service of a community, by means of an inner diligence that is the perseverance, the capacity for effort, and the will to give back the great amount he has received from society.

All of this determines that, in addition to the fact that no two men are the same, no two workers are the same and, I would venture, no two jobs are the same. Because, the term job refers both to the possibility of the work as well as the execution of the task committed to in the productive function.

And here we have the absurd aim of those who, denying man his substantive and essential equality, defend a coincidental equality – Marxist or belonging to closely related ideologies – which is summarised in a binding principle: *the same salary for the same work*. When experience shows the difficulty of finding this sought-after equality in work, which would necessarily require equality in the man of work; i.e., in the worker. In this way, man would cease to be singular and unrepeatable.

This personalist dimension of human work, through which man stamps the work carried out with the style and exigencies of his very being and behaviour, prevails over any other dimension. It prevails over the means of production, the utensils, the capital equipment.

This predominance, whilst being true, cannot marginalise the need the worker has of the job, because, in the words of Leo XIII "… The preservation of life is the bounden duty of one and all, and to be wanting therein is a crime. It necessarily follows that each one has a natural right to procure what is required in order to live, and the poor can procure that in no other way than by what they can earn through their work… wages ought not to be insufficient to support a frugal and well-behaved wage-earner".[8]

In earlier times, in the era of artisan work, each craftsman left an indisputable and easily perceptible hallmark of the authorship of each piece of work carried out with his hands. Despite the breakthroughs in techniques incorporated into the means of production, it cannot be said that that mark of authorship, incorporated into the work carried out as a subjective dimension of it, has ceased to exist. In the productive and manufacturing activity, assisted by complex machinery, the work of man continues to be visible, as a sign of good work and differentiation between the skills, diligence and self-exigency of workmen.

It cannot be forgotten that the workman is, above all, *a man*. In other words, a singular and unrepeatable being, composed of the conjunction of two dimensions: the material dimension – the body and all its physical faculties and capacities – and the spiritual dimension – the soul and its intrinsic powers; in Saint Thomas, corporeal and incorporeal powers. The two are inseparable from man in his humanity and they are demonstrated with clarity in his sociability. And that is the case on the different levels in which man is present and the levels in which he develops his sociability.

Therefore, in this respect, "Work constitutes a foundation for the formation of *family life,* which is a natural right and something that man is called to. These two spheres of values-one linked to work and the other consequent on the family nature of human life-must be properly united and must properly permeate each other. In a way, work is a condition for making it possible to found a family, since the family requires the means of subsistence

which man normally gains through work. Work and industriousness also influence the whole *process of education* in the family, for the very reason that everyone «becomes a human being» through, among other things, work, and becoming a human being is precisely the main purpose of the whole process of education. Obviously, two aspects of work in a sense come into play here: the one making family life and its upkeep possible, and the other making possible the achievement of the purposes of the family, especially education. Nevertheless, these two aspects of work are linked to one another and are mutually complementary in various points".[9] There can be no disassociation of them, in the same way that it is impossible to disassociate the spirit and the body, for it is the union of both that conforms man as a creature created in the image of the Creator.

In this way, the family, thanks to the work which sustains it and which, in its origin, gives it form, is in turn the platform upon which unfolds the training process of the workman, his vocation, his apprenticeship and his dedication to the work entrusted to him. The intergenerational relationship within the family enables the provision of encouragement in difficult tasks, as well as providing the example of the older generation as guidance for the younger generation.

And what we are saying of the family relationship can be extrapolated to the relationship, on a more far-reaching level, of the national community of which one feels a part, and taken to the maximum limit, the relationships of sociability and solidarity in the greatest of all communities: the human family. The workman, with this open attitude, with his willingness to share and help to solve the problems affecting his co-citizens, finds no difficulty in reconciling "… his deepest human identity with membership of a nation, and intends his work also to increase the common good developed together with his compatriots, thus realizing that in this way work serves to add to the heritage of the whole human family, of all the people living in the world".[10]

This sense of belonging, of openness to social relationships, of willingness to share what we have in common and what we obtain, of interdependence, is accompanied by something more than a feeling; a spontaneous blossoming of the practicing of the virtue of solidarity. "This then is not a feeling of vague compassion or shallow distress at the misfortunes of so many people, both near and far. On the contrary, it is a firm and persevering determination to commit oneself to the common good; that is to say to the good of all and of each individual, because we are all really responsible for all".[11]

It is this aspiration of the working man open to the community, from where he obtains the opportunities to improve, to enrich the community of which he forms part and to enrich himself from the community in turn. It is this desire to share that underlies true social progress, as a communal transposition of true human progress. In this, there is no place for euphemisms or confusion and, therefore, in conclusion we must point out that sought-after, and so-oft publicised progress "… which does not leave in its wake a better world and an integrally higher quality of life cannot be considered progress".[12]

III. The so-called *labour market*: regulation, full employment and unemployment. We would like to be capable of doing away with, or at least mitigating, the, probably justified, misgivings about the use of the term *market* to analyse, describe or evaluate the relationships between two subjects: the worker, as the subject of the work, and the businessperson, as the possessor of the means of production, which will be put at the disposal of the worker in order to carry out his activity in the processes associated with the production of goods and services.

It goes without saying that although objectively, there would appear to be a material, physically tangible dimension represented by primary production resources – raw materials from nature – and an equally tangible dimension represented by capital goods – comprising machines and utensils which in their essence are hours of work applied to natural primary or intermediate resources – the true essence of the aforementioned relationship is, fundamentally, a human relationship.

In that relationship, the two parties – worker and businessperson – value, in addition to their skills for the function expected of each, their humanity, their character and their desire and capacity to integrate into a nucleus of social relationships – beyond strictly working relationships – that constitute real life in the business environment. They are not, therefore, nor can they be, two anonymous beings, because they are called upon to be part of, as can easily be observed, a form of productive family, with the prosperous future of the collective entity depending on this atmosphere.

From this perspective, it can be deduced that the term *market* is too simple and abstract to represent such a complex reality, in which material aspects play a part, the poorest and least valuable part, and immaterial aspects, humans, play a part of primary value, which is overlooked by the simplistic vision of the market. But the fact is that we have been unable to find a generally accepted term that demonstrates the peculiarity of a relationship which stands out for its human dimension, which, on the other hand is not usually indicated in the stipulations set out in the contract regulating this relationship.

