The institutional challenges to the labor market and the fourth industrial revolution in the light of a new paradigm in economic thinking: the Brazilian case[1]

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ABSTRACT
Based on an institutional heterodox approach, in which the role of institutions is central to understand the different trajectories of the societies, and aiming to contribute to the construction of a new paradigm of economic thinking, this paper examines the advance of the fourth industrial revolution (4IR) in developed and developing economies. Such a revolution is in course and Brazil does not present a national strategy to manage this structural change. First, it is explicited the theoretical elements that underlie the article, focused on the role of institutions. Then, the main concepts and implications of 4IR are presented. Next, it is discussed how it will affect the labor market in general. From this perspective, an analysis of the Brazilian post-2008 labor market is elaborated, highlighting their potential and difficulties to implement an efficient development trajectory. It is considered that, in addition to the process of technological catching up, engendering a virtuous circle between 4IR and the Brazilian labor market will require a combination of institutional improvement and dialogue – of an active social and political character, human-centered – with the immersion of Brazil in international and regional development agendas at the domestic and foreign level. This will favor better opportunities for macropolicies and structural changes, a path that tends to make feasible sustainable socioeconomic development with equity and in close association of technology with the national labor market. Therefore, now that a new threat of labor precarization is imminent, the theoretical and methodological framework applied in this research can become an alternative to overcome this historic challenge.

Keywords: Brazil, 4IR, institutions, labor market, technology.

1. Introduction

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The recent acceleration of the third industrial revolution, already considered by some specialists as the 4IR, is in course and its rapid technological transformations will significantly impact the economic and social order as a whole, presenting itself to humanity as one of the greatest challenges of the 21st century in terms of risks and opportunities. The most visible disruption caused by this structural change seems to falls on the world of work, in an environment of uncertainty[2], mainly due to the ups and downs of the economic and financial crisis that broke out in 2008. In this context, Brazil does not present a proper strategy for coping with this reality.

This subject, although incipient, present a limited bibliography proposing to articulate the relations between 4IR and the Brazilian labor market. Thus, it is opportune a research effort that will lead to this debate and, at the same time, possibly cover this deficit of the economic literature.

Here, it is adopted, for the proposed discussion, a theoretical lens with a heterodox approach of the economy, following the perspective of Chang's Institutionalist Political Economy, combining it with conceptual, statistical and analytical studies of international institutions as The World Economic Forum (WEF), the Organization for Economic Co-operation and Development (OECD), the Economic Commission for Latin America and the Caribbean (ECLAC), the International Labor Organization (ILO) and other international, regional and national organizations.

Beyond this introduction and the final considerations, the study is divided into four sections: the second one presents the methodological assumptions underlying the article, focusing on the role of institutions, providing theoretical inputs that will permeate the debate in order to the proposed economic approach and its application to the 4IR issue; the third presents the main concepts and implications of 4IR; the fourth will discuss how it will affect the labor market in general, and the Brazilian in particular; the fifth examines data on the performance of the Brazilian labor market since 2008 and in terms of trends, also the challenges and possibilities for a successful insertion of the Brazilian labor market in the context of new technologies and how Brazil must act to make such insertion feasible.

2. Institutions, technology and the world of work: towards a new paradigm in economic thinking

How have countries become *de facto* developed? This is the question that Ha-Joon Chang sought to answer in the book "Kicking Away the Ladder" (2003a). Based on a denominated Institutionalist Political Economy approach – that emphasizes the effects of historical and socio-political factors on the evolution of economic policies[3] –, his main argument was that the advanced countries have historically used policies opposed to the orthodox framework currently advocated by them for emerging countries, hindering the development of the latter ones. He undertook an analysis that reveals the neoliberal fallacy that is to require from developing nations the presence and imitation of a set of institutions that would be prerequisites for creating an environment conducive to good governance practices. In this perspective, the fulfilment of institutional and economic policy conditionalities (especially in industry, commerce and technology) – embodied in the so-called Washington Consensus – would be necessary and sufficient to elevate developing countries to the category of advanced nations.

[2] In this article we use the uncertainty view proposed by Minsky (1996, p. 360), expressed as follows: "uncertainty (or unsureness) is a deep property of decentralized systems in which a myriad of independent agents make decisions whose impacts are aggregated into outcomes that emerge over a range of tomorrows".

[3] It should be noted that critics of the approach proposed by Chang point out as somewhat problematic the selectivity of the evidence used by the author, by supposedly randomly choosing success cases and omitting cases of socioeconomic failures of nations, according to the convenience of the argument constructed. The present paper does not exploit such evidences since the effect on selection of criticisms is smaller when it is examined the full list of considerations.

Central to his approach are institutions, understood as “devices which enable the achievement of goals requiring supra-individual coordination and, even more important, which are constitutive of the interests and worldviews of economic actors” (CHANG & EVANS, 2005, p. 101). From this definition, it can be seen that institutions change in time and space, according to the historical specificities of each society and economy, with multi-directional interactions between economic factors and existing institutions themselves, impossible to explain by models based only on mainstream archetype.

Chang (2006) sees institutional, cultural, and economic change as mutually influencing – in complex chains of causality – and that, after all, it is the people who do it, though not in the institutional context of their own choice. He criticizes the determinism of the conventional economic theory verified, or the neoliberal discourse, and argues that to supplant it is essential to understand the intricacy of culture and institutions, considering the relevance of human agency in institutional change. Moreover, he draws attention to the misconception of denying the diversity of institutions; that is, the impetus to simply transplant an institution into a context other than the original without making the necessary adaptations (the notion of “one-size-fits-all”). This is a relevant problem especially at the beginning of the 21st century, where structural disruptive changes, such as in technology and in the world of work, for example, are evident.

