

DOSSIER: ANTHROPOCENE AND THE LIKE

Technological transformations in the Technocene: theoretical challenges for work and social protection

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Abstract

This article critically analyzes the effects of contemporary technological transformations in the Technocene on the concepts of work and social protection models, using national and international theoretical frameworks. This is a theoretical essay with a critical, interdisciplinary, and propositional approach, supported by a qualitative analysis that combines bibliographic and documentary reviews, highlighting contributions from authors such as Bernard Stiegler, who problematizes algorithmic automation and the decline of wage labor, and Parra, Teixeira, and Vallejo, who discuss the impacts of platformization and datafication of everyday life. The research also draws on institutional documents, including government reports and the Brazilian Annual Social Information Report (Rais) database, which highlights the limitations of official information systems in the face of the complex transformations induced by the Fourth Industrial Revolution, centered on intensive automation, and the emerging Fifth Revolution, marked by human-machine cooperation. The results indicate that these transformations erode the wage-earning base of the Keynesian model of redistribution, increase the risks of technological unemployment, precariousness, and digital inequality, and weaken the state's ability to sustain social protection systems. In conclusion, to address this scenario, it is urgent to develop innovative and inclusive public policies that combine professional retraining, digital inclusion, labor regulation, and new forms of redistribution, capable of reconciling technological innovation, sustainability, and social justice.

Keywords: Technocene. Fourth Industrial Revolution. Fifth Industrial Revolution. Work and social protection. Public policy and labor regulation.

Transformações tecnológicas no Tecnoceno: desafios teóricos para o trabalho e a proteção social

Resumo

Este artigo tem como objetivo analisar criticamente os efeitos das transformações tecnológicas contemporâneas, no contexto do Tecnoceno, sobre o conceito de trabalho e os modelos de proteção social, utilizando referenciais teóricos nacionais e internacionais. Trata-se de um ensaio teórico de abordagem crítica, interdisciplinar e propositiva, sustentado em uma análise qualitativa que combina revisão bibliográfica e documental, com destaque para contribuições de autores como Bernard Stiegler – que problematiza a automação algorítmica e o declínio do trabalho assalariado – e Parra et al. – que discutem os impactos da plataformação e da datificação da vida cotidiana. A pesquisa também recorre a documentos institucionais, incluindo relatórios governamentais e a base de dados da Relação Anual de Informações Sociais (Rais), cuja utilização evidencia as limitações de sistemas oficiais de informação diante da complexidade das transformações induzidas pela Quarta Revolução Industrial, centrada na automação intensiva, e pela emergente Quinta Revolução, marcada pela cooperação humano-máquina. Os resultados indicam que tais transformações corroem a base assalariada do modelo keynesiano de redistribuição ampliam os riscos de desemprego tecnológico, precarização e desigualdade digital; e fragilizam a capacidade do Estado de sustentar sistemas de proteção social. Conclui-se que, para enfrentar esse cenário, torna-se urgente formular políticas públicas inovadoras e inclusivas que articulem requalificação profissional; inclusão digital; regulação do trabalho; e novas formas de redistribuição, capazes de conciliar inovação tecnológica, sustentabilidade e justiça social.

Palavras-chave: Tecnoceno. Quarta Revolução Industrial. Quinta Revolução Industrial. Trabalho e proteção social. Política pública e regulação do trabalho.

Transformaciones tecnológicas en el Tecnoceno: desafíos teóricos para el trabajo y la protección social