Several linguistic meanings are attributed to the term *market* and I would dare to say that all of them are unsatisfactory. From the definition of it as the place in which transactions are carried out – a throwback to ancient times, when today, the place is the least significant aspect – to a definition which contemplates the activities carried out in this place. Personally, if I had to choose from the best-known definitions of *market*, I would opt for a classic definition from the economics books, in which what stands out is the interdependence between participants in it: “A market is a mechanism through which buyers and sellers interact to set prices and exchange goods and services”.[13]

It is in the market process, in the negotiation, that each party gradually moves away from the initial goal until a point of agreement is reached, which, by distancing themselves from the initial target, is a satisfactory result for both parties. At the end of the day, the two parties have a common aim: the party who provides the good or service wishes to supply it, while the other party wishes to receive it in order to satisfy a need.

In this sense, the labour *market* would be the process involving two people, on the one hand, the worker, who wishes to offer his capacities, labour skills, personal attitudes, productive efficiency… and on the other, the businessperson – a natural or legal person – who wishes to have at his disposal those attributes of the worker to apply them to instruments or modes of production in order to generate value – represented by goods or services – and in exchange offers a salary– and perhaps other fringe benefits, quasi salary or salary in kind – capable of satisfying the objectives of the worker.

The agreement, in the terms described, is in principle, strictly personal and, therefore, must satisfy the objectives of both parties. If this were not the case, the sought-after result would not be achieved and the worker would miss the opportunity to work and the businessperson would not complete his production process, until another worker became a creditor of the frustrated agreement. It is a combination of the desire/need of the worker to work and sustain himself through the fruit of his labour – salary, remuneration – and the desire and objective of the businessperson to satisfy the needs of demanders, by producing the goods or services they require.

A problem emerges in this sought-after equality and this problem is precisely the probable lack of equality between the needs of the two parties. The virtue of the free market is its capacity to achieve equilibrium, in goods and service markets, efficiently through price fluctuation: an increase in prices will eliminate excess demand, while a reduction in price will eliminate excess supply.

Can this price fluctuation – in this case wage fluctuation – be applied in exactly the same way to excesses in the demand for and supply of work, with the expectation of an equivalent equilibrium? Amongst economists, there is no shortage of affirmative responses, which estimate that the salary is the price of labour and, as such, is subject, in free market conditions, to increases and decreases to adjust to the imbalances caused by excess supply or demand.

However, although there is great similarity between the need of a supplier of a consumer good to provide it and the need of the demander to acquire it – this occurs even with goods we describe as necessary due to the inelasticity of demand – the need of the supplier of labour – the worker – is clearly different to the need of the demander of labour – the businessperson or employer. An inequality which substantially affects the freedom of each party in terms of taking positive or negative decisions in negotiations on the contractual conditions of the job.

For this reason, Leo XIII stated: “Let the working man and the employer make free agreements, and in particular let them agree freely as to the wages; nevertheless, there underlies a dictate of natural justice more imperious and ancient than any bargain between man and man… If through necessity or fear of a worse evil the workman accepts harder conditions because an employer or contractor will afford him no better, he is made the victim of force and injustice. In these and similar questions… it is advisable that recourse… to some other mode of safeguarding the interests of the wage-earners; the State being appealed to, should circumstances require, for its sanction and protection”.[14]

In other words, the inequality to which we have referred cannot be a refuge for the unjust, humiliating treatment of whom can be considered the weakest party in a labour relation. For this reason, seventy years after the publication of the Encyclical Letter *Rerum Novarum*, John XXIII established that “It is furthermore the duty of the State to ensure that terms of employment are regulated in accordance with justice and equity, and to safeguard the human dignity of workers by making sure that they are not required to work in an environment which may prove harmful to their material and spiritual interests”.[15]

Twenty years before Saint John XXIII spoke in the terms to which we have just alluded, Pius XII had made a similar declaration, considering work as a duty and a right of all men. Therefore, it is these parties – workers and employers – who are called upon, in the first instance, to regulate their labour relations…But, in the event

that the interested parties cannot or do not wish to do so, Pope Pacelli added that "… it fall back on the State to intervene in the division and distribution of work, and this must be according to the form and measure that the common good properly understood demands" [*Acta Apostolicae Sedis 33* (1941) p. 201].[16]

In this way, pontifical doctrine acknowledges, as could not be otherwise, the sovereignty of the human being above all created beings, because man is created in the image of the Creator. Therefore, man is the first called upon to manifest his preferences, in accordance with the order of Creation, even if, as is written in Genesis, these preferences are against the will of the Creator. This enables the affirmation that "… There is no need to bring in the State. Man precedes the State, and possesses, prior to the formation of any State, the right of providing for the substance of his body".[17]

Providing for the sustenance of his body is tantamount to saying that man holds the primary responsibility for himself and, we would add, for his family. He is the first person responsible for aspects related to the sustenance of his family and of himself. Any action of the public authority must be carried out in accordance with the subsidiary function it holds. To be exposed to the possibility that this authority penetrates the intimacy of the home, even under the pretext of protecting and supervising the wellbeing of the family unit, thereby eliminating the initiative and criteria of its members, and also their efforts to achieve their life objectives, *is a great and pernicious error*.[18] One thing is to protect and reinforce the rights of citizens or families. Quite another, and very different, matter is to take ownership of them.

What can be deduced from all of the foregoing is the possibility, even the necessity, of regulation of the labour *market*, always for the purpose of protecting the rights and obligations that emanate from these labour relations – workers and employers. The question to be considered is the type and scope of the regulation to be implemented.

It is not a minor question. It seems evident that the great objective of a community and the government that rules it is to achieve full employment, i.e., that all those who can and are willing to work obtain work in certain conditions. It goes without saying that full employment does not have and cannot obtain an absolute quantitative value, when taken literally. When somebody decides to work, it is impossible, or at least very unlikely, that he will find somebody willing to employ him at that exact point in time. From the perspective of information on the part of the worker or on the part of the employer, this immediacy cannot be guaranteed, even given that the theoretical possibility existed in terms of time and place.

