SOCIAL INNOVATION AND INDUSTRY 4.0: A PROPOSITION FOR THEORETICAL-CONCEPTUAL INTEGRATION

INOVAÇÃO SOCIAL E INDÚSTRIA 4.0: UMA PROPOSTA PARA INTEGRAÇÃO TEÓRICA-CONCEITUAL

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Resumo: *As revoluções industriais conduzem a desenvolvimentos tecnológicos cada vez mais acelerados. A nova revolução industrial, denominada Indústria 4.0, e toda a sua difusão tecnológica, tem ferramentas e características que proporcionam impactos socioeconômicos significativos no contexto social dos países. Face a estas mudanças, torna-se importante adotar uma visão holística que abranja soluções para sistemas de inovação social. Destarte, este artigo objetiva investigar a relação entre a adoção da Indústria 4.0 e o desenvolvimento da inovação social, por meio de uma revisão sistemática da literatura. Como resultado, propõe-se um framework de análise onde podem ser visualizados fatores que estão relacionados à Indústria 4.0 e à inovação social de forma concomitante. Além disso, é possível perceber o uso de diferentes inovações tecnológicas, atreladas à Indústria 4. 0, que viabilizam e alavancam a promoção da inovação social que, por sua vez, busca minimizar ou solucionar problemas sociais e econômicos por meio da sustentabilidade, empreendedorismo, colaboração e tecnologia.*

Palavras-chave: *Revolução Industrial. Manufatura Avançada. Inovação Social. Indústria 4.0. Framework.*

Abstract: *Industrial revolutions lead to increasingly accelerated technological developments. The new industrial revolution, called Industry 4.0, and all its technological diffusion, has tools and characteristics that provide significant socioeconomic impacts in the social context of countries. Faced with these changes, it is important to adopt a holistic view that encompasses solutions for social innovation systems. Thus, this article aims to investigate the relationship between the adoption of Industry 4.0 and the development of social innovation, through a systematic review of the literature. As a result, we propose an analysis framework where factors related to Industry 4.0 and social innovation can be visualized concomitantly. In addition, it is possible to perceive the use of different technological innovations, linked to Industry 4.0, which enable and leverage the promotion of social innovation, which, in turn, seeks to minimize or solve social and economic problems through sustainability, entrepreneurship, collaboration and technology.*

Keywords: *Industrial Revolution. Advanced Manufacturing. Social innovation. Industry 4.0. Framework.*

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Introduction

Industry 4.0 is presented as the 4th industrial revolution, since it is defined as a new concept of industrial production, which is based on the business processes related to the manufacture, as well as the integration of all internal (employees and suppliers) and external actors (customers and society) in the value chain organizations (Rojko, 2017; Vaidya; Ambad; Bhosle, 2018)its drivers, enablers, goals and limitations. Building blocks are described and smart factory concept is presented. A Reference Architecture Model RAMI4.0 and role of standardization in future implementation of Industry 4.0 concept are addressed. The current status of Industry 4.0 readiness of the German companies is presented and commented. Finally it is discussed if Industry 4.0 is really a disruptive concept or simply a natural incremental development of industrial production systems.</p></p>",”author”:[{“dropping-particle”:””,”family”:”Rojko”,”given”:”Andreja”,”non-dropping-particle”:””,”parse-names”:false,”suffix”:””}],”container-title”:”International Journal of Interactive Mobile Technologies (iJIM. As expected, the industrial revolutions provide benefits and new challenges in the socio-economic aspects of countries that generate improvements and technological gains (Morrar; Arman, 2017). This evolutionary process can generate economic growth, increased productivity and well-being of society in the countries that are able to implement new technologies. On the other hand, the value added in the manufacturing process not always entails distributing wealth equitably throughout society (Lasi et al., 2014; Taatila et al., 2006).

For Mazali (2017) and Hahn and Andor (2013), Industry 4.0 is transforming the entire design of factory production when considering that the factories of the future are linked to the idea of digital and flexible factories in the production and service of internal actors. In this context, the new industrial factories will bring with them social challenges that demand a global analysis from modern society, once these aspects should be presented not only as solutions for an innovative system, but also as a sustainable solution for aspects of social innovation.