Resumen

Este artículo busca analizar críticamente los efectos de las transformaciones tecnológicas contemporáneas, en el contexto del Tecnoceno, sobre el concepto de trabajo y los modelos de protección social, utilizando marcos teóricos nacionales e internacionales. Se trata de un ensayo teórico con un enfoque crítico, interdisciplinario y propositivo, basado en un análisis cualitativo que combina revisiones bibliográficas y documentales, destacando las contribuciones de autores como Bernard Stiegler, quien problematiza la automatización algorítmica y el declive del trabajo asalariado, y Parra, Teixeira y Vallejo, quienes abordan los impactos de la plataformación y la datificación de la vida cotidiana. La investigación también se basa en documentos institucionales, incluyendo informes gubernamentales y la base de datos del Informe Anual de Información Social (Rais), cuyo uso pone de relieve las limitaciones de los sistemas de información oficiales ante las complejas transformaciones inducidas por la Cuarta Revolución Industrial, centrada en la automatización intensiva, y la emergente Quinta Revolución, marcada por la cooperación entre humanos y máquinas. Los resultados indican que estas transformaciones erosionan la base salarial del modelo keynesiano de redistribución, aumentan los riesgos de desempleo tecnológico, precariedad y desigualdad digital, y debilitan la capacidad del Estado para sostener los sistemas de protección social. La conclusión es que, para afrontar este escenario, urge desarrollar políticas públicas innovadoras e inclusivas que combinen la reconversión profesional, la inclusión digital, la regulación laboral y nuevas formas de redistribución, capaces de conciliar la innovación tecnológica, la sostenibilidad y la justicia social.

Palabras clave: Tecnoceno. Cuarta Revolución Industrial. Quinta Revolución Industrial. Trabajo y protección social. Políticas públicas y regulación laboral.

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INTRODUCTION

The intensification of digitization and automation in recent decades has ushered in a new era, in which technology plays a central role in the organization of social, economic and productive dynamics. To understand this phenomenon, the concept of the Technocene has gained prominence by indicating a historical period in which technical systems become determinants of social, environmental and economic dynamics (Cera, 2017). In this scenario, digital platforms, algorithms and intelligent networks shape everyday life, as observed by Parra et al. (2024), without a corresponding strengthening of democratic capacities for control and regulation. This is a context that presents new challenges, especially for work and social protection systems.

The problem is that such socio-technical transformations, accelerated by the Fourth (4IR) and Fifth (5IR) Industrial Revolutions, structurally reconfigure the forms of production, occupation and redistribution of wealth. According to Schwab (2016), the 4IR promotes convergence between digital, physical and biological technologies, producing profound disruptions in the economy and the labour market. The emerging 5IR, on the other hand, introduces the promise of ethical and sustainable integration between humans and machines. However, as Stiegler (2018) warns, algorithmic automation tends to erode the Keynesian model of redistribution based on wage labour, compromising the solvency of social welfare systems. Thus, the central question of this research emerges: how do the intensified socio-technical transformations in the Technocene, driven by the Fourth and Fifth Industrial Revolutions, challenge the theoretical foundations of work and social protection in contemporary societies?

To answer this question, this article aims to critically analyse the effects of contemporary technological transformations, in the context of the Technocene, on the concept of work and social protection models, drawing on national and international theoretical references. It starts from the assumption that digitization and automation directly impact the occupational structure and the wage-based redistribution, requiring new forms of labour regulation and inclusive public policies.

The research is developed as a theoretical essay with a critical, interdisciplinary and propositional approach, supported by qualitative analysis. The methodology adopts as its central procedure a review of the literature and documentation, using authors from the fields of philosophy, technology, sociology of work, political economy and public policy studies (Mollo & Acypreste, 2023; Parra et al., 2024; Perez, 2004; Rizzotti & Nalesso, 2022; Stiegler, 2018). In addition, institutional and regulatory documents were examined, such as the Constitution of the Federative Republic of Brazil (1988); technical notes from the Public Ministry of Labour; reports from the Ministry of Economy and the Inter-American Development Bank; as well as the Annual Social Information Report (Rais) database, which illustrates the limits of statistical capture of the new socio-technical dynamics.

The theoretical framework articulates critical and complementary perspectives on the Technocene, the 4IR and the 5IR, highlighting both optimistic views of innovation and efficiency and readings that problematize technological unemployment, precariousness and digital exclusion. This plurality of approaches underpins the interdisciplinary nature of the study and allows us to highlight the social, economic and legal implications of technological advancement.

The article is organized into five sections, in addition to this introduction. The first presents the methodology, justifying the critical and interdisciplinary approach adopted and detailing the bibliographic and documentary sources used. The second discusses the conceptual foundations of the Technocene as an analytical framework for contemporary socio-technical transformations. The third analyses the Fourth and Fifth Industrial Revolutions in the context of the Technocene, exploring their complementarities and contradictions. The fourth examines the effects of automation and digitization on work, redistribution and social protection, focusing on theoretical tensions and socio-political implications. Finally, the fifth section presents the concluding remarks, highlighting alternatives for innovative and inclusive public policies.