He warns that the success of institutional development is dependent on both formal and informal attributes, institutions are the product of shared patterns of thought, imbued with the daily life of society, determining individual actions and the type of social interaction between different groups. Thus, mere institutional imitation is absolutely insufficient to guarantee a successful institutional development, once there are a lot of tacit elements in institutions. Accordingly:

> if this is the case, importing the formal institution is not going to produce the same outcome [where it was originally successful] because the importing country may be missing the necessary, supporting informal institutions. So, in the same way in which imported technology needs to be adapted to the local conditions, some degree of adaptation is needed in order to make imported institutions work (CHANG, 2006, p. 11).

Besides, he points out the connection between institutional innovations and society in which the former, when interpreted as technologies for social management, allow the understanding of socioeconomic catching-up as an extract of institutional improvements in developing countries, from the adapted adoption of existing institutions into other advanced realities. Put another way, the latecomers can introduce institutions from the developed countries and thereby engender better institutions without paying the same price for it.

Thus, in the logic of the capitalist system, institutions are those that restrict, constitute and enable human actions, as a complex set of constituent rules of an organization composed, in this specific case, by the market, firms and the State. These three entities interrelate, mold and be shaped by this mode of production, according to the individual circumstances of intentional agents, in a reciprocal dependence between institutions and human action. Then, it is important the notion of a highly pervasive and interdependent institutional web, in which:

> the capitalist system is made up of a range of institutions, including the markets as institutions of exchange, the firms as institutions of production, and the state as the creator and regulator of the institutions governing their relationships (while itself being a political institution), as well as other informal institutions such as social convention. This suggests that we badly need an explicitly institutionalist perspective that incorporates non-market, non-state institutions as integral elements, and not simply as add-ons (CHANG, 2002, p. 8).

As for the role to be attributed to the State, Chang (2003b) is emphatic: markets, firms and the State are essential institutions to the functioning of the capitalist system and complex societies cannot rule out any of them. The critical point is that the free-market system *stricto sensu* rely exclusively on the law of supply and demand, and it is fundamentally a mistake to generalize it simply because there is no adherence to the reality historically observable. Therefore, the State necessarily has an indispensable active role to play in economic development. The State is, *inter alia*, the last guarantor of property, rights and the most important actor in the definition and execution of the public agenda. Thereby, there is no discourse that can fairly justify an institutional primacy of the market, with which this utopia confines itself only to an ideology like any other.

From the historical-institutionalist analysis which he elaborated, it follows that the possibility of socioeconomic development of any nation is the result of the engenderment of numerous factors in synergy over time, constructed by a certain society under different circumstances that change in time. It should be noted that at the center of events and their unfolding are the citizens. It is in this context that Chang's Institutionalist Political Economy approach can be improved, connected to a new paradigm in economic thinking, with a human-centered and sustainable development framework.

Assuming this view, it is essential the refoundation of socio-economic theory in order to provide new perspectives for the establishment of adequate and effective institutions, in line with the global and national multidimensional requirements of the twenty-first century, with a view to improving the general living conditions of people in general. This new social science should have a societal scope, be transdisciplinary, through an emphasis on scientific cooperation between economists and other social scientists. It is imperative to restore the economic paradigm as inseparable component of society, impossible to fully exist outside of a whole social context, being conceived as embedded and as a server of its needs (JACOBS, 2015, HOEDL, 2017).

It is necessary to overcome the controversial, dichotomous and not infrequently innocuous debates of the mainstream economy, so present between opposing groups of specialists, almost all confined to narrow academic circles, which in large part explains its own limitations. In fact,

> we need a new comprehensive and multidisciplinary socioeconomic theory that markedly differs from the present situation and in this vein makes a positive contribution in setting the ground for a new framework. The search for a new vision involves burning political and socioeconomic issues. Without a profound humanistic theory, which can produce significant actions, we are risking increasing uncertainties about democratic civilization (TEIXEIRA & TEIXEIRA, p. 197, 2016).

As it is well known economic theory is not only dedicated to wealth generation. The economic conception in each time and space is closely related to the relations of power established in each society and among societies. There are direct and indirect impacts of this power on institutions, which in turn have repercussions on the economy itself and in the quality of life of citizens. Thus, in any economic theory *de facto* it has roots in Political Economy, once the economy is strongly influenced by political and social power and vice versa. In this sense, the potential energy of society's achievement is highlighted, from which emerges the concept of social power, that is "the capacity of the society to direct, organize and utilize that energy for effective action by means of laws, social systems, institutions, knowledge and skills to accomplish social objectives" (JACOBS *et al*, p. 21, 2017).

Social power impacts on politics, economics, finance, laws, organizations, technology and innovation, the world of work, culture, education and many other aspects that make it possible to realize the common interests of society. So it is necessary to distinguish what is potential energy from what is the effective energy of society, as well as its productive application from the destructive one. The gap between them is a result of power allocation.

Emphasis should be placed on the most effective and positive use of social power, with a view to promoting the quality of life of human beings and sustainable development. A myriad of issues is part of this framework, such as: security, freedom, guarantee of fundamental rights, access to education and information, mobility, cultural diversity, creativity, decent work[4] and the alike. These institutional connections democratize and direct the application of social power forcefully (d'ORVILLE, 2015). It is a serious mistake to underestimate human and social capacities, since:

> human and social capital are unique in that they possess the ability to mobilize and utilize the other forms of capital to enhance performance. There is no inherent limit to the potential of human resourcefulness and social organization. Thus, there is no inherent limit to human development (JACOBS *et al*, p. 36, 2017).

That is why the participation of civil society in the design of its course is so necessary. Social power must be the key, in which it is important for the individual to have guaranteed their rights to have rights, allowing a qualified qualification in the productive system. This is a perspective of social transformation that seeks to avoid and eliminate the barriers that prevent individuals from having access to what they consider important to their lives. A substantial part of the socioeconomic backwardness is caused by limitations imposed on individuals with regard to restrictions and impediments to the improvement of quality of life and social conditions. Every citizen can and should demand access to a dignified life, through strategies for a more equitative distribution of societal power. The role of the individual in this new paradigm of economic thought is not suppressed, once society is not considered an aggregate of autonomous individuals. Each one of us are capable of unique initiatives, being the catalyst and source of social creativity and innovation, actions of a single individual can impact profoundly the economic performance. In this sense, individual freedom and collective welfare are complementary.