In this sense, Phills, Deiglmeier and Miller (2008but neither is adequate when it comes to understanding and creating social change in all of its manifestations. The authors make the case that social innovation is a better vehicle for doing this. They also explain why most of today’s innovative social solutions cut across the traditional boundaries separating nonprofits, government, and for-profit businesses.”,(PHILLS; DEIGLMEIER; MILLER, 2008) state that social innovation can be defined as an innovative solution that meet the increasing challenges imposed by technological advances to society and may provide innovative solutions to a social problem in a more effective, efficient, sustainable and fair way. Marolt, Pucihar and Zimmermann (2015) corroborate this understanding and argue that social innovation is defined by the emergence of new models, services and products that will meet, both, the social requirements imposed by technological developments.

Thus, Industry 4.0 may have different disorders and, thus, generate social inequality, and, therefore, they are considered a social challenge to the nations in the coming decades (Morrar; Arman, 2017). Additionally, considering that social innovations are known as the new practices used to solve social challenges, and considering that Industry 4.0 is a recent and multifaceted phenomenon in manufacturing, it is necessary to develop an approach to properly aggregate them (Mazali, 2017; Morrar; Arman, 2017). Thus, further analysis is needed, giving rise to the following research question: how the adoption of Industry 4.0 is related to the development of social innovation? Therefore, the aim of this article is to investigate the relationship between the adoption of Industry 4.0 and the development of social innovation. Thus, to achieve this objective, a systematic literature review was carried out, which followed the protocol proposed by Cronin et al. (2008), in order to explore the constructs Social Innovation and Industry 4.0 and, thus, identify the elements present in this relationship.

This paper is composed of the following sections, besides this introduction: the theoretical framework that deals with theoretical assumptions about Industry 4.0 and social innovation; the method used for analysis; the main results obtained from the analysis of the selected articles, and the related discussion. Finally, the conclusions, limitations and suggestions for future studies are presented in the last section.

Industry 4.0

Industry 4.0, also known as Advanced Manufacturing (Chromjakova, 2017; Brazil, 2018), is one of the fundamental features that increase the digitalization and the lean production process (Mrugalska; Wyrwicka, 2017; Vaidya et al., 2018)Industrial Internet, Smart Manufacturing and Cloud based Manufacturing. Industry 4.0 concerns the strict integration of human in the manufacturing process so as to have continuous improvement and focus on value adding activities and avoiding wastes. The objective of this paper is to provide an overview of Industry 4.0 and understanding of the nine pillars of Industry 4.0 with its applications and identifying the challenges and issues occurring with implementation the Industry 4.0 and to study the new trends and streams related to Industry For Zhong et al. (2017), Industry 4.0 aims to transform the production of single and optimized cells into a fully integrated, automated and optimized production flow, in order to lead to greater efficiency and change the traditional relationships of production suppliers, producers, and customers, as well as between humans and machines. Wang et al. (2016) believe that Industry 4.0 combines technologies of integrated production systems with intelligent production processes, paving the way for a new technological era in manufacturing, transforming production and industry value chains, as well as enabling the emergence of new business models.

The association between technologies in production systems and intelligent production processes, showed the concepts that are considered as Industry 4.0 integrating mechanisms: Internet of Things; Artificial Intelligence; Cybernetic Physical System; the analysis of Big Data; Virtual and Augmented Reality; Advanced Robotics, Cybersecurity; and Blockchain. Table 1 systematizes the main elements of Industry 4.0, their definition, and references.

Table 1. Systematization of mechanisms and concepts about Industry 4.0

Industry 4.0 Mechanisms	Concepts	References
Internet of Things (IoT)	Dynamic global network infrastructure with self-configuration and standards-based capabilities and interoperability of communication protocols, where things have physical and virtual attributes.	Hozdić (2015); Hudson (2017); Neugebauer et al. (2016); Schumacher, Erol and Sihn (2016)
Artificial Intelligence (AI)	Branch of Computer Science that is concerned with developing mechanisms and technological devices that can simulate human reasoning, the learning process presents improvements in the performance of applications, such as speech recognition, image, and natural language processing (translation, comprehension, and responses).	Waters (2016); Wang et al. (2018)
Cybernetic Physical System	Mechanisms through which physical objects and software are closely interconnected, allowing different components to interact with each other in a multitude of ways to exchange information.	Zhong et al. (2017); Derler and Lee (2012)

