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ARTIFICIAL INTELLIGENCE AND WORK: BRAZILIAN CHALLENGES

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ABSTRACT

A few years ago, the arrival of industry 4.0 intertwined disruptive technologies into the world of capitalized work. From the popularization of the digital universe, in the century. The relationship between humans and machines has changed significantly, becoming the new paradigm of economic development. The most recent technological innovation is artificial intelligence, which has expanded rapidly and spread beyond previous historical references, directly reaching the Latin American world of work. As in the first three revolutions, technological progress does not always mean the replacement of human labor, but its obsolescence and framing of the capitalist structure, which establishes new relationships and requires adaptations that hardly prioritize human dignity. In this sense, the arrival of disruptive innovations demarcates new challenges in the economic, social, and environmental dimensions of all societies, including the Brazilian one. Furthermore, the subsumption of the worker to the so-called "smart factory" resignifies the ways of existing and coexisting in the world, under the algorithmic supervision and management of the production processes, which bring greater efficiency and added value to products and services, but makes it difficult for the worker to access such "advantages". Also cited as the fourth industrial revolution, industry 4.0 establishes the refinement of the extraction of surplus value, in a non-circumstantial way, since capital does nothing without the purpose of submitting human potentialities to its expansion project, as the debate points out. To explain, Artificial Intelligence applies advanced techniques through logical processes, as a way to manage production through the analysis of trends and behaviors of systems, however, to achieve the desirable levels of efficiency, it is necessary to restructure the entire labor market chain, take risks and prioritize the worker. However, this primacy does not happen. The central criticism made in this article applies essentially to the Brazilian reality. In this context, it is of fundamental importance to analyze whether the 4.0 revolution, idealized by the hegemonic countries, can be applied to the national scenario in the same way, with the same speed, intensity and depth required. Brazil has particularities and primary structural deficiencies, therefore, when observing today's employees, who are unable to cross the technological funnel, we notice the intentionality of capital and its strategic project. It is also perceived that companies in the national territory are gradually assuming the adoption of such advanced tools. To this end, it bets on a highly qualified and specific workforce, usually through recruitment and hermetic selections that are not at all inclusive. For this reason, the questioning presented here tends to overturn the epistemological debate of the different versions of labor realities, through the lens of the

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Revista ARACÊ
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worker and analysis of the Brazilian industrial conjuncture. The theoretical framework is the fundamental studies of Karl Marx in Capital and other works produced by the author. Therefore, the methodology of bibliographic and documentary research was used, in addition to data extracted from the CNI (National Confederation of Industry), the MIT Technology Review Magazine- Brazil and other secondary sources.

Keywords: Living Work. Dead Work. Algorithm. Precarious.

Revista ARACÊ
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INTRODUCTION

> The cornerstone is laid: dead labor in the movement endowed with intelligence and the living existing only as one of its conscious organs (Marx, 1994, p. 108).

At the beginning of the century. Humanity was able to witness a complex technological transformation, which proved to be a challenge in various areas and social perspectives. Digital processes widely interconnected with everyday life represented the subversion in the way we live, feel and produce life, revealing opportunities, benefits and risks. In this context, research tends to produce insights into the misuse of advanced technologies in the dynamics of work and employment. When investigating the theme, the importance of understanding the relationship between technology, unemployment and the decrease in the dignity of human work is highlighted.

From the conveyor belt to artificial intelligence, the so-called Industry 4.0 not only means a revolution at the macro level, but also reaches the micro dimensions of daily life, which are reached by the (almost) global use of the IoT (internet of things). There are bridges between places previously inaccessible by people, companies, machines, and the connection exists thanks to information and computing technologies (SESI, 2020), or "a simple piece of hardware that we carry around in our pockets" (Taulli, 2020). In this sense, another chapter in the history of humanity is digitally edited, and highly debated among researchers in various areas and over many years.

According to Schwab (2016, p. 19): "revolutions have occurred when new technologies and new ways of perceiving the world trigger a profound change in social structures and economic systems". In this bias, the new connections between humans and machines engendered changes in social and production relations, a fact known as the Fourth Industrial Revolution (Schwab, 2016; Skalfist; Mikelsten; Teigens, 2020). Currently, the United States, China, and France lead the main scientific publications in the area of AI, respectively, given that they are countries traditionally recognized by the authority of investments in high technology and concentrate most of the most respected Universities (Machado et al., 2023; ABC, 2023).