METHODOLOGY

This research adopts a critical and interdisciplinary approach, based on qualitative analysis, drawing on a review of the literature and documentation. This methodological choice aims to interpret the effects of contemporary socio-technical transformations on work and occupational structure, highlighting, in particular, institutional responses or their absence in the field of public employment policies.

The critical approach is based on questioning the structural impacts of recent technological revolutions, notably the 4IR and 5IR, on the current social protection model. Instead of considering technology as a neutral phenomenon, the study understands it as socially conditioned technogenesis, marked by power asymmetries and a deficit of democratic regulation. The concept of the Technocene is central to the analysis, as it expresses the dominance of the technical factor in economic, political, and social dynamics, often to the detriment of institutional control processes.

Interdisciplinarity is reflected in the articulation between fields of knowledge or disciplines such as the philosophy of technology, sociology of work, political economy, and public policy studies, enabling a multifaceted reading of the challenges imposed by technological transformations on the world of work and state action.

The literature review brings together authors from different theoretical traditions, among whom the following stand out:

- i. Philosophy of technology and critique of automation: Bernard Stiegler (2018), Cera (2017), Amâncio (2023) and Froehlich (2024).
- ii. Political economy and sociology of work: Mollo and Acypreste (2023), Bezerra (2024), Rizzotti and Nalesso (2022).
- iii. Public policy studies and institutional innovation: Parra et al. (2024), Rocha (2021), Lanzara and Castro (2024), Caliendo and Podolan (2024) and David et al. (2024).
- iv. Studies on industrial revolutions: Schwab (2016), Anil (2025), Kovács (2016) and Perez (2004).

This theoretical basis supports the analysis of issues such as technological unemployment, precariousness through platforms, dismantling of labour protection and the emptying of state responses in the face of technical acceleration.

The selection of authors used in this research was guided by three main criteria: (i) theoretical relevance in the field of study; (ii) contemporaneity of reflections in the face of recent technological transformations; and (iii) disciplinary diversity, in order to support the critical and interdisciplinary approach adopted.

Authors such as Bernard Stiegler (2018) and Cera (2017) offer philosophical-critical foundations on the role of technology and automation. In the field of sociology and labour economics, authors such as Mollo and Acypreste (2023) and Rizzotti and Nalesso (2022) analyse the effects of precariousness and technological unemployment. Studies of public policy and institutional innovation are represented by recent works, such as those by Parra et al. (2024) and Rocha (2021), which discuss the limits of the state in the face of new socio-technical demands.

The absence of classical authors is also justified because this research does not aim to provide an exhaustive historical overview, but rather an analytical snapshot focused on contemporary debates, and because the emphasis is on authors who address current socio-technical impacts with a critical and interdisciplinary bias.

The documentary analysis covers constitutional norms, technical opinions, decrees, institutional reports, and international documents, with the aim of mapping how the Brazilian State, as a formulator and executor of public policies, has or has not responded to the challenges imposed by the Technocene. Among the main documents analyzed, the following stand out (Table 1):

Table 1
Normative and institutional documents analyzed in the research

Document	Type	Contribution
1988 Federal Constitution (Art. 7, XXVII; Art. 3)	Legal norm	Establishes the right to protection against automation
Technical Note No. 7/2020 – National Coordination for the Promotion of Trade Union Freedom and Social Dialogue/ Public Ministry of Labour (CONALIS/MPT)	Technical document	Interprets technology-induced layoffs and workers social protection
Direct Action of Unconstitutionality by Omission (ADO) 73 – Attorney General’s Office (PGR) vs National Congress	Legal action	Points to legislative omission in the regulation of the constitutional article on automation
Decree No. 76,403/1975 – National Employment System (SINE) Borges (2018)	Infraconstitutional norm	Outlines the history of public employment policies in Brazil
Powers of the Ministry of Labour and Employment (2023)	Institutional document	Defines state responsibilities in light of new labour market demands
Report by the Ministry of Economy (2020)	Management report	Highlights the progress of the digitization of public services and its economic impacts
Report by the Inter-American Development Bank (IDB), Porrúa et al. (2021)	International document	Analyses digitization in the Latin American public sector

Source: Elaborated by the authors based on institutional and regulatory documents.