Therefore, it is necessary to inquire how to reconcile the premises of Institutional Political Economy linked to a new paradigm of economic thought with the rapid structural changes underway, specifically facing the technological and world of work scenarios. It is assumed that this is an urgent discussion, since it has become increasingly apparent that economies and societies have moved from an industrial logic (limited by the scarcity of material resources) to service logic (where knowledge and information – immaterial – are unlimited). Obviously, an absolute convergence of economic thought is not expected, even by its nature as a social science, but it is time to think the economy beyond the dichotomy orthodoxy *versus* heterodoxy, to understand that the true Gordian knot of socioeconomic development is between the past and the future. This finding is paradoxical in the face of a dynamic in which having a reality that is indivisible coexists with an increasingly fragmented scientific knowledge.

In this new era in which knowledge and information will increasingly be the linchpin of economic development, the trend is that the sciences of society will increasingly be judged on their ability to contribute to people's quality of life. In this case, a structural change in its bases must aspire to the formulation of knowledge applicable to this end, in a sustained way. Recognizing the limitations of conventional economic theory is an important start, for example, in what concerns to the narrow concept of economic efficiency, ignoring the social costs and other implications of maximization and minimization in the production chain. The efficiency of society is totally different compared to the efficiency of firms, where the former must be inclusive while the latter is achieved by replacing workers by machines.

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[4] The concept of decent work is contained in the document prepared by the 90th International Labor Conference, which expressly defines it as the central axis to which the four strategic objectives of the institution converge: i) promote and realize standards and fundamental principles and rights at work; ii) create greater opportunities for women and men to decent employment and income; iii) enhance the coverage and effectiveness of social protection for all; iv) strengthen tripartism and social dialogue (ILO, 2002, non-paged).

In accordance with this reasoning, even the use of technology must be rethought, not having an end in itself but intended to serve human needs in all walks of life. Possibly the most obvious of these is the technological increasingly pattern employed in the world of work, a process that if not well conducted can be pernicious even from the standpoint of conventional economic theory. This is due to the possibility of investing in technology aimed at production without having to worry about mitigating the potential harmful effects on consumption, for example. On the other hand, facing technological advances as progress of mankind, in a broad spectrum, is mandatory in this dynamic.

Therefore, in this new paradigm of economic thought there will be a special debate and action on the role of work in the 21st century, since the current configuration of the capitalist system cannot ensure decent work for citizens. The various societies have sought answers to the new global dynamics of the world of work, whether through multilateral agreements or through tensions within nations, which denotes the strength of society in affirming the dignity of workers and, consequently, it as a fundamental right of citizenship. Account must always be taken on the importance of the active participation of society and its institutions in order to ensure fairness of opportunities, protection of the social fabric and guaranteeing individual and collective rights at work. Work, in addition to ensuring material life, has fundamental relevance for the autonomy of individuals, the construction of identity and social recognition.

Consequently, a new paradigm in economic thought must have as its pillars the search for a free, democratic, just, pluralist, supportive and participative society, in which absolute respect for the dignity of the human person is emphasized. The economy should favor the practice of market rules, provided that it has as its main objectives the quality of life and equity among citizens. Economic action must be guided by social values, functioning effectively in a dynamic social market economy.

To put it in a nutshell, the theory and methodology set forth in this section will be adopted as the basic premises that will permeate the interpretation of 4IR advance in the developed and developing economies and their impacts on the Brazilian labor market. It is assumed that such a foundation will favor a better understanding of the proposed analysis, revealing key aspects of the subject that were neglected in possible similar investigations. Moreover, looking at these phenomena by examining their role in the development process implies that this research offers a different angle of view in relation to this theme, distinct from the way it has been approached until the present moment.

3. The forth industrial revolution: structural change and its magnitude

The expression “fourth industrial revolution” echoed worldwide firstly in the Hannover Fair 2011 meeting, due to the launch of the German government’s High-Tech Strategy 2020 industry 4.0 program, whose main objective is to establish this country at the forefront of the techno-industrial paradigm shift underway[5]. Industry 4.0 refers to smart factories, through decentralization and digitization of productive processes, with which cyber physical systems – characterized by the close union and coordination between physical and computational resources – perform tasks and exchange information autonomously (THE FEDERAL GOVERNMENT OF GERMANY, 2011; KAGERMANN, WAHLSTER & HELBIG, 2013).

[5] It should be emphasized that there is a State policy behind this phenomenon, denoting a deliberate strategy for the productive insertion of Germany in the context of 4IR. Other governments have outlined similar policies, such as: Australia (*National Industry Investment and Competitiveness Agenda, 2014*), China (*Made in China 2025 Initiative*), South Korea (*Action Plan for implementing its 3rd S&T Plan, 2015*), United states (*Strategy for American Innovation, 2015*), India (*Make in India, 2014),* Japan (*5th S&T Basic Plan, 2016*), United Kingdom (*UK Productivity Plan, 2015*), *etc* (*OECD Publishing,* 2016). The Brazilian government, for its part, launched the “National Strategy for Science, Technology and Innovation 2016-2019” (Estratégia Nacional de Ciência, Tecnologia e Inovação 2016-2019, Encti, 2016), which will be discussed in section 5.

From this spectrum emerges the 4IR, which in the words of Schwab (2016a, p. 14-21) is characterized "by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres". According to him, highlights of this reality are the technological advances in areas such as robotics, nanotechnology, crypto-currency (digital currency), artificial intelligence, big data, cloud computing, internet of things and 3D printing. In this sense, the 4IR is different from previous industrial paradigms, as observed in table 1.

