TRANSFORMATIONS OF THE 4.0 REVOLUTION: ORGANIZATIONAL PSYCHOLOGY IN THE AGE OF ROBOTIZATION AND ARTIFICIAL INTELLIGENCE

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ABSTRACT

The text explores how industrial revolutions, from the first to the fourth, transformed society, production and work. Each revolution brought technological advances, but also significant social and economic challenges.

Keywords: Industrial Revolutions. Social Transformation.

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INTRODUCTION

The human need to transform its context, reshape society, and evolve in the face of the challenges of the contemporary scenario is intrinsic to the dynamic nature of civilization (Sakurai, & Zuchi, 2018). Since the beginning, humanity has incessantly sought innovations and adaptations to face the complex dilemmas that arise along its journey. At the epicenter of this constant pursuit is the ability to reshape the production of goods and services, since the way we produce and consume is inextricably intertwined with our collective progress and well-being.

History records distinct periods of industrial revolutions that, driven by technological advances, economic changes, and social transformations, not only transformed the face of production, but also redesigned the fundamental structures of society (Junqueira, 2020). In the face of the imperatives of the present, the need persists, and the current Revolution 4.0, or Industry 4.0, represents the latest stage in this evolutionary process, with the aim of reshaping the way we produce and live, redefining the boundaries of innovation and the interconnection between the physical and the digital. In this scenario, the search for transformation produces impacts in a multifaceted way; in which they reverberate in different ways in sectors of society (Junqueira, 2020).

HISTORY OF INDUSTRIAL REVOLUTIONS

In view of this, each evolutionary phase, represented by the Industrial Revolutions, was a crucial milestone in this process of adaptation and reinvention. With regard to the First Industrial Revolution, in the eighteenth century, it witnessed the transition from an agrarian economy to one based on industry, highlighting mechanization and the steam engine, which allowed such advances to act as catalysts for this period, marked by changes in production practices, urbanization and the emergence of factories (Sakurai, & Zuchi, 2018).

If, on the one hand, the economic benefits were evident, with mass production providing greater efficiency and productivity, on the other hand, this transition to an industrial model was not without significant social and labor challenges (Junqueira, 2020). In the field of social inequalities, industrialization has accentuated socioeconomic disparities. Factory owners reaped substantial economic benefits, while workers faced reduced wages, grueling hours, and dangerous working conditions. These disparities contributed to the emergence of a deeper divide between social classes. At the same time, the organization of work was also impacted, with mechanized production leading to specialization and repeatability in work functions. While increasing efficiency, this

specialization often led to monotony and alienation of the worker from the final product (Sakurai, & Zuchi, 2018).

In response to these adverse conditions, labor movements and trade unions emerged, seeking better working conditions, fair wages, and labor regulations. Protests and strikes became fundamental instruments in the struggle for labor rights, leaving a lasting legacy in the way labor relations would be addressed in the following decades (Junqueira, 2020).

Consequently, the Second Industrial Revolution, nineteenth and early twentieth centuries, was distinguished by electrification, mass production, and the implementation of assembly lines. Innovations such as electricity, serial production, and the application of steel and oil have significantly boosted the growth of heavy industry and the expansion of the manufacturing sector (Junqueira, 2020). Therefore, it brought with it economic benefits, but also substantial challenges.

In this context, factories have evolved into mass production centers, leveraging efficiency and significantly increasing productivity. However, this revolution also entailed considerable social challenges. Urbanization intensified, leading to changes in the living conditions of urban populations. The concentration of workers in industrial centers has resulted in often unsatisfactory housing conditions, contributing to disparities (Sakurai, & Zuchi, 2018).

In view of this, labor challenges, such as specialization in tasks, have become a distinctive feature of assembly lines. Although it increased efficiency, this model of production often resulted in monotonous and alienating working conditions. Workers faced exhausting working hours and, in some cases, a lack of adequate regulation regarding occupational safety (Sakurai, & Zuchi, 2018).