These documents were selected for their relevance in understanding the degree of adherence or omission of the State in the face of labour market restructuring in a technocene context. The articulation between critical theory and institutional document analysis enables an approach that not only diagnoses the effects of technology but also questions the limits of the legal framework and public policies in the face of the new productive configuration.

TECHNOCENE AND ITS EFFECTS ON EMPLOYMENT AND DIGITAL INCLUSION

The purpose of this section is to discuss the Technocene as a critical category for understanding the dominant role of technology in shaping the present. By mobilizing different theoretical perspectives, we seek to highlight both the complementarities and tensions between authors who analyse the phenomenon in its geological, philosophical and social dimensions. This debate allows us to problematize the impacts of automation and digitization on work and question the limits of public policies in the face of the contradictions produced by the techno-human entanglement.

The concept of the Technocene, by highlighting the dominant role of technology in economic and environmental reconfiguration, highlights the growing dependence of productive systems on advanced technologies. This process has intensified the automation of tasks, reducing the demand for certain occupations and widening digital inequalities, since unequal access to technologies can exclude significant portions of the population from the labour market and digitalized social life. Workers in traditional sectors, for example, face difficulties in adapting to jobs that require advanced digital skills, which deepens social and economic exclusion.

For Froehlich (2024), the Technocene prompts reflection on the influence of technoscience on the Earth system and on the intersections and contradictions of post-humanist perspectives. According to the author, the Technocene reveals that humans do not exist in isolation: they are intertwined with technology (machines, algorithms, digital platforms) and the environment. Post-humanist perspectives seek to understand this “techno-human entanglement,” in which humans, machines, and the planet can no longer be analyzed separately. However, contradictions arise: some strands celebrate the overcoming of the human condition, such as transhumanism and the fusion of man and machine, while others warn of the ethical, social, and environmental risks of this integration, as in the case of eco-posthumanisms.

Costa (2021, as cited in Amâncio, 2023) points out that the Technocene marks irreversible transformations on Earth at geological levels, caused in the past by human action and, more recently, by technical action. This paradigm shift highlights technology as a central transformative force and has led to new forms of life and human-machine interaction.

Despite their different approaches, Costa and Froehlich converge in emphasizing that the Technocene breaks with human centrality: either through insertion into the techno-human entanglement (Froehlich, 2024) or through the replacement of human action by technical action as an agent of planetary transformation (Costa, 2021, as cited in Amâncio, 2023). While Costa is more attentive to the structural and geological nature of change, Froehlich emphasizes the philosophical and relational plane, discussing post-humanist contradictions in the interaction between humans and technology. Thus, the views complement each other: Costa highlights the Technocene as an irreversible technical milestone, while Froehlich broadens the debate by analyzing its philosophical and social impacts.

In this sense, López-Corona and Magallanes-Guijón (2019) reinforce that, if the Earth system co-evolves with life phenomena, modern societies today are enormously coupled with technology. For the first time in history, technology has the potential to modify the central processes that drive the dynamics of the Earth system. Thus, a new dimension of analysis should be considered in studies of the Earth system in its co-evolution with life and, particularly, with human beings.

Considering technology as this new dimension, Caliendo and Podolan (2024) point to the urgency of reflecting on the social effects of automation, especially the impact of mass layoffs that relegate millions of workers to the margins of social protection. This process intensifies poverty and inequality, revealing that the thoughtless adoption of technology can become unsustainable. The author illustrates his analysis with the case of the banking sector: the queues that used to form at human tellers were gradually replaced by ATMs and, later, by digital applications mediated by Artificial Intelligence (AI). A similar phenomenon occurs in supermarkets, fast-food chains, and also in industrial and agricultural sectors, where the intensive use of technology deepens the replacement of human labour.