This is what leads us to natural unemployment, which is not a cause for excessive concern, firstly because it is small in quantitative terms – depending on the country, the figures are around 3-4% – and, secondly, because it is very transitory and the unemployed find work within a very short period without the worker suffering economic problems or problems of morale. The problem arises when unemployment affects a significant portion of the labour force that wish to work; i.e., when the quantity of unemployed workers is far higher than what we have termed natural unemployment. And, amongst the unemployed, the situation of the long-term unemployed is urgent and dramatic.

Can regulation guarantee full employment and, if so, how? I would dare to say that the effectiveness of regulation in the areas of occupational health and safety, prohibiting minors from working, providing incentives and training to the disabled, universal social security coverage, and even in the setting of maximum working hours and the obligation of daily, weekly and annual rest, has not been witnessed in terms of achieving full employment.

What is more, the countries with the lowest unemployment rates are also those with the least wage regulation – and also those with the greatest flexibility in terms of taking and leaving a job – even whilst respecting regulatory guarantees in the remaining aspects that directly affect the worker, his life on the job and that of his family, as well as the cover he requires to be protected against ordinary risks to him and his family, both during his working life and in retirement.

More than a few countries concentrate their regulatory efforts not so much on what we have just spoken of but on what is most visible from a political perspective, which is the setting of a minimum wage, without considering the effects that such a measure might have in terms of guaranteeing full employment, which, in principle, is the primary objective of any worker.

It goes without saying, for the purpose of avoiding confusion, that the parties, both workers and employers, are motivated by personal aspirations, aspirations which are not those of angels, but rather those of human beings, of men, with their strengths but also with their weaknesses. Workers expect to receive a salary that compensates for the efforts of their work, as well as for the time and effort spent preparing for this work, and for loss of free time etc., meaning that the higher the salary, the greater the compensation for all of the foregoing.

Employers, on the other hand, aspire to obtaining a productive output from the worker that compensates the salary paid in exchange for the work. From an economic perspective, it would not be rational for an employer to be willing to pay any worker a higher salary that the product he expects to receive from the productive tasks carried out by the worker.

What would be the effect of regulatory action on the minimum wage? There are three alternative ways of setting a minimum wage: a) establishing the equilibrium wage – *full employment wage* – as the minimum wage, in which case there would be no resulting distortions in the *market*, although the regulation would not have had any effect, either positive or negative. b) A second, albeit inconceivable, alternative would be to set the minimum wage below the equilibrium wage – *full employment*; in this case a dual result would be possible: there would either be a zero effect, because employers would continue to employ previously employed workers with the same conditions, or, in the event of a scarcity of national workers to cover the jobs offered at the minimum wage, there would be an effect of attracting the immigration of less qualified workers for marginal and not very productive jobs. Finally, c) the minimum wage is set above equilibrium or *full employment* wage, which would reduce the demand for labour and there would be demand only for the most productive labour. Unemployment would emerge as a result of the imbalance between the pretensions of workers and employers, which would no longer be in equilibrium.

The average salary of the economy, in purely statistical terms, increases, but with a very high social cost: the increase in the number of people who find themselves unemployed, people who were previously working with full satisfaction. Work and its remuneration, the personal fulfilment of skills, to the benefit of the worker, his family and society as a whole, has disappeared due to clumsy regulation.

Given the diversity of unemployment rates in European countries and more so in the relationship between these rates and those of the United States of America, a number of authors have studied the relationship that might exist between such unemployment levels and the different regulation of the labour market in each country. “In general, they conclude that rigid labor market institutions or high taxes explain the observed unemployment pattern”.[19] Moreover, we can state that when, in addition to wage rigidity, we introduce the qualifications required of the worker, in a scenario of unforeseen technological change, the reduction in the employment of less-skilled workers occurs immediately.

The greatest scourge from which a community can suffer is that of ongoing unemployment; which is certainly worse than the scourge of precarious jobs or salaries, where the hope is that precariousness will come to an end. The long-term unemployed live in the anguish of today, intensified by that of tomorrow, whilst also enduring the desperation of waiting for a change that never happens.

IV. A retrospective look at disruptive innovations. It should be stated that any discovery, any invention that manages to have an economic and social impact has the fundamental aim of improving the lives of people, lowering production costs, resulting in greater profitability in real terms – as a result of lower prices, finding and availing oneself of more abundant or better quality resources and, ultimately, placing the intelligence of people at the service of the community.

A discovery to lower the standard of living of society would make no sense. Such a discovery would not be implemented in the real world and would remain a dead end or a forgotten patent on a register. A retrospective look at the history of humanity would conclude with a declaration of the evidence of what we have just pointed out, from the first inhabitants of the planet to the present day.

I would also venture to state that each invention, each innovation, at the time at which it becomes effective in the lives and for the lives of men, produces two effects: on the one hand, *fascination* before the work created by man – a man who stands out from others in initiative and skill; and, on the other hand, what we would call a *percussive* effect, a consequence of its economic and social impact, disrupting the production system and, in all probability, influencing, at least in the short term, the work of a significant part of the community.

The fascination effect is occasionally of such a nature that man and the community forget that they are above the invention and that the latter is due to their competence and endeavours. Of all the things I have heard in my life, nothing has been quite as striking as what was said at the “Mobile World Congress”, held in Barcelona from 25 to 28 February 2019. Following the performance of a robot on the piano, the presenter stated, in reference to the performance of the robot, that it had shown “greater interpretative perfection than that of the finest virtuous pianist”; which, frankly, seems to be a manifestation of excessive fascination. I would prefer an interpreter capable of interpreting and of erring.

Would the first time a plough was seen in the process of cultivating the land not have produced fascination, over five thousand years ago? Or an ox-drawn cart transporting goods without any effort on behalf of the carrier? How many workers were left jobless as a result of those two inventions? It is certainly true that the loss of the

job, which undoubtedly took effect immediately, became mitigated over time as the man acquired the skills to use the invention, and the productive use of the new instrument became more widespread.

The truth is that the two inventions, whilst causing admiration and disruption at the time, were also saving time and effort for those men devoted to the tasks affected by the invention. Where did those unemployed men end up? We are still enraptured by the architectural beauty of a Roman aqueduct, when we are not thinking about how many water carriers were left jobless as a result of its construction. But I would dare to pose a question for the purposes of reflection. Would 21st-century society be the same, with its magnificence, shortcomings, strengths and weaknesses, without those Roman aqueducts, the wide field of knowledge opened up by them, the application of this knowledge in terms of architecture and engineering, and, of course, the beauty of the finished infrastructure?