The global AI scenario is moving quickly towards improving production in various sectors, especially in the industrial and manufacturing sectors, following industrial policy strategies to drive market advantages (Melo, 2020; Almeida, 2023), with government and business funding (Industry Portal, 2023). In reality, what we currently have is an imbalance between countries that are at the forefront and have a remarkable path in technological

Revista ARACÊ
ISSN: 2358-2472

development and others that, like Brazil, are concerned with following trends from abroad, while submitting to historical dependence on dominant countries (Brazilian Academy of Sciences, 2023). According to recent data from the ABC (Brazilian Academy of Sciences), in 2023:

> The Brazilian context is critical: it is known that only a small portion of our population has access to quality education. Although the country has world-renowned scientists in several areas — including AI — it lacks the critical mass necessary to drive significant technological advances, or even to make adequate use of technology (which is rapidly and constantly changing) on a scale that favors sustainable technological growth. The situation becomes even more worrying with the recent advances and proliferation of the so-called **Large-Scale Language Models (LLMs).**[4] Brazil still does not have a broad mastery of this essential technology to analyze the results of the models and their implications, as well as to exercise effective criticism of the applications developed based on this technology.

Given this scenario, not surprising, the future of AI in Brazil remains enigmatic, especially in relation to the labor market, since every technological transformation requires adaptation and professional qualification, as well as an infrastructure network that makes it possible to leverage the development of this technology (Brazilian Academy of Sciences, 2023). However, some points remain under discussion, such as the difficulties of implementing AI in a country considered to be in transition (Melo, 2020; Mazzoni, 2022; ABC, 2023) and the practical impacts of Industry 4.0 on the lives of the Brazilian working class. According to Antunes (2023):

> [...]where Industry 4.0 expands, we are witnessing a significant expansion of dead labor, with digital machinery as the dominant and driver of the entire production process, with the consequent reduction of living labor, through the replacement of activities that become superfluous, due to the entry of new automated and robotized machines, under the command of algorithms.

Under this bias, the social well-being that could be provided by the technological production model, encounters historical obstacles and lack of innovative adaptation in Brazilian Industry 4.0. The model of "order and progress" remains contradictory, since the same system that projects modern technological advances, submits the workforce to exploitation, historically archaic (Antunes, 2023). Another point focuses on the invisibility of the worker in relation to advanced technologies, since living work is hidden, behind technology in supposed autonomy. In addition, "the AI factory floor, "which requires a lot of

[4] Large Language Models (LLMs) are a type of artificial intelligence model designed to understand and generate text. These are machine learning models that use deep learning algorithms to process and understand natural language (Data Science Academy, 2023).

Revista ARACÊ
ISSN: 2358-2472

human labor, is configured as a secret ingredient of automation" (Grohmann; Araújo, 2021, p.5 apud Casilli, 2019). All of these topics are distinct forms of exploitation of human labor.

In view of the problem, in order to better understand the current scenario, it is extremely important to resort to the industrial historical process of the industrial revolutions until the arrival of the Fourth Industrial Revolution, because more than the fact, or phenomenon, it seeks to understand its composition, organization and functioning, which are the premises of scientific knowledge, according to Cervo and Bervian (2002). The article is organized, therefore, in sections distributed according to the historical order of events. Therefore:

The first section addresses the industrialization process during the revolutions that preceded industry 4.0, for a better contextualization of the ideas discussed. Then, the development of industry 4.0 and its perspective on the Brazilian scenario will be discussed, its fundamentals and implications, with emphasis on AI. The third section makes a theoretical debate about AI in the world of work in the twentieth century. XXI, focusing on the concepts of living labor and dead labor proposed by Karl Marx (1994; 2015) and algorithmized surplus value, an idea developed during the research, as a fundamental objective of capital in the 21st century. The fourth and last section proposes the conclusion, which points to the improvement of the forms of extraction of surplus labor in industry 4.0, based on Artificial Intelligence, with the algorithmization of surplus value, in a process of robotization of society.