Consequently, the emergence of trade union and workers' movements played a crucial role in the struggle for better working conditions. Strikes and demonstrations have become essential means of pressing for labor rights, leaving a remarkable legacy in the history of labor relations (Sakurai, & Zuchi, 2018).

With regard to the Third Industrial Revolution, also recognized as the digital revolution, it began in the second half of the twentieth century, evidenced by electronics, information technology and automation. The digitalization of production processes, the development of computers, and the automation of tasks have boosted efficiency and productivity in industries.

This period represented a remarkable transition, where the incorporation of digital technologies redefined the paradigms of industrial production and had a profound impact on the management and execution of tasks (Sakurai, & Zuchi, 2018).

The digitalization of production processes, the development of computers and industrial automation were pillars of this evolutionary phase. The economic benefits have been remarkable, with improved production efficiency and the creation of new sectors such as technology-based services. However, the societal challenges associated with automation and computerization have become evident. The replacement of traditional jobs with digital technologies has raised concerns about the "reskilling" of the workforce and the need to adapt to new work paradigms (Sakurai, & Zuchi, 2018).

In the work scenario, automation has transformed the demands of functions, demanding a new range of skills and abilities. That said, the reorganization of work and the emphasis on knowledge-based professions marked a significant transition. The need to address the challenges of structural unemployment and the guarantee of fair working conditions stood out as areas of critical concern in this period of the second industrial revolution (Sakurai, & Zuchi, 2018).

INDUSTRY 4.0

Finally, the current stage, the Fourth Industrial Revolution or Industry 4.0. A revolution driven by the convergence of digital technologies such as the Internet of Things (IoT), artificial intelligence, big data and cloud computing. This revolution aims to create smart factories, where the interconnection of cyber-physical systems and advanced automation not only optimize production, but also allow for greater customization and sustainability (Gimenez, & dos Santos, 2019).

The emergence of Industry 4.0 represents a significant milestone in industrial evolution, in order to outline a paradigm that has gained notable prominence in recent decades (Gimenez, & dos Santos, 2019). This concept, revolution 4.0, was pioneered in 2011 in Germany as "Industrie 4.0" by a consortium of representatives from various sectors, including business, politics and academia. This initiative primarily aimed to strengthen Germany's competitiveness in the global manufacturing industry scenario, promoting leadership in technological innovation (Gimenez, & dos Santos, 2019).

The essence of Industry 4.0 lies in the search for the synergistic integration of advanced technologies, such as the aforementioned (Internet of Things (IoT), artificial intelligence, big data, cloud computing and cyber-physical systems). The goal is to transform production processes, developing smart, highly efficient, and adaptable factories

(dos Santos et. al., 2019). This industrial revolution advocates the digitalization and automation of manufacturing procedures, fostering the interconnection of machines, systems and assets. This scenario aims to facilitate autonomous decision-making and production optimization, culminating in the achievement of higher levels of operational efficiency (dos Santos et. al., 2019).

CHALLENGES OF INDUSTRY 4.0

The developments of the current industrial revolution go beyond the operational sphere, presenting the potential to instigate new business models, services and products, with significant economic implications (Oztemel, & Gursev, 2020). In view of this scenario, the discussion about the Fourth Industrial Revolution has intensified, focusing particularly on the implications that it will have on the labor market and on the functional profiles of organizations.

Kagermann et al. (2013) stress that the Fourth Industrial Revolution will lead to a growing need for complexity management and problem solving within the workforce.

Therefore, the direct relationship between Industry 4.0 and process automation has a direct impact on the labor market, fundamentally changing the nature of work as we know it (Gimenez, & dos Santos, 2019). A study conducted by the consulting firm McKinsey (Bughin et. al., 2017) reveals that, in a period of ten to fifteen years, the adoption of technologies related to automation and artificial intelligence will transform the labor market, as machines become increasingly intelligent, as well as the interaction between Man and machines (Bughin et. al., 2017).