Table 1 – Comparison among industrial paradigms

Industrial paradigm	Period	Technological change	Productive structure
1IR	mid-18th century	mechanical production (via water and coal)	mechanical loom, steam engine
2IR	between the end of the 19th century and the beginning of the 20th century	electricity, petroleum	assembly line
3IR	early 1970s	automation	electronics, information and communication technologies
4IR	present	digitalization	cyber physics

Source: adapted from GTAI (2014) and Schwab (2016a).

Although there is no consensus on whether these advances can be considered a 4IR or an acceleration of 3IR, certain technological changes will generate significant impacts on the economic and social order as a whole, presenting humanity as one of the major challenges of XXI century. On this question, Schwab (2016a, p. 1) states that in fact this is a revolution that "entails nothing less than a transformation of humankind". He also asserts:

> we stand on the brink of a technological revolution that will fundamentally alter the way we live, work, and relate to one another. In its scale, scope, and complexity, the transformation will be unlike anything humankind has experienced before. We do not yet know just how it will unfold, but one thing is clear: the response to it must be integrated and comprehensive, involving all stakeholders of the global polity, from the public and private sectors to academia and civil society (non-paged).

Rifkin (2015, p. 11) points out that this process will lead to the replacement of capitalism with a new socioeconomic model, "better suited to organize a society in which more and more goods and services are nearly free". He predicts that in the not too distant future the set of rapid technological transformations under way will greatly reduce the marginal cost of production, which will trigger a systemic impact on the economy and society as we know it. It also argues that the current capitalist economy is progressively tending to give way to the economy of sharing and common collaborative goods, opening space for a more cooperative society.

The effects of 4IR on all socioeconomic agents present enormous possibilities for improving living conditions in general, and also have unfortunate potential risks. As written by Davis (2016, non-paged), "every period of upheaval has winners and losers. And the technologies and systems involved in this latest revolution mean that individuals and groups could win – or lose – a lot". He affirms that the fact of this revolution being in its beginning makes its impact imprecise, but points out three great aspects to be addressed: security, identity and inequality.

As for security, the dangers are of fragmentation, segregation and social unrest, which can lead from violent extremism to the transfer of power to spurious non-state actors (see *Global Risk Report 2016 – WEF*, 2016b). Regarding identity, the paradox is that while the expansion of connectivity makes it possible to access different worldviews and increase the interaction between people and groups, it can raise the level of social polarization and tension. On the other hand, inequality, which has grown since the last quarter of the twentieth century – as Piketty (2013) has shown – can be considerably increased among those who will or will not be able to buy, access and enjoy technological innovations (DAVIS, 2016).

The challenge of all nations to form an institutional arrangement that does not break with this dynamic is fundamental to mitigate the risks of global geopolitical instability. The greatest risk in a context of very low marginal cost production – labor saver – is the rapid transfer of world manufacturers to the advanced economies, since wages may no longer be a factor of competitiveness between companies.

This will have significant impacts on the global economy and the organization of the world of work. It will impose on emerging countries – the case of Brazil – to rethink their strategies and development models. The greatest socio-economic threat that 4IR could cause is a dynamic of plays of the type everything to the winner between countries, as well as within them, generating overall insufficient demand for work or labor skills available.

4. Labor market 4.0: the juxtaposition of structural changes

According to "The Future of Jobs Report" (WEF, 2016a), the most visible disruption caused by structural change under way will fall on the world of work. As we move forward, production will tend to increasingly incorporate cyber physics, whereby the comparative advantages of the supply of human labor – at least the conventional ones – will gradually decline. Many existing labor activities today will lose relevance and/or be extinguished. The same report indicates that between 2015 and 2020, 7.1 million jobs will be extinguished (especially those related to administrative routines, but also to production), while approximately 2 million new jobs will be created (mainly in areas related to mathematics, architecture , engineering and computing); the net balance will be the elimination of more than five million jobs. Such report also estimates that 65% of children currently entering primary school will work in activities that do not yet exist[6]. It concludes that of the advanced and developing countries/regions, especially fifteen of them will be hardest hit by 4IR, among which Brazil ranks fifth[7].

At the 104th International Conference of ILO (2015, p. 2), devoted to discussing the future of work, it was stated that 4IR could deepen a paradoxical situation in which:

> extraordinary advances in the productive capacity of the global economy now provide the material means to eliminate poverty and meet human needs as never before, but are singularly failing to do so. At the same time, the workings of that economy are generating mass unemployment and underemployment and large-scale exclusion, as well as great prosperity and social advances, which are present in tense coexistence within and between our societies.

[6] Frey & Osborne (2013) developed an econometric study pointing out that 47% of the existing professions in 2010 in the United States labor market were at risk, which meant that their functions could be computerized in the next ten or twenty years.

[7] The other fourteen countries/regions are in alphabetical order: South Africa, Germany, Association of Southeast Asian Nations (ASEAN), Australia, China, Gulf Cooperation Council (GCC), United States, France, India, Italy, Japan, Mexico, Turkey and the United Kingdom (WEF, 2016a).

This structural change of the productive paradigm occurs simultaneously with the ups and downs of the economic and financial crisis that broke out in 2008, which has since unemployed about two hundred million citizens. Considering that about 40 million people are entering the labor market annually, it is estimated that by 2030 the world economy will need to create about six hundred million new jobs – mostly in developing economies – if it is to equalize this difficulty in an inclusive way. It is also necessary to consider as an aggravating fact that half of the world's population is active in the informal economy – a proportion that has increased even in advanced countries – and that the biggest barriers to decent work are imposed on the poorest citizens, young people, women and the elderly.

There are several reasons why unemployment cannot simply be eradicated fully. It takes time for people to move from one job to another: this is said to cause "frictional" unemployment. If people cannot find jobs because they have outdated skills they become "structure" unemployed. No democratic society could tolerate endlessly raising unemployment.

Therefore, the immediate questions to be asked when discussing the future of the world of work are where the jobs will come from and how they will be. These questions are directly related to 4IR, since their answers lead to the conclusion that the institutional and political instruments currently at the disposal of national and international policymakers are not enough to create the necessary jobs in a satisfactory quality and quantity.