In the public sector, Porrúa et al. (2021) highlight that, during the COVID-19 pandemic, governments resorted to digital tools to maintain their operations and services. This sudden transition revealed the potential of digital transformation not only to improve the quality of public services but also to reduce costs. The 2020 Balance Sheet of the Ministry of Economy, systematized by Andrade et al. (2020), confirms this trend by reporting that the Gov.br portal already provided more than 2,600 digital public services, representing 65% of the total, as in the case of biometric proof of life for retirees of the National Social Security Institute (INSS). The estimated annual savings are R\$ 2 billion, of which R\$ 1.5 billion is for the population and R\$ 500 million is for the government.

Thus, whether in public or private administration, the Technocene has been described as a possible new geological era marked by the impact of technology, characterized by technological acceleration, digitization, automation and its effects on natural cycles, global geopolitics and social life. More than just describing this scenario, the Technocene establishes a horizon of urgency: as Parra et al. (2024) state, it is a matter of democratizing the processes of deliberation on technologies that profoundly affect everyday life but emerge without asking permission.

In this context, thinking about effective public policies implies recognizing the centrality of technology and adopting inclusion strategies, such as: massive digital training and upskilling, especially for vulnerable groups; incentives for professional retraining in sectors impacted by automation; and expanding access to emerging technologies in order to avoid deepening social and digital inequalities.

In summary, the theoretical debate surrounding the Technocene shows that, although authors start from different approaches, sometimes highlighting its geological and structural dimension, sometimes emphasizing philosophical, social and political implications, there is consensus in recognizing the centrality of technology as an irreversible transformative force of our time. This convergence reinforces the need to treat technology not only as a tool, but as a constitutive element of social life, capable of reconfiguring labour relations, institutions and ecosystems. At the same time, the divergent perspectives between critical analyses of the techno-human entanglement, diagnoses of digital exclusion, and reflections on the impacts on public governance allow us to stretch the limits and possibilities of state action in the face of inequalities intensified by automation and digitization. Thus, the concept of the Technocene, rather than describing a new era, is a critical tool for thinking about inclusive and democratic public policies capable of addressing the social and ethical risks of contemporary technological transformations.

RELATIONSHIP BETWEEN THE FOURTH AND FIFTH INDUSTRIAL REVOLUTIONS: CHALLENGES FOR WORK

This section aims to discuss the relationship between the Fourth and Fifth Industrial Revolutions and their effects on work in the context of the Technocene. It seeks to highlight the advances and setbacks brought about by these processes, highlighting complementarities and contradictions between different authors, in order to assess how such transformations, challenge social inclusion and the formulation of public policies.

The 4IR, which began around 2010-2015 and gained prominence at the World Economic Forum, particularly during the 2016 Davos meeting, introduced a scenario marked by automation, artificial intelligence and digitization, impacting both the private sector and the functioning of the public sector. The 5IR, emerging from 2020 and still in consolidation, expands this process by emphasizing the humanization of technology and sustainability. These transformations affect work in several dimensions: digitization of services, demand for new professional profiles to operate advanced platforms and automation of bureaucratic processes, reducing traditional administrative functions but increasing the need for professionals qualified in technology and data analysis. The expansion of digital government and the use of AI in public administration exemplify this process, requiring civil servants who are prepared to ensure citizen inclusion.

In the research by David et al. (2024), managers and employees in public administration perceive the “future of work” as uncertain, requiring constant preparation. For them, digital transformation redefines tasks in the public sector, making it essential to improve civil servants’ skills and anticipate new competencies.

The concept of 4IR, popularized by Klaus Schwab (2016), refers to the convergence of digital, physical and biological technologies, with disruptive impacts on the economy and society. AI, the Internet of Things (IoT), *big data*, advanced robotics, 3D printing, cloud computing and biotechnology are milestones of this phase. Its effects include intensive automation, mass customization, the restructuring of the labour market, and the creation of so-called “smart factories”, in which machines communicate and make autonomous decisions. For Schwab, Industry 4.0 can revolutionize global value chains, enabling flexible and highly customized production models.

However, the advances of 4IR bring risks. Kovács (2016) warns that technological replacement can even affect skilled workers, leading to large-scale unemployment. Cavalcante (2020) reinforces that technological unemployment results from the replacement of traditional functions by digital implementations. Mollo and Acypreste (2023) add that such changes intensify the capitalist logic of profit maximization: from factory control to outsourced or Uberised work, new forms of exploitation are expanding, in which workers compelled to act as “self-entrepreneurs” lose rights and have to submit to exhausting working hours. Along the same lines, Lanzara and Castro (2024) point out that platforms such as Uber, iFood, and Amazon benefit from hiring workers as freelancers, exempting themselves from labour obligations and transforming themselves into “unregulated virtual factories.”