Is there such a great distance between the cutting instrument used to produce the carved stone in Paleolithic times and the knife of the 21st century? And more importantly, would the knife of today exist if that cutting instrument had not existed? Egypt, China, Greece and Rome and the different ages of the Christian era are the foundations and fertile land on which the world of the 21st century was built. Knowledge of the past, which will never be repeated, enables us to venture into the circumstances, ways and behaviours that guided the old world to the world of today, demonstrating the firmness and perseverance with which the former was constructed in remote times. And all the work of men at the service of mankind.

That lack of knowledge led Keynes to reflect on what commonly occurs in the event of any major technological change: “We are suffering just now from a bad attack of economic pessimism. It is common to hear people say that the epoch of enormous economic progress which characterised the nineteenth century is over; that the rapid improvement in the standard of life is now going to slow down – at any rate in Great Britain; that a decline in prosperity is more likely than an improvement in the decade which lies ahead of us”.[20]

The disruption associated with inventions and discoveries, and specifically in the period when an innovation is actively current, until it reaches a point where it first remains in a quasi-static state, before being replaced by a subsequent invention, is briefer as time progresses.

Now, as we are about to examine those changes classed as Revolutions, which by their very nature altered the conduct of most of the scientific, economic and social spheres, what we have just pointed out will be verified, because if, on the threshold of the Fourth Industrial Revolution, we are analysing the events of the three preceding Industrial Revolutions; we are speaking of just the last two and a half centuries.

The First Industrial Revolution, which occurred basically in the United Kingdom, lasted no longer than eighty years (1760-1840). This was the Revolution which brought with it both industrial and agricultural mechanisation. The former, through the application in industry – the textile industry is worthy of special consideration – of the spinning and weaving machines. However, the true revolution had its origins in the discovery of the steam engine – James Watt, 1782 – which was applied with great productive success both in industry and in transport – the railway and the steamship.

But what was the reaction of society and, more specifically, the working man to the great technological advances that were now being witnessed? A historical anecdote is very eloquent: “Back in 1811, weavers in Britain’s Nottinghamshire… staged a rebellion, wrecking the machine looms that were threatening their livelihood. They were right to be afraid. The decades ahead were grim. Machines did replace human labour, and it took time for society to adjust. But those weavers couldn’t imagine that their descendants would have more clothing than the kings and queens of Europe, that ordinary people would eat the fruits of summer in the depths of winter. They couldn’t imagine that we’d tunnel through mountains and under the sea, that we’d fly through the air, crossing continents in hours, that we’d build cities in the desert with buildings a half mile high, that we’d stand on the moon and put spacecraft in orbit around distant planets, the we would eliminate so many scourges of disease. And they couldn’t imagine that their children would find meaningful work bringing all of these things to life”.[21]

The Second Industrial Revolution, which brought to Western Europe, the United States and Japan the elements and effects of the First Revolution, lasted just twenty years in terms of its heyday (1850-1870), although its effects continued until they were halted by the outbreak of the First World War (1914). It marked the beginning of the automobile, the airplane – both with combustion engines – the telephone and telegraph, the light bulb, electricity, petroleum and its derivatives, iron and steel.

The Third Industrial Revolution, known as the “Information Society” began in the middle of the 20th century (1950), after the period of reconstruction and reparation following the Second World War and has lasted practically to the present day. It has been led by the United States, the European Union and Japan, and, with a certain timidity and in a very sectorial manner, by China. It is the revolution of the New Information and Communications Technology, the development of renewable energies, automation – automation processes in industry and elsewhere – new electric and hybrid engines for vehicles, and concern about sustainable

development. Perhaps we are witnessing its final moments because there are signs that the Fourth Industrial Revolutions will begin, if not immediately, then in the very near future.

V. On the eve of the Fourth Industrial Revolution. The Fourth Industrial Revolution, also called "Globalisation 4.0" or, alternatively and very concisely, "Digitisation", is attributed to Klaus Schwab,[22] who believes that current times present man with a complex contradiction between very powerful expectations and very great dangers. Depending on the attitude of the present generation, the former will prevail or we will be enveloped by the latter. Up to this point, there is possibly nothing very distinct or different from what has occurred in the history of humanity as a result of scientific and technological changes at any given time.

It was J.M. Keynes who first used the term "technological unemployment" to illustrate the immediate effects of rapid large-scale innovation: "For the moment the very rapidity of these changes is hurting us and bringing difficult problems to solve. Those countries are suffering relatively which are not in the vanguard of progress. We are being afflicted with a new disease of which some readers may not yet have heard the name, but of which they will hear a great deal in the years to come – namely, *technological unemployment.* This means unemployment due to our discovery of means of economising the use of labour outrunning the pace at which we can find new uses for labour".[23]

At this point in time, on the threshold of the Fourth Industrial Revolution, we cannot resist recalling what David Ricardo advised at the most decisive time of the first of these revolutions, under pressure, no doubt, caused by the loss of many jobs in the textile factories of the United Kingdom. In 1817, he wrote: "The employment of machinery could never be safely discouraged in a State, for if a capital is not allowed to get the greatest net revenue that the use of machinery will afford here, it will be carried abroad, and this must be a much more serious discouragement to demand for labour, than the most extensive employment of machinery; for, while a capital is employed in this country, it must create a demand for some labour; machinery cannot be worked without the assistance of men, it cannot be made but with the contribution of their labour. By investing part of a capital in improved machinery, there will be a diminution in the progressive demand for labour; by exporting it to another country, the demand will be wholly annihilated".[24]

It is certainly true that the changes that come with all revolutions seem to be accentuated as we progress through history. The earlier Industrial Revolutions might have required training of worker skills, mainly of a physical nature. More recent Industrial Revolutions have required intellectual training and a mental disposition that has not always been within the reach of everybody, especially older workers.