Nevertheless, the Fourth Industrial Revolution brings with it a number of social and ethical challenges, particularly in the field of work psychology. The distinctive characteristics of this revolution, namely automation and digitalization, have the potential to cause large-scale unemployment and significantly change labor relations, which can impact the mental and emotional health of workers, as well as raise preponderant ethical issues (Cavalcante, 2018).

The occurrence of mass unemployment resulting from the replacement of workers by machines emerges as one of the main social challenges of Industry 4.0 (Cavalcante, 2018). According to Cavalcante (2018), job loss can induce stress, anxiety, and uncertainty among workers, affecting their psychological well-being and mental health. The scarcity of employment opportunities can lead to a socio-political sphere with the possibility of greater dependence on social programs, such as social assistance and unemployment benefits, which can consequently affect the dignity of workers.

Changes in employment relationships can also have an impact on the mental and emotional health of workers. According to studies conducted (Graglia, & Lazzareschi, 2018), the introduction of new technologies and the redefinition of roles and responsibilities can generate anxiety with regard to job security, adaptation to new tools and processes, as well as pressure to acquire new skills.

In addition, the replacement of workers by machines raises relevant ethical questions regarding the responsibility of companies in the face of the social impact of their decisions. Cruz (2020) points out that it is imperative that organizations consider the human impact of their automation and digitalization strategies, in order to ensure the implementation of support measures for affected workers, such as professional retraining programs, psychological support, and retraining for new roles (Cruz, 2020)

In view of these challenges, it is important that companies and competent bodies carefully consider the social and ethical implications of the Fourth Industrial Revolution. Promoting healthy work environments, implementing psychological support programs, and ensuring opportunities for retraining and retraining are essential to mitigate negative impacts on workers and society as a whole (Graglia, & Lazzareschi, 2018).

In summary, the Fourth Industrial Revolution poses significant challenges in the social and ethical spheres, especially with regard to the psychology of work. Understanding and responsibly addressing these issues is key to ensuring that the transition to Industry 4.0 takes place in a fair and sustainable way for all stakeholders.

CONSTANT ADAPTATION IN INDUSTRY 4.0

The incessant dynamics of technological changes in the contemporaneity of Industry 4.0 imposes substantial challenges not only for institutions, in the political-social sphere, or for workers in general, but also directly affects work and organizational psychologists. requiring constant adaptation. This demand covers several aspects, from the updating of professional skills to the understanding of the psychosocial impacts on work dynamics (Heloani, & Capitão, 2003).

Given this scenario, the introduction of advanced technologies such as artificial intelligence, automation, and real-time data analysis creates an environment where organizations and occupational psychologists are forced to keep themselves continuously updated. This pressure to keep up with the speed of change can result in stress and work overload and a redesign of your approach in general.

The need for continuous updating encompasses not only the assimilation of the psychological nuances associated with human-machine interaction, but also the ethical

application of artificial intelligence in recruitment. This constant demand for learning and adaptation can generate a feeling of informational overload in professionals.

The pressure for constant updating can, in turn, have implications for the professional health of occupational psychologists. The need to quickly assimilate new knowledge and technologies can lead to a sense of inadequacy, anxiety, and even burnout. The constant race to remain relevant can negatively impact the psychological well-being of professionals (Heloani, & Capitão, 2003).

With regard to psychosocial interventions, the speed of change can hinder the effective implementation of these interventions. The ability of occupational psychologists to keep up with changes in group dynamics, emotional needs and psychological challenges faced by workers may be compromised, impairing the effectiveness of their actions (Heloani, & Capitão, 2003). Constant adaptation can also give rise to a generational gap, with younger professionals more inclined and prepared to quickly adopt new technologies, while those with more experience may feel disconnected or resist change. Effectively managing this gap becomes an additional challenge.

In addition, the rapid obsolescence of knowledge can make knowledge management within organizations challenging. The transfer of skills and experiences between team members can be hampered by the constant need to adapt, creating knowledge gaps that can affect the effectiveness of operations (Cavalcante, 2018).