This precariousness is accompanied by social inequalities. Rizzotti and Nalesso (2022) argue that technology redefines the division of intellectual and manual labour, but also erects new “immaterial walls”, marked by digital exclusion. Unequal access to virtual knowledge divides the population between *insiders* and *outsiders* of the digital economy. Lanzara and Castro (2024) reinforce that, in Latin America, the lack of access to skilled jobs deepens these gaps, affecting the most vulnerable groups in particular.

In the Brazilian context, Rocha (2021) observes that the national industrial structure has a low capacity to react to technological unemployment. Although large companies are able to incorporate automation, the country lacks structured adaptation policies. For the author, addressing the *trade-off* between technology and employment requires investing in professional retraining and bringing universities, R&D centres and local production complexes closer together, creating solutions adapted to national specificities.

In contrast to the effects of 4IR, 5IR emerges as a more optimistic response. Although it is an emerging concept, it stands out for seeking a balance between technology, sustainability, and human well-being. While 4IR favours efficiency and automation, 5IR values human-machine cooperation and digital ethics. Its elements include productive personalization, green technologies, technological governance, and collaborative artificial intelligence. Anil (2025) adds that digital, physical, and biological

convergence is paving the way, enabling cognitive machines capable of enhancing human decisions. Bioprinting and additive manufacturing illustrate this advance, in which machine learning algorithms increase the autonomy of complex processes.

Thus, the debate on 4IR and 5IR reveals both advances and setbacks under the logic of the Technocene. Advances such as digitization, productive efficiency and innovation sustained by 5IR coexist with setbacks such as technological unemployment, precariousness and digital exclusion. The analyses complement and contradict each other: while Schwab (2016) praises the transformative potential of the 4IR, critical authors such as Mollo and Acypreste (2023), Lanzara and Castro (2024), and Rizzotti and Nalesso (2022) point out its unequal and exclusionary effects. The Technocene, in this sense, highlights the central contradiction: technology appears simultaneously as a force for innovation and as a producer of inequality, requiring public policies that reconcile technological progress with social inclusion and labour protection.

In summary, the analysis of the Fourth and Fifth Industrial Revolutions in the context of the Technocene reveals a field marked by complementarities and contradictions. On the one hand, there are advances related to digitalization, intelligent automation, sustainability, and human-machine cooperation, heralded by the 5IR as a possibility for balancing efficiency and inclusion. On the other hand, setbacks persist, evidenced by technological unemployment; precariousness via digital platforms; and the widening of digital inequalities, especially in peripheral countries such as Brazil. The contrast between Schwab's optimistic view and the criticism of authors such as Mollo and Acypreste, Lanzara and Castro, and Rizzotti and Nalesso reinforces the idea that technology is not neutral: it can both broaden the horizons of innovation and deepen social exclusion. In this sense, understanding the 4IR and 5IR in light of the Technocene means recognizing that industrial revolutions not only reconfigure work, but also pose urgent challenges to public policies, which must seek to reduce inequalities, promote retraining, and democratize access to emerging technologies.

CHALLENGES FOR SOCIAL PROTECTION AND LABOUR REGULATION

The objective of this section is to analyse the limits of traditional redistribution models, such as the Keynesian model, in the face of automation and datafication, discussing the theoretical tensions and socio-political implications that emerge in the context of the Technocene. It starts from theories of technical and occupational change, in particular the technological bias by qualification (SBTC) and creative destruction, to highlight both the optimistic arguments about the creation of new occupations and the critical readings that highlight unemployment, precariousness, and digital exclusion. The analysis seeks to articulate these advances and setbacks in order to understand how automation erodes the wage-earning base of the Keynesian model and challenges the sustainability of social protection systems, requiring new forms of labour regulation and income redistribution.