THE ADVANCEMENT OF INDUSTRIAL AUTOMATION AND THE NEW WORK DYNAMICS

Initially, "manufacturing work required physical effort and had a low scale of production, in addition to high costs. Employees were qualified for specific tasks, managed the production, design, and even marketing of goods" (Sacomano et al., 2018, p. 18). However, following the general trend of capitalism: "the replacement of human labor (living labor) by the (dead labor) of the machine" (Marx, 1994) or its constant reintegration was the most important step in the implementation of mechanics in manufacturing processes. This meant that investing in technical instruments could increase the capture of surplus value, since the exploitation of labor power and the consumption of vitality are inherent and inseparable forces in the capitalist production model. According to Marx (2023, p. 315),

Revista ARACÊ
ISSN: 2358-2472

"[...]From the very beginning, machinery extends the degree of exploitation together with the human material of exploitation, i.e., with the field of exploitation properly so called."

Starting from this propensity of capital, as Marx (1994) pointed out, the British Thomas Newcomen (1664 –1729) and the Scotsman James Watt (1736-1819) brought the development of the steam engine, with continuous improvement and efficiency (Caldas, 2015). Such refinement of spinning jenny in the textile market corroborated important changes throughout British society (Júnior; Saints; Leme, 2018). Edmund Cartwright (1783-1823) created and industrialized textile processes and, in 1785 (Sacomano et al., 2018), engendered the so-called 1st industrial revolution. However, Marx analyzed it from the following perspective, in Capital:

> The steam engine itself, as it was invented at the end of the seventeenth century, in the period of manufacture, and as it continued to exist until the early 1780s, did not bring about any industrial revolution. What happened was the opposite: the creation of machine tools[5] was what made the revolutionized steam engine necessary. As soon as man, instead of acting with the tool on the object of work, starts to play only the role of driving force on a machine tool, the fact that the labor force is clothed in human muscles becomes accidental, and wind, water, steam, etc., can take its place (Marx, 2023).

For Marx (1994, p. 106), "the machine appears as an intrinsic element of the capitalist mode of production, as a revolution within the mode of production in general". In this sense, with the gradual changes brought about by industrial development, several production paradigms were considerably altered (Junior; Saltorato, 2018). Notwithstanding the fact that capital is the driving force behind major processes that have changed the world, globally, it also accommodates contradictions that are objectionable to human labor. The creation of "human machines" represented the possibility of capital increase, through mass production and exhaustive extraction of surplus value, as demonstrated by the first, second and third industrial revolutions. Such revolutions were produced through the abuse of human labor, from the beginnings of factories, in the nineteenth century. XVIII (Antunes, 2023) to the current phase 4.0.

From 1870 onwards, with electricity, the emergence of Frederick Taylor's (1856-1915) assembly lines, and the principles of rationalization of the production process, the 2nd Industrial Revolution took place, which enabled mass production, price reduction, in

[5]Marx (2023, p. 302) makes it explicit in his analyses in chapter 13 *of Capital*, entitled *Machinery and large industry* that: "The machine tool is, therefore, a mechanism that, after receiving the transmission of the corresponding movement, performs with its tools the same operations that the worker previously performed with similar tools".

Revista ARACÊ
ISSN: 2358-2472

addition to adding changes in the areas of chemistry, oil, and steel (Schwab, 2016; Junior; Saints; Leme, 2018).

> The city of Cincinnati, Ohio, became the largest manufacturing and commercial center in the Western United States, as this region was the birthplace of the centralization of production. When companies become experts in producing certain products, they also adopted the division and specialization of labor, inspired by Adam Smith's book, The Wealth of Nations, published in 1776, thus generating mass production (Sacomano et al., 2018 apud Gordon, 1990).

In view of this, "Frederick Taylor's treatise developed the rationalization of labor and perfected the division of labor into multiple stages" (Sacomano et al., 2018), introducing "a new dynamic in the system of social metabolism of capital in which the capital-labor relationship changed not only the way of producing, but the way of thinking, being, and acting of/in capitalist societies" (Antunes, 2009). According to Harvey (1992), the separation between management, design, and control was also already advanced in many industries. "The focus was on production time and on how to improve production efficiency, through the supervision of workers' performance" (Júnior; Rudder; Santos, 2018). However, Antunes (2009, p. 58) ponders, "the new forms of contracting or subcontracting, in practice, brought about the intensification of the exploitation of the workforce, based on the logic of the 'multifunctional worker', who now began to be charged in terms of participation, performance and income".