With regard to the Brazilian labor market, the promotion by the OIT[8,9] (2016a, 2016b) together with its national government, employers and workers of the so-called "National Dialogues on the Future of Work" (*Diálogos Nacionais Sobre o Futuro do Trabalho*) has analysed the impacts of 4IR on the organization of work and production in the country. Corroborating in general with the previous analyses, these meetings added the concern that especially in Brazil the projections for the future put in jeopardy the centrality of the work as motor of the development and also that there is the fear that there is a technological determinism in a moment in which a large part of Brazilian society still does not have access to the most advanced technologies.

Equally relevant is the fear that the global production chain will damage the specific knowledge, the identity of the workers and the bonds of solidarity within that class. In addition, the risks of 4IR have been raised in reducing the capacity to stimulate development models combined with social equity[10], which may limit the construction of a development model with national sovereignty that takes into account the inclusion of citizens and decent work . All of these topics are associated with the deepening of Brazil's insertion in interdependent global capitalism, especially with regard to global value chains and the context of increasing financialization of the economy. Its consequences for the labor market are not clear, especially for the most vulnerable Brazilian workers (OIT, 2016a).

A discussion also in the meetings promoted by the ILO focused on the case of Brazil suggested that, in addition to being attentive to the rapid technological changes under way, it is also necessary to consider in an integrated way other aspects of the utmost importance for the labor market. In this vein:

[8] The acronym OIT in Portuguese has the same meaning as the ILO in English, being only a distinction between languages. Thus, the original font format was mantained in the references.

[9] Brazil is one of the founding members of the organization (established in 1919), which implies that the country remains in line with the general guidelines and ratifies a large number of conventions and recommendations of this international organization. According to material provided by the OIT (2017a), Brazil has ratified 78 of the 189 conventions proposed by the institution.

[10] The issue of equity, which encompasses the improvement of working and living conditions, is at the heart of the debate on ECLACs sustainable socio-economic development, progressively integrating its Latin American integration agenda, including 4IR. See ECLAC (2015, 2016).

> current transformations are not only due to advances in technology, but also to society's values and expectations, as adequate income, [...] these expectations are sharpened by the fact that the wealth that exists today surpasses previous levels, but with great inequality, instability and precariousness of social access (OIT, 2016b, p. 11).

Other concerns that permeated the National Dialogues on the Future of Labor – directly linked to the advancement of 4IR – concern, *inter alia*, issues related to the informal economy, income, labor productivity, investment in research and development (R&D) and competitiveness. The next section will focus on the related analysis of these specific aspects and their relations with 4IR and the Brazilian labor market post 2008, also highlighting their trends.

5. Brazilian labor market in the context of 4IR: challenges and possibilities

In order to face the theory presented in the second, third and fourth section of the article with some of the main indicators of the Brazilian labor market, this explanation is initiated by the most pressing issue: unemployment. While in a large part of the world the international economic and financial crisis of 2008 had a serious impact on the labor market, the trajectory of the gradual decline of unemployment in Brazil remained until 2014. The consolidated data of the "Monthly Employment Survey" (*Pesquisa Mensal de Emprego*, IBGE/PME, 2016) showed that in 2008 and 2014 unemployment rates – based on the months of December – were 6.8% and 4.3%, respectively. This was due, in particular, to countercyclical policies adopted by the federal government[11], which avoided a more severe impact on the Brazilian labor market.

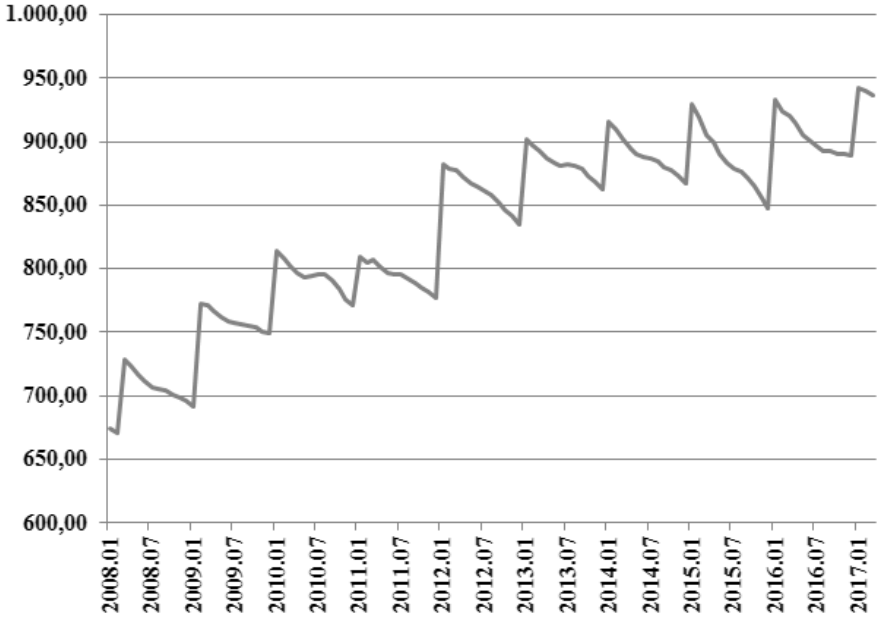
After that, this process receded. The unemployment rate in 2015 rose to 6.9% and in 2016 to 11.9%. The OIT (2017b) observes that at the end of the third trimester of 2017 Brazil had 13.1% of its economically active population unemployed, one of the biggest among the G20 economies. Brazil will account for 35% of the new unemployed worldwide in this year. The report shows a possibility of slight improvement in the occupancy rate in the Brazilian labor market at the end of 2017, which provides a glimpse of positive evolution for the year 2018, very dependent on a more stable macroeconomic environment (in a year of general elections) and a consistent rate of Gross Domestic Product (GDP). Nevertheless, it is emphasized that about half of the national workforce carries out economic activities in precarious and/or informal conditions (see Vargas, 2017).