This means that many of those currently carrying out productive tasks, will either be late in meeting the demands of new technologies or will never be able to do so, leaving them, in theory, on the margin of labour insertion processes. It may be risky to say so but, at this point in time, it would seem the challenges posed by the Fourth Industrial Revolution are greater than those of previous eras. They are greater in intensity and also greater in terms of training and specific preparation.

We are speaking of a Revolution based on so-called artificial intelligence (AI). Of the multiple definitions of AI, the one I find easiest to accept is that AI "… are machines that reproduce the cognitive, problem-solving and learning functions of humans".[25] Despite my acceptance of this definition, I acknowledge and, at the same time affirm, that it is not easy to accept that *intelligence* is, conceptually, a machine, although it is certainly true that the 21st century is linguistically characterised by the devaluation of the strict meaning of terms.

Through AI, and based on AI, the automated economy will be constructed, going beyond the automation of industry, which has already been operating in the market for many years. This has been possible, "Firstly, *[due to]* the increasingly greater capacity of machines and computers to recognise patterns… Secondly, *[due to]* autonomous machine learning… Thirdly… *[due to]* the exponential increase in computing capacity and mass data use…"[26] Without forgetting the importance played by lower equipment costs in this revolution and, also bearing in mind, as we have mentioned, the constant increase in the capacity for calculation, data storage, recognition of environments and, above all, processing capacity, making the unit cost of mechanisation insignificant with respect to the historic costs in times that are still very recent.

Does this mean that all productive activity, also those activities that require the involvement of the human being, will become automated? Obviously not. Sometimes because the activity will not be susceptible to automation and, on other occasions, because such automation will not be economically feasible. It should not be forgotten that any change must be justified by its efficiency, a *sine qua non* condition, as well as the evaluation of its human and social effects.

The fact is that there are already studies that have analysed the professions that could be susceptible to automation. C.B. Frey and M.A. Osborne analysed the professional profiles required for certain activities in 207 professions and observed that 33 were not automatable and that 37 had already been automated. It can be deduced from this that potentially 70% of professions could be threatened by automation that might

affect employment; although, given human and economic constraints, there would be no certainty that these professions would be automated in reality.[27]

Similarly, a study, based on statistical data, of the potential substitution of human work for computers or robots, carried out in fourteen economic sectors between 2013 and 2016, in Germany, produced some eloquent results (see Graph I).

In four of the sectors analysed, the incremental real substitution potential between 2013 and 2016 was never higher than five percentage points – in sectors associated with the provision of services and those related to medicine and health, the substitution potential was a negative impact, ranging from between minus one and minus four percentage points, respectively; six sectors had an increased probability of substitution of between six and ten percentage points, while the potential for automation in four of the sectors researched increased in the range of 13 to 20 percentage points in the period considered.[28]

It is certainly true that the German labour negotiation model is not the most common in European countries, or in non-European countries for that matter. In other countries, imbalances in the labour market give rise to employment and unemployment figures. On the contrary, in the German model, the adjustments do not occur in the level of employment. They occur, and have occurred often, in the wage level, in the form of salary contractions. This has a direct income effect on the most easily replaceable workers, but the objective of full employment prevails over sustaining or even increasing salaries.

Based on what we have been saying, it is true that the Fourth Industrial Revolution can be seen as a threat to workers who currently have jobs – this was also the case with the three previous revolutions and many of the scenarios that we would simply classify as upheavals. But it is no less true that the adverse or favourable effects will depend on the attitude of the subjects, who play a leading role in the production process, and the social improvements or regression arising from their decisions.

Let us not lose sight of the fact that "Technology… is a profoundly human reality, linked to the autonomy and freedom of man. In technology we express and confirm the hegemony of the spirit over matter… Technology enables us to exercise dominion over matter, to reduce risks, to save labour, to improve our conditions of life. It touches the heart of the vocation of human labour: in technology, seen as the product of his genius, man recognizes himself and forges his own humanity. Technology is the objective side of human action whose origin and *raison d'être* is found in the subjective element: the worker himself. For this reason, technology is never merely technology. It reveals man and his aspirations towards development; it expresses the inner tension that impels him gradually to overcome material limitations".[29]

What for now is indisputable is that the Fourth Revolution is there; offering opportunities, generating doubts and unease, and that the response of countries and their people will determine the outcome. The opportunities perceived are not uniform in the different countries and neither are the doubts and unease observed with the same intensity and fear in all of them. Therefore, the response will be positive in some cases and negative in others. This has always been the case of man in the world in which he has had to live.

We have also seen from Graph I that the potential for substituting human work with the work of computers is very variable depending on the specific sectors and professions we look at. It is clear that for a repetitive, manual task, the substitution potential is very high, which does not necessarily mean that substitution will occur, because, as we have pointed out, there are other constraints – economic and human – which favour or hinder the substitution decision.

In contrast, it is undoubtedly the case that in creative work, research work and management, in which productive action is individualised within a specific person, the potential to substitute men with machines is almost non-existent, unless high risks are assumed with respect to both the quality and results of the process. In the case of both high and low substitution potential, an important factor is the readiness of the subject of the work, and also that of the entire production system, for man/machine permeability.

At the end of the day, the productive entity aspires to competing in the markets, as a requisite for survival, and human rejection of the new technologies or lack of qualification in the implementation of them, in order to provide what the world is demanding, could bring the existence of the company as a whole to an end. It goes without saying that the current capacities of different countries to address the challenges associated with the Fourth Industrial Revolution are very different, both in terms of human capital and the capital equipment needed for the purpose. Based on this, we recall what Ricardo wrote in the text referred to at the beginning of section V of this paper: "By investing part of a capital in improved machinery, there will be a diminution in the progressive demand for labour; by exporting it to another country, the demand will be wholly annihilated".[30]

We cannot forget that the market, with a size and freedom that never existed in times gone by – as a result of the process of globalisation – enables goods, services and capital equipment, as well as the knowledge arising

from research, to flow across borders – borders which ceased to isolate nations a long time ago – with a speed that does not permit, without serious damage, sealed compartments that are not influenced by the environment around them. Therefore, we must be convinced of the fact that the challenge posed by the Fourth Industrial Revolution will be an opportunity to be availed of by those who join it and will mortally wound countries wishing to protect themselves from its influence.