In 1914, Henry Ford was able to compose Frederick Taylor's idea, initially taking it to the automobile industry in the USA and later, to several central capitalist countries, for application in industrial processes, a production model known as the Taylorist-Fordist binomial (Antunes, 2009). It is thus stated that:

> With the support of the electromechanical technology of the time, Ford developed high-precision interchangeable parts, which eliminated the need for adjustment and, consequently, the need for the adjuster itself. Without the need for adjustment, the assembly began to be divided, causing semi-skilled mechanics to specialize in the assembly of small parts. Production becomes simplified and continues (Júnior; Rudder; Santos, 2019, p. 11).

In parallel with the development of the industrial sector, in 1944, a professor at Harvard University developed the first electromechanical computer, the Mark I, in partnership with the United States Navy. And at MIT (Massachusetts Institute of Technology), the WhirlWind digital computer emerged, considered the first computer to process information in real time (Júnior; Rudder; Santos, 2018). According to Sacomano et

Revista ARACÊ
ISSN: 2358-2472

al. (2018), in the late 1960s, PLCs (programmable logic controllers) emerged that facilitated industrial automation.

From the decade of the 70s of the twentieth century, a period that marked the world scenario began, the 3rd Industrial Revolution, called the Digital Revolution or "of computers", also known as the "Age of Electronics" (Júnior; Saints; Leme, 2018). In this phase, the use of new information technologies further developed the automation of the means of production (Veiga; Pires, 2018, Júnior; Saltorato, 2018 apud Hermann; Pentek; Otto, 2015; Schwab, 2016), driven by the development of semiconductors, mainframe computing (1960s), personal computing (1970s and 1980s), and the internet (1990s) (Schwab, 2018). In this way, the lean fanufacturing or lean production, based on the Toyota Japanese Production System, in integration with automation and intensive use of IT, provided a substantial increase in gains for the industry (Sacomano et al., 2018).

Although the vast literature has much to say about the expansion and improvement of industrial technologies, on the other hand, little focus is given to the consequences and impacts on labor relations and the life of industrial workers. According to Antunes (2009, p. 250-251), there is an evident contradiction between the development project of the "modern company" and the modes of control and subordination of the subjects of work. In this sense, the point raised by the author is an example of how the web of capital expresses its controlling character, endowed with various means of subordinating living human labor to the dead labor of automated machinery, since the beginning of the Industrial Revolution. As Marx (1994, p. 107) inferred as a tendency of machinery, a movement of attraction and constant repulsion of the worker's existence.

> With machinery - and with the mechanized workshop founded on it - the predominance of past labor over living labor is consolidated, not only from the social point of view, expressed in the relationship between capitalist and worker, but also as a **technological** truth (Marx, 1994, p. 109).

INDUSTRY 4.0 AND BRAZIL

The Fourth Industrial Revolution, as mentioned by Schwab (2016), has the capacity to reach various parts of the world, organizations and entire communities, given the level of reach that technological mechanisms have. In addition, the speed, breadth and depth (Schwab, 2018; Skalfist; Mikelsten; Teigens, 2020) of this revolution means that such characteristics enter society as forces designed to impact existing lives, behaviors, and (re)relationships.

Revista ARACÊ
ISSN: 2358-2472

According to Junior, Leme and Santos (2018), the Industry 4.0 proposal brings together several sectors of production, from Research and Development (R&D), Marketing and logistics, to the use of machines with a high degree of automation. In this context, Artificial Intelligence, robotics and IoT are very familiar terms in the industrial sector, as they have allowed the digitalization of manufacturing activities in search of increased productivity and improvement of production processes.

> The incorporation of Advanced Robotics, Machine-Machine Connection Systems, the Internet of Things (IoT) and the Sensors and Actuators used in this equipment makes it possible for machines to "talk" throughout industrial operations. This can allow the generation of information and the connection of the various stages of the value chain, from the development of new products, projects, production, to after-sales (Portal da Industria, s.a).