Regarding the issue of income, the policy of valuing the minimum wage established in 2007 under a specific rule of adjustment[12] favored the public regulation of remuneration, once sustained in time – and combined with other mechanisms – it has supported the growth of wages of the categories of less organized workers, while favoring the negotiation of the other categories. The minimum wage increased by almost 30% in real terms (excluding inflation) between 2008 and 2016, implying a significant increase in the salary mass and the consumption of wage goods. There was considerable improvement in the (functional) distribution of income in this period, mainly due to the dynamism of the Brazilian labor market, but also driven by direct income transfer programs to the most vulnerable population (see Saboia, 2015; Alvarez *et al*, 2017). This improvement was much more significant between 2008 and 2013 (except for 2011), as observed in graphic 1.

[11] For a detailed analysis of the policies implemented by the Brazilian government at the time, see OIT (2011).

[12] This criterion provides for the adjustment according to the "National Index of Consumer Prices" (*Índice Nacional de Preços ao Consumidor*, INPC) of the previous year plus a real increase corresponding to the variation of the GDP of the previous two years.

Graphic 1 – Minimum real wage (in constant R$ of January 2017, deflacioated by INPC) Brazil (2008-2017)



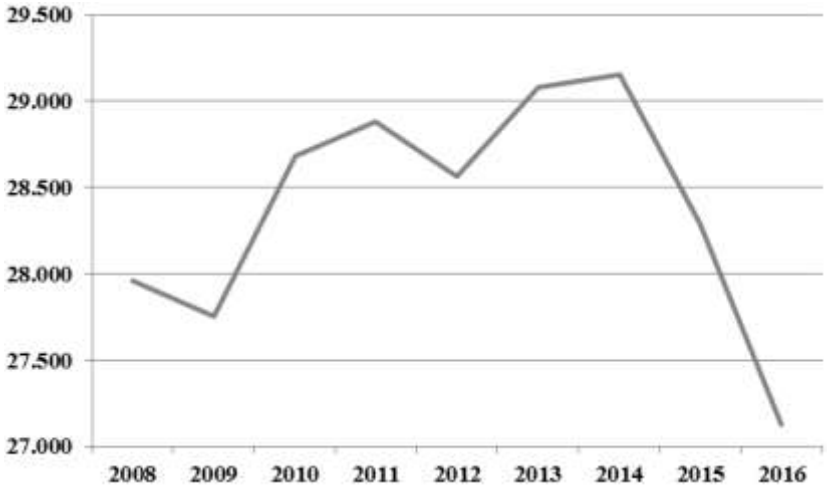
Source: IPEADATA, 2017. Elaborated by the authors.

However, according to official projections, the year of 2017 will be the first since the beginning of the series in which the minimum wage will accumulate loss of 0.1%. While maintaining the current criterion for the adjustment of the minimum wage, its real value tends to grow very little also in the following years. The question posed by continuing to improve the (functional) distribution of income is that lower wages should grow proportionally higher than the highest levels, in order to reduce the large difference between the lowest and the highest wages in Brazil. But this can become a problem if they grow at a rate well above labor productivity (GDP/employed population), which has been decreasing in the last two years.

Labor productivity is another fundamental character for such an analysis, corresponding in Brazil to 88% of the world average, but only one third of that in advanced economies. In fact, the stagnation of Brazil's absolute and relative productivity – whatever its measurement categories or the selected productive sector – in relation to the rest of the world is a matter of great concern about the future of the Brazilian labor market (ABDI/IPEA, 2014, 2015).

Data from the Brazilian Central Bank (BRASIL/BCB, 2017) demonstrate that labor productivity showed an average growth rate of 0.5% in the last 20 years, in trend movements significantly correlated to the oscillations in growth. Graph 2 shows that in 2008, labor productivity in Brazil was US$ 27,962 per worker and that in 2016 it was US$ 27,129 per worker, a level 0.97% lower. For 2017, the forecast is for Brazil to advance 0.5% in this matter (THE CONFERENCE BOARD, 2017).

Graphic 2 – Productivity of work (in constant US$ of 2014) – Brazil (2008-2016)



Source: The Conference Board, 2017. Elaborated by the authors.

Regarding the R&D, which is central to the 4IR context in terms of generating jobs with quality and income, Brazil presents a performance similar to the topics discussed above, that is, between 2008 and 2014 it advanced in its process of technological catching up, but in 2015 worsened and stagnated its absolute situation at the general level. This is evident, for example, in the so-called Global Innovation Index – the annual ranking of countries based on their capacity and success in the field of innovation. This index, which considers four factors – institutions, political environment, regulatory environment and business environment – in a universe of 127 countries, in 2016 placed Brazil in the sixty-ninth place (same position of 2015). This leaves him as the worst placed among the so-called BRICS - China (22nd), Russia (45th), South Africa (57th) and India (60th) – and only seventh among Latin American and Caribbean countries, behind of Chile (46th), Costa Rica (53rd), Mexico (58th), Panama (63rd), Colombia (65th) and Uruguay (67th). The report states that the country's strengths in R&D focus on the quality of its scientific publications, high-tech manufacturing and agribusiness (CORNELL UNIVERSITY, INSEAD & WIPO, 2017).

When comparing the total number of patent applications, neither is the outcome encouraging. According to table 2, in the comparison among the BRICS from 2008 to 2015 Brazil occupies the penultimate position, only ahead of South Africa. More than the Brazilian position comparatively, it stands out the stagnation of the country in this question between 2012 and 2015, especially in relation to the Chinese evolution in the same period.