To overcome these challenges, it is imperative to develop organizational cultures that promote constant adaptation. Creating an environment where continuous learning is encouraged and valued requires not only offering training opportunities, but also fostering a mindset of openness to change at all levels of the organization (Cavalcante, 2018).

PSYCHOLOGY IN THE CONTEXT OF ORGANIZATIONS IN INDUSTRY 4.0

In this context, despite the aforementioned challenges, the psychology of work and organizations emerges as a field of study and intervention of paramount importance to address the psychological and organizational demands arising from the 4.0 revolution. Work psychology can play a crucial role in promoting healthy and sustainable work environments amid technological and organizational transformations (Bughin, et. al., 2017).

This contribution is materialized through interventions aimed at the prevention and treatment of psychological problems, the promotion of socio-emotional skills and the adaptation to new work paradigms. At the same time, it aims to ensure the safeguarding of the mental health of workers, thus ensuring the quality of life at work and healthy adaptation to the changes imposed by the 4.0 revolution (Junqueira, 2020).

In order to illustrate, the Burnout syndrome, manifested by emotional exhaustion, depersonalization and low professional fulfillment, emerges as one of the main psychological challenges faced by workers in the context of the 4.0 revolution (Barlach, & Malvezzi, 2008). Workaholism is also a preponderant issue, since digital hyperconnection and the pressure for productivity can result in work overload and difficulty in disconnecting from the professional environment (Barlach, & Malvezzi, 2008).

In addition, the transition to new roles in the field of automation and artificial intelligence can induce anxiety and insecurity in workers, often requiring professional reskilling and adaptation to new work models (Kagermann, & Wahlster, 2013). The transformation of labour relations, characterised by the integration of self-employed workers into online platforms, also entails psychological challenges, as the safeguarding of labour rights is often insufficient (Kagermann, & Wahlster, 2013).

One of the main challenges is the skills gap, where the demand for professionals with technology competencies outstrips supply. In this sense, Work Psychology can play an active role in the development of training and capacity building programs, with a view to updating and acquiring new skills by workers, encouraging their adaptation to the new demands of the labor market (Junqueira, 2020).

Additionally, organizational psychology can contribute to the identification of key competencies necessary for success in the Industry 4.0 era, assisting in the selection and development of talents aligned with the needs of organizations (Junqueira, 2020).

Another relevant challenge is the limitations of cybersecurity action, which has become a growing concern with digitalization and connectivity. Rapid technological evolution and the interconnection of devices and systems in Industry 4.0 significantly increase exposure to cyber threats, such as hacker attacks, data theft, and disruption of operations (Cruz, 2020).

INTERVENTIONS OF WORK AND ORGANIZATIONAL PSYCHOLOGY

In this context, in the promotion of an organizational culture oriented towards cybersecurity and in the awareness of employees to threats and safe practices in the workplace, the approach of Work Psychology to the challenge of cybersecurity can integrate several intervention strategies:

I. Awareness and training: Organizational psychology can develop awareness and training programs for employees, aiming to promote the understanding of cyber risks and the adoption of safe practices in the use of technologies and systems. This can

encompass simulations of cyberattacks and the dissemination of information on how to identify and report on potential threats (Cruz, 2020).

II. Promoting a culture of security: Work psychology can work to foster an organizational culture that values cybersecurity by encouraging open communication about incidents and vulnerabilities, and promoting shared responsibility for protecting the organization's digital assets (Cruz, 2020).
III. Management of cybersecurity-related stress: Exposure to cyber threats can generate stress and anxiety in employees. In this regard, organizational psychology can develop psychosocial support strategies to help workers cope with the emotional and psychological impact of cybersecurity concerns (Cruz, 2020).
IV. Employee engagement and participation: Work psychology can promote the active participation of employees in identifying vulnerabilities and proposing solutions to improve cybersecurity, promoting a sense of responsibility and involvement with the protection of the organization's digital assets (Heloani, & Capitão, 2003).