It is very true that there will be changes, that there will, of necessity, be new labour relations models and new ways of hiring workers. In all probability, the old concept of job, allied to the concept of the worker being regarded as the possessor of this *job*, will change or even disappear, to give way to a more functional and necessarily more agile concept of *occupation*, with the worker executing this occupation, based on the demands of the function to be carried out, and the technical skills and abilities acquired for this purpose.

Personal competences will be decisive in order to have access to the occupations that will emerge as the production system incorporates the improved technologies arising from the research and development of the capital equipment. The pace of adoption of these technologies will be determined, on the one hand, by business initiative and openness to change and, on the other hand, by the financial capacity to make the necessary investment in capital equipment to enable the change to be executed.

Pace and intensity will be very different in different countries and in different sectors and economic activities, and even more so in different people, different workers. Even now, at the beginning, the differences are very noticeable, giving rise to grounds for special concern. Graph II shows the comparative supply of industrial robots (data and forecasts) in different continents, with a more than significant predominance of supply in the continent of Asia.

The exponential growth in the figures for Asia in the period 2017 to 2018 is forecast to continue at a similar annual rate in the period 2018 to 2022. The figures for Asia, and particularly those for China, at least in absolute terms, South Korea and, perhaps to a lesser degree, Japan, are alarming when compared to the rest of the world, regardless of the fact that figures for Europe and America continue to be comparatively significant.

The 2017 figures show that the number of robots (units) supplied to Asia is the equivalent to 233.33% of those supplied to the rest of the world. This already large figure keeps the level of 205.07%, according to the latest available data for 2018. Figures that cannot be seen with optimism, comparatively speaking, and more so if we consider that in Europe, more than in America, and particularly in some European countries, populations are old as a result of decades of crisis in terms of birth rates.

From this it can be affirmed that, as of now and in the immediate future, spanning a number of years, the age variable, manifested in the form of an old and very old population, will prove an obstacle for the provision of an appropriate response to the demands of the innovations and transformations which will almost certainly have to take place within the framework of the Fourth Industrial Revolution, in which the development of Artificial Intelligence and the automation of economic and social activities will become patent.

If we go from the aggregated dimension of the market by continents to a breakdown of the figures for the fifteen most significant countries, as expected, given that we are speaking of absolute figures, Graph III shows that China stands out with 154.0 thousand industrial robots installed, followed by Japan with 55.2 thousand units, the United States with 40.4, Republic of Korea with 37.8, Germany with 26.7, Taiwan (Republic of China) with 12.1 and Italy with 9.8 thousand units installed. The remaining countries represented in the Graph, at the very right hand of it, eight all together, from France to Czech Republic, with the fewest units installed, have less than 6,000 units installed, the last one being the Czech Republic, with no more than 2,700 industrial robots.

However, if we look at the number of industrial robots in relation to the number of employees, instead of looking at absolute figures, either by continents or by countries, the situation looks quite different, due to the different volume of employment in industrial sectors of the countries represented. This is an illustrative figure if our aim is to reach a conclusion on the mass implementation or otherwise of robots in jobs and their capacity to operate in production processes.

Graph IV shows the number of industrial robots installed per 10,000 employees in production processes in 21 countries in 2018. China now occupies the 20th position, with 140 robots for every 10,000 people employed. Singapore tops the table with 831 robots for every 10,000 employees, South Korea follows with 774 robots, Germany with 338 robots, Japan with 327 robots, Sweden 247, Denmark 240, Taiwan (Rep. of China) 221, and the USA 217.

The remaining countries represented have fewer robots than the USA, with the Czech Republic occupying the final position, with 135 robots, immediately after China, which we have already alluded to. The Graph also includes, for illustrative purposes, continental averages. Europe has the highest average, with 114 robots per

10,000 employees, followed by America with 99 robots per 10,000 employees, and Asia with 91 robots per 10,000 employees. Finally, the world average is 99 robots for every 10,000 employees.

In the light of these technology endowments, job offers in many countries will see, more than ever before, significant differences between qualified and unskilled workers. It will not be possible to achieve qualifications through short, intensive training courses, because the knowledge, skill and capacities needed to address the challenges of innovation demand wider competences that require a long time – higher education – to acquire.

Some countries, in accordance with what can be seen on the graphs, began to take measures some years ago, while others have been less diligent in terms of the educational efforts needed to serve the technological breakthroughs of the present era. Therefore, the concern of the analysis at this point in time centres mainly on wage differences arising from more and better training, as well as similar differences in terms of the employability of better qualified workers compared to that of unqualified workers.[31]

The fact is that countries which commenced the process of training workers in technology earlier have significantly enhanced worker skills in terms of addressing the current process of change, with a considerable increase in the number of higher education graduates in the entities responsible for the production and distribution of goods and services. It is true that, in this process, it is necessary to distinguish between the commencement – short term – and future needs and the capacity to satisfy them – medium and long term. A percussion effect at the beginning, with revenues arising from scarcity, will be followed by a period of stability, which will last until a new percussion effect occurs.

An accordion effect that should be taken into account occurs between one and the other. In the first instance, during the phase of the technological impact, the demand for highly qualified workers meets with a rigid supply of qualified workers. This gives rise to an exponential increase in salaries and employability, until suppliers of labour react and adapt to the required qualifications. The consequent rise in supply, for an already consolidated demand, tends to stabilise, and even leads to a relative reduction in the salary levels of qualified workers, and job stability also decreases.

We believe that the adaptation of the supply of labour – workers – requires a long period of time to offer the qualifications demanded by the new technology, first for basic training and, subsequently, for specialised training. This period cannot be abbreviated, unless it is cut short at the expense of the qualification demanded by the means – physical capital – or through the procedures implemented. On completion of these two training levels, a period of practical training in the production process itself will be advisable, in order to consolidate the academic knowledge acquired.

Therefore, in some countries we face a situation of double dualism in the markets. On the one hand, the dualism we might describe as traditional, particularly in countries with high levels of job protection as a result of high dismissal costs. This dualism occurs between workers with many years of service – with high dismissal costs – and recently recruited workers, very often with temporary or project-based contracts – with low redundancy costs.

Along with this dualism, which we have called traditional dualism, we now find a new brand of dualism, featuring highly-qualified workers with high salaries and low, if any, unemployment, and very little volatility in terms of employment and salaries, and workers with low qualifications, no qualifications or qualifications unsuited to the demands of the new technological revolution. These workers suffer high unemployment, very low salaries and high volatility in terms of job security and salary levels.