Table 2 – Total Patent Applications (in units) – *BRICS* – 2008-2015

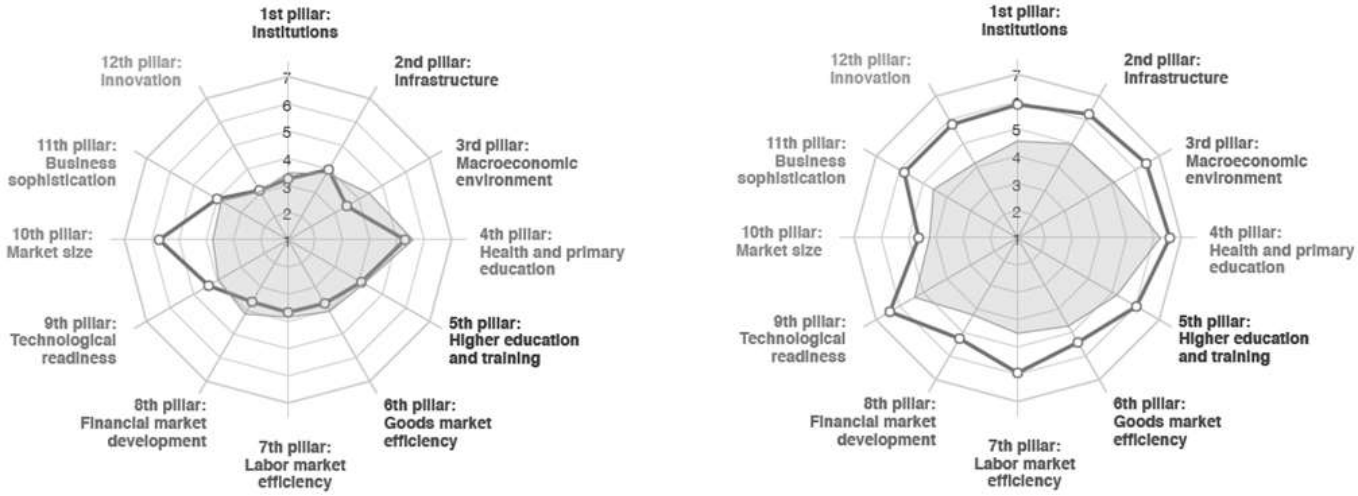
Country	2008	2009	2010	2011	2012	2013	2014	2015
China	289.838	314.604	391.177	526.412	652.777	825.136	928.177	1.101.864
India	36.812	34.287	39.762	42.291	43.955	43.031	42.854	45.658
Russia	41.849	38.564	42.500	41.414	44.211	44.914	40.308	45.517
Brazil	23.170	22.406	24.999	28.649	30.435	30.884	30.342	30.219
South Africa	7.941	6.735	6.393	7.245	7.444	7.295	7.552	7.497

Source: Extracted from *WIPO statistics database*, 2017. Elaborated by the authors.

The objective of the federal government, spelled out in the 2016-2019 National Science, Technology and Innovation Strategy (Encti, 2016) proposal is to invest 2% of the national GDP in R&D by 2019 – which would lead Brazil to a level of investment of the OECD average of 2.4% in 2015 (OECD, 2016). It is noteworthy that by the last available data, in 2013, R&D investment in the country was only 1.24% (WB, 2017), well below the target to be reached.

The analysed aspects, although they do not cover all the structural and productive complexity of the Brazilian economy, assert that Brazil is in an internationally unfavorable competitive position. Such a claim is endorsed, for example, by The Global Competitiveness Report 2016-2017 (GCI) (WEF, 2016c), in which the country appears in position eighty-first in a ranking of 138 countries. Since 2012, Brazil has lost twenty-three positions in this annual survey – with a deteriorating trend in subsequent years – that takes into account twelve pillars of competitiveness[13]. In the report this is justified as a result of the "context of negative terms of trade shocks and political turmoil" (WEF, 2016c, p. 126). It can be seen (figure 1) that the country stands out, due to its population size, in the market size compared to Latin America and the Caribbean as well as to Switzerland (country first place overall, which is precisely its weak point), which shows that this factor is not preponderant. The aspect in which Brazil presents the worst performance is that of the institutions, mainly due to the increase of insecurity and the perception of worsening quality of the public sector.

Figure 1 – Global Competitive Index 2016-2017



Brazil versus Latin America and the Caribbean ***Switzerland versus Europe and North America***

Source: *International Monetary Fund; World Economic Outlook Database,* 2016. Extracted from *WEF*, 2016c, p. 126 e 332. Note: in the figure, Brazil and Switzerland are represented by the darker line, while Latin America/Caribbean and Europe/North America are represented by the gray area.

[13] In that the closer to the number seven - from the edge of the dodecagon, therefore - the better positioned one is in some specific pillar. From the weighted calculation of these twelve pillars is determined the ranking of the countries that make up the ICG.

It is also important to note that in this ranking, Brazil shows itself to be equivalent – in absolute terms – compared to Latin America and the Caribbean, but far from the European and North American countries, showing its great competitive gap in relation to the advanced economies. In addition, in the pillar of innovation – the most correlated to the 4IR of the GCI – Brazil ranks in the hundredth position (the country's worst note among the twelve pillars of the index in 2016, 3.1), while in the labor market efficiency issue the country ranks 117th.

Based on the argument above, it is evident that the Brazilian labor market presents great challenges and as well as significant possibilities in the context of 4IR. The first challenge is directly related to a structural transformation aimed at technological catching up, with which only conventional economic policies will be insufficient to do so. If this process does occur, it will necessarily be in a more uncertain environment – in a world of globalization and financialization – where information, value-adding, and economic integration are the chiefs of development. In order to do so, it is urgent that Brazil accelerate the step in the quantitative and qualitative development of knowledge.

The second challenge for the technological catching up is the creation of a virtuous circle between 4IR and the Brazilian labor market, which will require: i) internally: the achievement of a (re)structuring agenda of the Brazilian labor market, especially with regard to the institutional improvements in the labor sector and to the deepening of tripartite dialogue, with an active social and political character; ii) externally: among the many aspects in which Brazil needs to move forward (foreign trade, internationalization of companies, professional and intellectual exchange, foreign direct investments, etc.). It is considered as the most important its progressive involvement in the various international and regional development agendas – without, however, giving up its autonomy – both in the labor field and in the socioeconomic area (such as ILO and ECLAC, for example).