The intensification of disruptive technologies increases the risk of technological unemployment, especially in sectors with high automation potential. To understand this phenomenon, it is important to revisit the theories of technical and occupational change, which analyse how technological progress impacts the labour market. Two concepts are central to this debate: (i) *Skill-Biased Technological Change* (SBTC), according to which automation favours skilled workers, reducing the demand for low-skilled occupations; and (ii) *Creative Destruction* (Schumpeter 1942), which argues that new technologies eliminate existing jobs but create others, usually more complex ones. The relevance of these theories in this analysis lies in the fact that both help to understand contemporary dilemmas: if, on the one hand, innovation can generate new sophisticated jobs, on the other, it intensifies the precariousness and exclusion of vulnerable groups.

Perez (2004) deepens this understanding by conceiving technical change not as a purely engineering phenomenon, but as a complex social process, traversed by technical, economic, and institutional interactions. Its consequences, according to the author, include widespread unemployment, obsolescence of skills, destruction of livelihoods, geographical displacement and widening inequality between regions and countries. Here, a critique of Schumpeterian optimism is already taking shape: the gains from innovation are not automatic, but socially mediated.

This mediation becomes even more critical when viewed in the light of the Technocene. For Stiegler (2018), algorithmic automation undermines the very wage base of the Keynesian model of redistribution, understood as the centrality of formal work in sustaining income, consumption and tax collection. In classical Keynesianism, this foundation allowed for a virtuous circle in which productivity gains translated into higher wages, greater consumption capacity, expansion of aggregate

demand, and broadening of the tax base to finance public policies. However, with the decline of salaried work, this logic collapses: without formal employment, there is no income to redistribute; without income, aggregate demand falls; and with the reduction of the tax base, the state's capacity to sustain social protection systems is depleted. The risk, according to the author, is a collapse of macroeconomic solvency, in which the gains from automation are concentrated in a few groups, while precariousness and exclusion increase.

This diagnosis is reinforced by empirical analyses. Lanzara and Castro (2024) show how the COVID-19 pandemic has accentuated digital inequalities, exposing the fragility of social protection systems in the face of the intensified use of technologies. Rizzotti and Nalesso (2022) highlight that digital exclusion is becoming the new structural marker of inequality, requiring policies for training and democratic access to technologies. Bezerra (2024) adds that the fear of human labour being replaced by AI, popularized, for example, with the spread of ChatGPT-4, fuels uncertainty and pushes for new forms of regulation.

In the Brazilian context, these transformations have direct impacts on the occupational structure. Nozoe et al. (2003) already pointed out that traditional occupations have disappeared or been transformed into new professional profiles. This dynamic can be identified in Rais, a database of the Ministry of Labour and Employment (2024), which provides information on all formal establishments and CLT and statutory employment relationships in Brazil, with some limitations given the complexity of the transformations induced. Caliendo and Podolan (2024) and the Constitution of the Federative Republic of Brazil (1988) (Art. 7, XXVII) recognize the right to protection in the face of automation, but this legal provision remains unregulated. Technical Note No. 7/2020 from CONALIS/MPT (Public Ministry of Labour, 2020) and ADO 73, filed by the PGR in the Federal Supreme Court ([STF], 2022), highlight the legislative omission and the fragility of the legal apparatus to address technological replacement and ensure social protection.

Given this situation, proposals for regulatory innovation are emerging. Abbott and Bogenschneider (2018) question whether robots should pay taxes, advocating adjustments to the tax system so that automation does not *erode* the tax base. In the same vein, Ooi and Goh (2019) suggest a tax on automation, capable of slowing down the massive replacement of jobs and financing fair transition measures for workers.

In light of the Technocene, therefore, we see the coexistence of advances and setbacks: while automation and datafication bring productivity gains and new fields of activity, they also erode redistribution models, deepen inequalities, and weaken social protection. The common thread running through the analyses reveals complementarities and tensions: the optimism of creative destruction contrasts with the criticism of Perez (2004) and Stiegler (2018), but both readings prove indispensable for thinking about the present. The critical synthesis of this debate points out that the challenges of social protection and labour regulation cannot be reduced to a choice between technological progress or regression, but rather require innovative public policies that promote professional retraining, digital inclusion, and new forms of redistribution, including taxation, capable of responding to the displacement of human labour in the technocene context.