The National Service for Industrial Learning (SENAI), between 2018 and 2019, carried out a pilot program in 43 companies in 24 states, to observe the impact on market production with the use of low-cost tools, such as sensing and IoT, and found that the productivity gain is more related to how much is learned during the production process.

The introduction of artificial intelligence in industries has boosted the process of automation of production, making human labor invisible or simply placing it hostage to the expansionist project of capital. Around this problem, Araujo (2022) highlights that, in contemporary capitalist society and in the context of industry 4.0, we have reached the moment when machines interact autonomously with each other, generating a machine-machine interface that, in some cases, already almost completely dispenses with human action.

In return to what Schwab (2018) said, the speed with which the transformations in Industry 4.0 occur does not allow countries to misalign science and work. In addition, those countries that do not adapt to technological changes will be on the sidelines of global development. The high qualification required to handle engineering techniques and programming language, as well as other AI-specific tasks, puts industrial workers in even greater challenges. Knowing that they are unable to adapt to the new demands of the technological market, many workers lose hope in the future, which explains the great abyss of those who depend on work to survive and those who own capital (Schwab, 2018). According to data from the GT-IA of the ABC (Brazilian Academy of Sciences, 2023):

> AI can directly affect various profiles of workers, either by monitoring their performance or by excessive automation — factors that can lead to the worsening of working conditions or even the extinction of functions. These risks already

Revista ARACÊ
ISSN: 2358-2472

> existed when other technologies were adopted, but with AI, the impact can be greater, not only being limited to easily automatable jobs, which require little qualification, but interfering with jobs that require analytical capacity, information processing, and some degree of creativity (ABC, 2023).

By contrast, in this new AI revolution, only a certain group of countries have the necessary scope to drive technological advances, due to the "highly specialized nature of high-paying jobs, concentrated in highly educated professionals who master these new technologies" (ABC, 2023). However, it is known that the late process of Brazilian industrialization was related to the role of the State in financing the industrial sector. The macroeconomic policy and the industrial development policy were compatible and followed the same national project (Cassiolato, 2001), however, in the face of the unfavorable conditions of the 80s, it resulted in high international competitiveness with changes in the technological sector and in the organization and dynamics of the industrial sector itself.

Since then, Brazil has been seeking to reach technological levels that are already advanced in many countries. It can be seen that the Brazilian delay reflects the little importance given to AI in the country's infrastructure, which technologically depends on other countries, in addition to the fact that nations that do not master AI are doomed to be overtaken in the geopolitical system (Melo, 2020).

> Brazil cannot run the risk of being just a user of AI solutions designed abroad. Dependence on other countries and large companies in this area can harm national security and sovereignty, as well as the competitiveness of national companies at home and abroad. Countries that intend to build new technologies based on AI must be able to understand the principles of developing these solutions. Otherwise, the lack of knowledge will perpetuate an increasing dependence on large corporations and technology-dominant countries (ABC, 2023, p. 4).

In this way, the development of AI affects both the individual workforce that cannot adapt, and those that have been replaced by intelligent software that performed the same functions. As already mentioned by Marx (1994), dead labor or past labor of the machine predominates over living labor, which in some cases, instead of being integrated into it, ends up being subordinate to the employer and to dead matter itself. That said, it is observed that:

> The power relationship that is established between employee and employer is maximized in the digital age by use, in some cases this relationship promotes the symbiosis between man and AI, in other cases employers are using AI as a new way to weaken the effectiveness of workers' fundamental rights. In addition, it is necessary to point out that in this scenario, the State loses control of the economic and financial flow, being relegated to the background as a political unit and space for the development of government and sovereignty, in the face of transnational

Revista ARACÊ
ISSN: 2358-2472

> companies that accumulate power and capital which, in turn, are subsidized by the States to generate employment and heat up the local economy (Juliano, 2022).

For Veiga and Pires (2018), a company can significantly reduce the human workforce by implementing the use of AI or replacing it with equipment, causing an increase in capital wealth, given that: "a robot does not get sick, cannot have children, does not go on strike and is not entitled to annual leave". This scenario causes an increase in underemployment, precariousness and the dismantling of labor rights, paradoxically justified by the development project for the improvement of human life (Juliano, 2022 apud Antunes, 2018).