It is precisely in the spirit of these agendas that the structural changes suggested at the domestic and foreign level should be promoted, taking into account Chang's Institutional Political Economy conceptions and the need to rethink Economic Sciences, in a human-centered way. It is arrived the *momentum* for economic approach as a whole, specially the heterodox theory and methodology, to recognize Economic Sciences as interdependent with other fields of human knowledge, based on processes, principles and premises shared by society, tied to its power. Therefore, its aim should be to contribute to the improvement of the general living conditions of human beings.

Given the circumstances, it is imperative to implement national strategies, adapted to the Brazilian reality and specificities in such a way that make it possible to overcome conjunctural short-term and structural long-term problems. More than holding the reins of their destiny, one must be clear about what to do with them. In this sense, it is necessary to take advantage of the concrete possibilities that Brazil has, recognized worldwide in several documents and reports analysed in this research: its great internal market, its potential in relation to the environment, renewable energies, agriculture and correlated. These characteristics need to be better exploited, even in the sense of becoming the propulsion of the jobs of the future for the Brazilian labor market. This path tends to enable sustainable socioeconomic development with equity and in close association with technology.

6. Concluding remarks

Based on an institutional heterodox approach, and aiming to contribute to the construction of a new paradigm of economic thinking, the objective of this article was to examine the progress of 4IR in developed and developing economies and their impact on the Brazilian labor market. In general terms, it can be seen that the economy and global society are at a crossroads. The 4IR has tremendous potential for improving living conditions in general, and it also has lamentable potential risks. It is necessary to reflect how this structural change is wished to be conducted, especially with regard to the relations between the advanced and the developing economies. However, reflection is not enough. It is essential to implement desirable actions (or goals).

The 4IR will have a strong impact on the organization of the world of work. It will impose on emerging countries – the case of Brazil – to rethink their strategies and development models. The greatest socio-economic menace of 4IR in this area is to generate insufficient demand for labor or available labor skills, threatening to throw millions of workers into structural and/or precarious unemployment.

As the 4IR moves forward, production will tend to increasingly incorporate cyber physics, with which the comparative advantages of the supply of human labor – at least its conventional standards – will progressively decline. More seriously, this structural change in the productive paradigm occurs simultaneously with the ups and downs of the economic and financial crisis that broke out in 2008 and still impacts the nation.

Concerning the Brazilian labor market, the main consternations are that the centrality of labor as a motor of development is put at risk and that a technological determinism comes at a time when a large part of Brazilian society still does not have access to technology. Also of relevance is the fear that the global production chain will isolate the specific knowledge, the identity of the workers and the bonds of solidarity within this class. Consequently, the risks of 4IR have been raised in reducing the ability to stimulate development models combined with social equity, which may limit the construction of a development model with national sovereignty, which takes into account the inclusion of citizens and decent work. All of these challenges are associated with the deepening of Brazil's insertion in interdependent global capitalism, especially with regard to global value chains and the context of increasing financialization of the economy.

Analytically, it has been shown that Brazil – and its labor market in particular – has been revealing important advances in several significant areas from the point of view of socioeconomic development, such as: employment and income, labor productivity, investment in R&D and competitiveness. However, especially from 2014 onwards the country has stagnated or regressed in these aspects because of both conjunctural and structural issues. Unfortunately, *ceteris paribus*, the trends are not too much promising for years to come.

It is clear that the national labor market presents major challenges, but also potential possibilities in the context of 4IR. In addition to the process of catching up technologically, engendering a virtuous circle between the two will require a combination of institutional improvement and tripartite dialogue at the domestic level – of an active social and political character, human-centered – with the simultaneous immersion of Brazil in the various international and regional development agendas of different institutions on the external plane. This will favor the best use of the concrete possibilities that the country has, recognized worldwide, a path that tends to make feasible sustainable socioeconomic development with equity and in close association of technology with its labor market. To this end, policymakers need to put more attention in such issues.

Last but not least, it is recognized that for a structural change in the Brazilian labor market in this direction to take place, it is necessary to architect more synergy with the advanced economies, and for that to happen, not only will the national disposition in promoting the necessary adjustments and transformations, given the current conditions quite asymmetric in terms of international competitiveness. In order to contemplate this goal, it will be necessary to progressively improve the regulation and global governance (of work) and also greater social and political power of Brazil in the concert of nations. International institutions have a key role to play in this regard.

History has shown that technology, in spite of the inevitable setbacks it has caused, in the long run has created more jobs than destroyed and has also raised living standards overall. In the future we hope to reach the same encouraging conclusion about the consequences of this debate, which is emerging with all the strength in the present time. In this challenging beginning of the twenty-first century, globalization continues to dismantle socio-economic and technological frontiers. Society can only improve through thought and conscious actions that can positively modify existing adversities, better taking advantage of new technologies and seeking sustainable development. It is of fundamental and of immediate importance an extended vision of this reality, through a deep examination of the changes and transformations that occur on our planet.

The theory elaborated by Chang is promising in this context. His criticisms of the neoliberal conceptions of institutions highlight the urgency of rescuing the historical perspective of development, respecting the particularities of each society. The possibility of socioeconomic development of any nation is the result of the engenderment of numerous factors in synergy over time, constructed by a certain society under different circumstances that change in time. It should be noted that at the center of events and their unfolding are the citizens.

The 4IR will play a decisive role in our way of life and production. The need to formulate and implement appropriate policies gives decision makers a unique opportunity to offer society new and promising possibilities. At this moment, when the threat of a new era of labor precarization in the world in general and in Brazil in particular is imminent, attention must be paid to the Institutionalist Political Economy approach, linking it to the construction of a new paradigm in economic thinking, human-centered, as an alternative to overcome this historical challenge!

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