The latter workers will be exposed to greater unemployment, due to lack of technological capacity. This unemployment will not be absorbed until the economic process becomes capable of generating low skilled jobs, in the shadow of highly specialised jobs. At the same time, the salary map will accentuate the inequalities between the two worker types, and the gap will not be closed in terms of their professional capacities until the educational system can have an effect on their qualifications, which requires will, determination and effort at all levels.

There is abundant economic literature on the relationship between human labour and technological improvements that can be incorporated into production processes, and the distribution of goods and services. The available literature covers both the microeconomic dimension, as is the case with Puhani,[32] and the macroeconomic dimension, based on endogenous growth models to determine long-term trends in both unemployment and inequality.[33] Some of the literature focuses fundamentally on the effects of the technological change on the labour market, without yet considering rigidities in this market and other phenomena influencing unemployment. This is the mainly the case of P.A. Gautier,[34] as well as Albrecht and Vroman,[35] amongst others.

In certain instances, the impact of technological change is analysed in general dynamic equilibrium models, as in the case of Lindquist,[36] although he does not incorporate the rigidities of the labour market. However, relative wage rigidity is taken into account in the work of Pierrard and Sneessens.[37] On occasions, the empirical evidence provided by model, Acemoglu, differs when more than one country is considered. Thus, technological incursions in the United States result in immediate improvements in employment, whereas in Germany we observe wage reactions rather than reactions in employment.[38] Some of these models are more sensitive than others to certain variables, as well as, for reasons of data availability, focusing on certain countries or others in accordance with the preferences of the researchers. This is not the place to enter into this matter in detail, although a wider selection of this literature can be found in the bibliography at the end of this paper.

VI. By way of conclusion. Allow us to begin this final section with a quote that could serve as a frontispiece for it. “Much as happened during the industrial revolution, new technology is rendering obsolete whole cases of employment while making untold new wonders possible. It is making some people very rich, and others much poorer. It is giving companies new ways to organize…”[39]

This being the case, given the content we have just seen, we cannot but ask ourselves: Will the jobs we are doing today disappear? What do we do with our professions, which have been consolidated with personal effort? What do we do with our training, unquestionable over the decades of our working lives? And, finally, who will survive to bear witness to what has occurred?

Perhaps the questions are very apocalyptic, just as those asked in the course of a dinner on the occasion of the visit of President Obama to Silicon Valley, in February 2011. Each attendee had been asked to have a question ready for the President, but the question that attracted most attention was one the President himself put to Mr. Steve Jobs, CEO of Apple.

“President Obama asked, «What would it take to make iPhones in the United States? Why can’t that work come home?» Job’s reply was blunt. «Those jobs aren’t coming back». *[Later on]* Mr. Jobs told Obama «I’m not worried about the country’s long-term future. This country is insanely great. What I’m worried about is that we don’t talk enough about solutions»”.[40]

We have already said that the new opportunities will be at the disposal of everyone; some will avail of them and others will not. For this reason, and with a view to not becoming immersed in the list of dangers, in the obscurity of a horizon without roads, without ways out, flooded in rejection, it is worth making a clarification. A clarification which Steve Jobs himself might well have made, as someone who lacks nothing in terms of knowing the implications of a technological revolution. In our opinion, his reply could have been: *Those jobs, in existence until now, will not return. But there will be many new forms of employment, currently not in existence, that will be able to cater for employees who lack adequate training for the demands of the new technology.* This response, which I believe to be more in line with what will probably occur, would have given greater hope, and not gratuitous hope, to the dinner guests.

I base my broadening of the answer on the fact that in all previous revolutions, and I expect that it will be no different in the Revolution of Artificial Intelligence, there have been instruments – machines, for the sake of brevity, and generalising – which, in effect substitute man but, even in these cases, the replacement always has a limit, because there will always be a man above the machine.

Keynes himself, subsequent to announcing *technological unemployment*, assessed the final result of a problem he considered to be transitory. In this respect, he stated: “But this is only a temporary phase of maladjustment. All this means in the long run *that mankind is solving its economic problem.* I would predict that the standard of life in progressive countries one hundred years hence will be between four and eight times as high as it is today. There would be nothing surprising in this even in the light of our present knowledge. It would not be foolish to contemplate the possibility of a far greater progress still”.[41]

What role is currently being played by so many varied platforms that act as virtual instruments for the connection between suppliers and demanders of goods, and also of services, even of very personal services? What point must the flexibility of the worker, the provider of a service, reach in order to reconcile his desires for an intense family life with the need to work in exchange for remuneration? Or is it that work – perhaps better expressed as «occupation» – necessarily implies the rigidity of a timetable and the physical association of a manufacturing space in which to carry out the productive activity? Naturally, these spaces will continue to exist, with their mechanised installations, with their robots, for activities susceptible to automation, and with men, with workers, performing functions different to those carried out by their predecessors.

Moreover, not all technologically advanced instruments of production are geared towards substituting human work. Many of them co-exist with man in a complementary relationship. In fact, in these cases, all the potential

of the most advanced technology, incorporated into a machine or production process, is put in the hands of the qualified man, with the skills and competences required for the purpose, in order to satisfy the technical and economic demands of the production associated with the business activity.

Do we have nothing to say regarding that capital-human labour equation in the quest for a competitive product that meets the demands of a competitive market? What is there to say of technological innovations and their effects when it comes to determining what K. Marx called "*the value of labour power*"? In other words, what was the value of labour power, i.e., the hours of labour needed to produce subsistence goods for the worker, in 1867, the year in which the first of the three volumes of *Das Kapital* was published?