In conclusion, the debate on the limits of traditional models of redistribution in the context of the Technocene shows that the optimistic promises of technical change, such as the creation of new, more skilled occupations, coexist with critical effects of unemployment, precariousness, and digital exclusion. The centrality of the wage-earning base, which underpinned the Keynesian model, is weakened in the face of algorithmic automation, compromising both income redistribution and the solvency of social protection systems. By bringing together perspectives such as Schumpeter's creative destruction (1942), Perez's socio-technical reading (2004) and Stiegler's critique (2018), as well as recent analyses of digital inequality and insufficient regulation in Brazil, it is clear that the current challenges are not limited to the adaptation of the labour market, but require the reformulation of social and fiscal protection mechanisms themselves. In this sense, professional retraining, digital inclusion, and innovative redistributive alternatives, such as the taxation of automation, appear to be indispensable ways to address the tensions between technological progress and social justice.

FINAL CONSIDERATIONS

This article has critically analyzed the effects of contemporary technological transformations on work and social protection in the context of the Technocene, bringing together European and Latin American authors in an interdisciplinary and critical reading. The main contribution of this study is to propose an alternative theoretical framework that interprets the Fourth and Fifth Industrial Revolutions not only as waves of innovation, but as concrete manifestations of a broader process of technocentrism, in which technology becomes a structuring force of the economy, institutions, and social relations.

The debate showed that theories of technical and occupational change, although relevant for understanding the bias of automation in favour of skilled workers and the logic of creative destruction, are insufficient if they are not challenged by critical analyses such as those of Perez (2004), which highlight the social effects of technical change, and Stiegler (2018), which demonstrate the erosion of the wage-earning base of the Keynesian model. By articulating these perspectives, the article reinforces that automation and digitization not only create new sophisticated jobs, but also deepen precariousness and digital exclusion, weakening the state's ability to sustain social protection systems.

The originality of this analysis lies in highlighting the central paradox of the Technocene: on the one hand, the promise of greater efficiency, innovation, and sustainability, particularly in the discourse of the SIR; on the other, the concentration of technological gains in a few groups and the intensification of inequalities in access to work and income. In this sense, the contribution proposed here is to recognize that work should be thought of not only as an economic factor, but as a pillar of social cohesion and human dignity, requiring new institutional agreements for its regulation.

From a public policy perspective, the article indicates that addressing the effects of the Technocene requires an agenda that goes beyond traditional social protection. This involves: continuous professional retraining, with an emphasis on digital skills; democratic technological inclusion, which reduces the gap between *insiders* and *outsiders* in the digital economy; fiscal reform, including alternatives such as taxation of automation and digital platforms; and the construction of a more comprehensive and widespread public employment system, capable of responding quickly to occupational transitions. The SIR, still in consolidation, presents itself as an opportunity to reconcile technology and humanity, but only if accompanied by robust and socially inclusive regulatory instruments.

Finally, the study also raises new questions for the academic agenda. If salaried work ceases to be the central axis of redistribution, what new mechanisms can sustain social cohesion? What role can universal basic income, algorithmic governance, and digital taxation policies play? How can we build indicators capable of monitoring the impacts of digitalization on social inclusion in different territories? These questions reinforce the need for comparative empirical research that examines international and local experiences of regulation in order to broaden understanding of the possibilities for public policy formulation in the Global South.

Thus, the contribution of this article is not only to describe already known technological transformations, but to offer a critical and proactive reflection on work in the context of the Technocene, by articulating European theoretical traditions – as presented by authors Stiegler (2018), Perez (2004), Schwab (2016), Amâncio (2023) – and Latin American ones – brought by Parra et al. (2024), Mollo and Acypreste (2023), Rizzotti and Nalesso (2022). This framework reveals that technological innovation and social justice should not be seen as incompatible spheres, but as dimensions that need to be reconciled in new institutional pacts. One question that imposes itself on academia, and which this study seeks to open as an agenda, is: what theoretical and practical paths can be constructed to transform the Technocene into an era of inclusion and social protection, and not just exclusion and precariousness?

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DATA AVAILABILITY

The entire data set supporting the results of this study was published in the article itself.

CONFLICTS OF INTEREST

The authors have no conflicts of interest.

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