CONCLUSION

Because it has assumed a central aspect in capitalism, work has become a dominant figure, so that the other aspects of life simply seem irrelevant, invisible or even (some say) unnecessary. In this way, the human race tends to lose, surreptitiously, the meanings and motivations of its own social life that exists outside of work, since it is conditioned to look at the world through the perspective of capital, in addition to being restrained from labor in the struggle for survival. The fact is that the boost of digital telecommunications throughout the century. and the beginning of the twenty-first, and the technological levers (Siqueira, 2008), triggered the refinement of the exploitation and algorithmization of work.

The contemporary capitalist digital society, in general, allows digital technologies to significantly alter the world/meaning of work and with this, the impact on the working class has repercussions on the way in which more value is subtracted during production processes (Antunes, 2023). With digital automation, capital (dead labor), which controls the production of value (Araújo, 2022) is an indirect oppressor, or also invisible, since the image of the dominating boss, loaded with orders dumped under the factory floor, has changed to a system of operations (networks) that control and direct the destiny of workers.

Although we know that it is the human hand (living labor) and its efforts that guarantee production, the most value is sucked indirectly through the application/platform/software, etc., which drives the network of operations and receives credit for the task performed. There is, therefore, the abstraction of the materiality of surplus value, what Marx (1994; 2004) called dead labor. Furthermore, in the modern

Revista ARACÊ
ISSN: 2358-2472

paradigm, the human being who works has been assigned a new burden, that of maintaining the artificiality of intelligence, whether it is exposed (as in the case of apps, which act as "bosses") or hidden under the "algorithmization" of things, such as chatGPT, which supposedly "responds" to conversations made to it.

According to Braz, Tubaro, and Cassili (2023, p. 8), there are more than fifty microwork platforms[6] in Brazil, whose purposes are diverse, among which we highlight the "training of data for machine learning", as in the case of Artificial Intelligence (AI). This production chain, however, does not make clear the precariousness of an arsenal of living work that is trained to generate, classify and prepare data through platforms such as Amazon Mechanical Turk (AMT) and Appen. Also for the authors, these workers, mostly women (63.9%), seek an alternative to obtain extra income, often linked to an ideology of self-management, entrepreneurship and appreciation of performance (Braz; Mendes and Ferreira, 2022). In this sense, it is argued that there is always in the capitalist project, a living labor army in the shadow of the so-called "technological development" producing relative surplus value. Every technical advancement of machinery, (in this case, the technology itself) is directly linked to the commitment of time and effort of men and women, who work tirelessly to create, formulate, design, build, and keep the gear turning.

It is concluded that, more than necessary to evaluate the reproductive logic of capital, it is necessary to face it on a daily basis. Without, however, making the mistake of thinking that it is technology, technology itself, that is the root of the precariousness and corrosion of labor rights. However, the possibility of "reverse artificial intelligence", exposed by Daniela Antunes (2023, p.164) as "The control of automation by computational reverse engineering techniques can be an instrument for the effectiveness of human rights and resistance, which can contribute to the mitigation of the overexploitation of human labor by digital capital", exists if we consider the numerous possibilities for applying advanced techniques for the well-being of workers, so that they can be used for the realization of rights and conquests against capitalist logic.

This is a necessary debate and therefore, the need to expand outside the academic spheres, through research and public policies aimed at mitigating the damage caused in the world of work. In addition, it is important to reaffirm that the mechanisms of resistance

[6] "Microwork is a form of online work done on digital platforms, which involves the performance of micro tasks of low complexity, repetitive, done on demand, reduced to a service and paid per task" (Braz; Tubaro and Cassili, 2023, p. 4).

Revista ARACÊ
ISSN: 2358-2472

to precariousness are factors that can contribute to the struggle for human rights, especially with regard to labor relations, which are always pre-established according to hegemonic logic. Dead labor needs to turn to filling the labor gaps that capital has imposed on workers, even if only in an attempt to minimize the damage caused by the misuse of technology.

Revista ARACÊ
ISSN: 2358-2472

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