Marx is very clear in his assessment, saying that: "The value of labour power is determined by the value of the necessaries of life habitually required by the average labourer: The quantity of these necessaries is known at any given epoch of a given society, and can therefore be treated as a constant magnitude. What changes is the value of this quantity".[42] We cannot forget that the value of goods, those goods customarily necessary for the subsistence of the worker – and also that of his family, we would add – is, in turn, determined by the hours of work invested in their production, as had previously been established, first by Ricardo, and subsequently by Marx himself.[43]

Marx, however, is conscious of the possibility of a change in the value of the mass, although the mass remains unchangeable. Thus, he added that: "The value of a commodity would, therefore, remain constant, if the labour time required for its production also remains constant. But the latter changes with every variation in the productiveness of labour. This productiveness is determined by various circumstances, amongst others, by the average amount of skill of the workmen, the state of science, and the degree of its practical application, the social organization of production, the extent and capabilities of the means of production, and by physical conditions".[44]

Effectively, the labour time needed for the production of any good changes when the production conditions of the good change; i.e., the number of hours required at any given time and place for its production. In some cases, it will be determined by the dexterity and skill of the worker – labourer – and in other cases, by the effectiveness of the means of production, a consequence of scientific and technical progress. Our imagination cannot comprehend the quantitative and qualitative differences of these magnitudes at the time *Das Kapital* was written and the present day, even in the same scenarios that the author knew very well.

Examples of these magnitudes are abundant in the work of Marx. There is frequent reference to the idea that, of the twelve daily working hours of a labourer, six are required to produce the food, clothes and remaining socially necessary goods for his subsistence. Therefore, the six remaining hours constitute the surplus value appropriated by the capitalist from the work of the labourer.

Two questions should be considered at this juncture: a) what today is the dimension of the value of labour power in the same countries that Marx knew very well – England, Germany, France…; what point has what is socially necessary reached? And b) How much, in terms of labour hours, is needed for the production of these goods, given the scientific and technical advances that have called into question, and even contradicted, the proposals of the author from Trier (Rhineland-Palatinate), in terms of their descriptive formulation and the capital-labour ratio, as well as with respect to the revolution needed to emancipate labourers from the bondage of capitalism?

We have already pointed out that society, and more specifically the working man, have always had doubts when innovation becomes apparent.[45] Thus, we can state with complete certainty that the man of the immediate future – the man of the 21st century itself – will find himself, in the same way as his predecessors, impacted by this dual feeling of which we have spoken: the feeling of fascination arising from the possibilities opened up by the new contribution of human knowledge, and the feeling of panic arising from the doubt about his own capacity to accept the change and benefit from the great results afforded by it. But, he will also confirm, with fairness, that his life unfolds along very different lines to that of his predecessors from a mere three generations ago.

Greater endowments of goods at all levels. The average worker is not required to work eight hours per day in order to achieve mere subsistence. The twelve-hour working days so oft-referred to in the works of Marx have been left behind. Those scenarios of exhausted children sleeping in bunks in the textile factories prior to commencing another working day are but a distant memory.

The protagonist of this radical change, between living conditions at the beginning of the 19th century and those of the 21st century is development; scientific, technological and economic development, and, above all, human development. The man of today has more free time for family, for sociability, for leisure, for contemplation, for spiritual enrichment. Shorter working days than those of just half a century ago have not meant a reduction in his economic and social rights, or in his quality of life.

Less and less effort on the part of the worker will be required to carry out the work of the Fourth Industrial Revolution, in line with trends since the incorporation of the first machine in production processes. In turn, the economic capacity of workers and their families, in real terms, will be increasingly greater due to lower production costs, which is also a consequence of continuous technological progress.

The words of Keynes, spoken at a conference in Madrid in June 1930, and which had previously (1928) been the subject of discussions in the Winchester College Essay Society and the Cambridge Political Economy Club, would prove to be prophetic: "For many ages to come the old Adam will be so strong in us that everybody will need to do *some* work if he is to be contented. We shall do more things for ourselves than is usual with the rich to-day, only too glad to have small duties and tasks and routines. But beyond this, we shall endeavour to spread the bread thin on the butter – to make what work there is still to be done to be as widely shared as possible. Three-hour shifts or a fifteen-hour week may put off the problem for a great while. For three hours a day is quite enough to satisfy the old Adam in most of us!"[46]

What is also true is that many jobs that are very common today will belong to those that Steve Jobs told President Obama *"will not return"*. Nonetheless, there will be many more, in sectors currently unimaginable, that will offer new employment opportunities for people who perhaps do not yet exist: new industries with a greater human touch, social media providing remunerated employment for individual creators, public funding for services aimed at children and the elderly, chat box designers, pedestrian behavior specialists for autonomous vehicle software...

Alain Dehace, CEO of Adecco, a human resources company, "is not one of those who believe that robots will take away our work… *[Although]* he believes that half of today's jobs will not exist in a few years or will be otherwise… «Of those children who are now between six and twelve years old, six out of 10 will perform work that does not exist today ... There are about 375 million people, representing 14% of the world's workforce, that will have to be recycled. The content of the work has changed because of technology»".[47] People trained to respond to the needs of the new era, as new generations in the past responded when the response of their predecessors was insufficient. Two milestones emerge on the horizon: competent education and flexibility in learning.

The educational system should emphasize its scientific, technical and, above all, humanist training, carried out with rigour and intensity, as well as lifelong learning and responsibility in the endeavour demanded; a responsibility which, although identified with the person, also embraces the sphere of social responsibility. We are all called to the endeavour: individuals, families, communities, private and public sector, at national and global level... And, let us not forget that we are human persons; a privilege above and before any material matter, regardless of the benefits of the latter.

As human persons, we are called upon not to succumb, due to lack of diligence, to the new conditions of life and work. In the second half of the last century there were already many temptations associated with materialism, hedonism, a superficial and ephemeral life of leisure, which caused many to abandon the path of truth and become enslaved in the possession and enjoyment of material goods.

Some of this may continue to be the case, and there may be additional dangers: could the proximity of the machine – the robot – distance us from men? Is there a place for indifference to the *OTHER*, to our *BROTHER*? Could scientific and technical progress cause us to forget our own humanity? With whom, the practice of charity, of solidarity? The answer to all of this is to be found in our own heart, called upon to work with rectitude. We must be mindful of the teachings of the prophet, "…I shall pour clean water over you and you will be cleansed; I shall cleanse you of all your filth and of all your foul idols. I shall give you a new heart, and put a new spirit in you. I shall remove the heart of stone from your bodies and give you a heart of flesh instead. [Ezk 36 25-26]".

It depends solely on us. And this is certainly a task that we cannot entrust to Artificial Intelligence (AI) or to the algorithms that make it effective.

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