In short, cybersecurity represents a significant challenge in the era of Industry 4.0, and Work Psychology can play a crucial role in promoting safe practices, awareness, stress management, and employee engagement to address cyber threats and protect organizations' digital assets. It should be noted that the performance of professionals in this context is organized and planned according to the practice scenario and adapting to the reality faced.

In addition, organizational psychology also plays a fundamental role in managing change and promoting the well-being of workers in the face of the transformations brought about by Industry 4.0. Thus, psychosocial intervention strategies can include supporting adaptation to new technologies, managing stress and anxiety related to organizational changes, as well as fostering healthy and motivating work environments (Heloani, & Capitão, 2003).

Professionals in the area play a crucial role in organizational change management, contributing to the proper transition of employees in the face of new demands. Citing Heloani & Capitão (2003), it is evident that well-designed intervention strategies are essential to minimize the negative impacts of change and encourage workers' adaptation.

One of the key strategies is the promotion of effective communication. In this context, Organizational Psychology can develop strategies that include informational meetings, specialized training, and the dissemination of information through internal communication

channels (Heloani, & Capitão, 2003). These measures aim to inform employees about the changes, elucidating the expected impacts and the resulting benefits.

Another crucial point is the active participation of workers in the change process. The work of professionals aims to promote participation through the creation of working groups, change committees and other forms of involvement (Junqueira, 2020). The direct collaboration of employees in the decision-making process can significantly increase acceptance and adaptation to new requirements.

It is important to recognize that change can lead to stress and anxiety among employees. In this sense, Organizational Psychology plays a vital role in the development of psychosocial support strategies, aiming to mitigate the emotional and psychological impacts of change (Junqueira, 2020). This focus not only contributes to adaptation, but also promotes the well-being and mental health of employees.

Additionally, Organizational Psychology can play a crucial role in the development of skills necessary to face the new demands imposed by change (Coelho-Lima, & Yamamoto, 2011). The implementation of training and qualification programs is an effective approach to assist employees in acquiring new skills and abilities required for effective adaptation to new demands (Coelho-Lima, & Yamamoto, 2011).

In summary, Work Psychology, through its intervention strategies, can contribute significantly to the promotion of adaptation, skills development, cybersecurity and well-being of workers in the face of the challenges presented by the Revolution 4.0, playing a crucial role in building more productive, healthy work environments adapted to the demands of the digital age.

CONCLUSION

Therefore, Industry 4.0 constitutes an innovative phase in the evolution of the production of goods and services, driven by technological advances that redefine the limits of innovation and the interconnection between the physical and the digital. However, this industrial revolution is not without challenges, especially in the social and ethical spheres, particularly in the context of work psychology.

In this way, the incessant dynamics of technological changes in Industry 4.0 imposes substantial challenges not only on institutions in the political-social sphere and on workers in general, but also directly on work and organizational psychologists, requiring continuous adaptation. Therefore, the need for constant updating encompasses not only the assimilation of the psychological nuances associated with human-machine interaction, but also the ethical application of artificial intelligence in the workplace.

Emphasizing that the replacement of workers by machines raises relevant ethical questions regarding the responsibility of companies in the face of the social impact of their decisions to promote healthy work environments. In addition, the implementation of psychological support programs and the guarantee of opportunities for recycling and professional retraining are essential to mitigate the negative impacts on workers and society as a whole. Understanding and addressing these issues responsibly is key to ensuring that the transition to Industry 4.0 takes place in a fair and sustainable way for all stakeholders.

In short, the transition to Industry 4.0 imposes a substantial challenge on the psychology of work and organizations, requiring support and training to effectively face technological changes and their psychosocial impacts on work dynamics. Adequate preparation is essential, considering that the continuous adaptation and ethical application of artificial intelligence in the workplace are crucial elements to ensure quality of life at work and a healthy adaptation in the face of the transformations resulting from the 4.0 revolution.

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