Industry 4.0 Mechanisms	Concepts	References
Big Data	Collection and comprehensive assessment of a large volume of data from different sources of equipment and production systems, as well as different corporate and customer management systems that, together, can be analyzed to promote better decision making, to reduce costs, to save time and to develop new products and processes with more confidence.	Wamba et al. (2015); Sivarajah et al. (2017); Saggi and Jain (2018)
Virtual and Augmented Reality	Virtual Reality can be understood as simulations used more broadly in manufacturing operations to leverage data in real time and, thus, be able to mirror the physical world in a virtual model, which can include machines, products and human beings, reducing setup times and increasing quality. In turn, Augmented Reality is a technology used to unite the real world with the virtual, that is, it is the insertion of virtual objects in the physical environment, demonstrated to the internal or external user in real time and with the support of technological devices.	Vávra et al. (2017); Simons, Abé and Neser (2017)
Advanced Robotics	Robots are becoming more autonomous, flexible and cooperative, which may lead to interaction with each other or even working side by side with humans in interconnection tasks and using intelligent human-machine sensor interfaces.	Bahrin, Othman, Azli and Talib (2016); Vaidya, Ambad and Bhosle (2018)
Cybersecurity	Set of practices that protect information stored on computers and are transmitted through communication networks.	Trappey et al. (2016)
Blockchain	Distributed ledger technology that aims at decentralization as a security measure and serves as the basis of cryptocurrencies such as bitcoin and ethereum.	Underwood (2016); Sikorski, Haughton and Kraft (2017)

Source: Elaborated by the authors.

Thus, Industry 4.0, based on its integrative concepts, aims to generate high-impact changes in the processes and devices of manufacturing organizations, since many work processes can be performed more efficiently and effectively, leveraging productivity and production quality (Zhong et al., 2017). According to Buhr (2015), this systemic view of the manufacturing process influences both changes in production line processes, as well as new forms of commercial business and new social relationships in the processes of generating innovation.

Social innovation

Social innovations are known as new practices used to meet social demands that can positively influence individuals, society and organizations (Mulgan, 2006). Many of the known innovations can be classified as social innovations, since they aim to provide sustainable solutions to social needs imposed by technological developments (Marolt et al., 2015; Taylor, 1970; Gallouj et al., 2018).

It is observed, over the past decades, that the concept of social innovation has received contributions from several authors, showing the interest and the demand for alternatives to solve, or minimize, social problems (Mulgan, 2006; Voorberg; Bekkers, 2017; Osburg; Schmidpeter, 2013). In this sense, social innovation can be seen as a way to mitigate demands or rearrange social roles, seeking new or improved solutions for society (Rodrigues, 2007).

Due to the growing interest in the subject, Gallouj et al. (2018) point out that there is no consolidation in the literature on the concept of social innovation, nor on the different possible units of analysis - organizational, individual and initiatives. In this context, Table 2 presents the main concepts and approaches of researchers in the area.

Table 2. Systematization of concepts and approaches about social innovation

Authors	Concepts
Taylor (1970)	Social innovation arises from the need for a new way of doing things by introducing a social invention. The author suggests five principles of successful social innovation: (i) maximum investment; (ii) appointment; (iii) equal responsibility; (iv) the research principle as a creative piece; and (v) ideological research leadership.
Levesque (2002)	The definition of social innovation derives from the social economy, which is, by definition, innovative and generally meets the needs or aspirations that are not met by the market or the state. Thus, there is need for social innovation to meet the challenge of competition-exacerbated capitalism.
Cloutier (2003)	The concept of social innovation is a new response to a social situation judged as unsatisfactory and susceptible to manifest in all society sectors.
Rodrigues (2007)	Social innovation occurs at three levels - organizational, institutional and social actors - and can intentionally occur or emerge from a process of social change without prior planning.
Mulgan et al. (2007)	Social innovation can be driven by government, public and private companies, universities and other social actors, and it thrives through effective partnerships between these actors.

Pol and Ville (2009)	Social innovation is related to quality of life and longevity of individuals, and, in addition, there is value built into the notion of innovation.
Haxeltine et al. (2015)	Social innovation is a change in social relations, involving new ways (or co-productive combinations) of doing, organizing, framing and/or knowing, and its objects can be ideas, goods and/or activities.
Gallouj et al. (2018)	Social innovation can be understood from the perspective of innovation in services and they propose a framework for analyzing the relationship between the service industry and social innovation.
Moulaert and MacCallum (2019)	They explore the historical and contemporary meanings of social innovation and its relationship to political and social movements, developing an understanding of practical and ethical ways to meet social needs.
Galego et al. (2021)	They present a discussion of the relationships between governance and social innovation, which involve collaborative practices between civil society organizations and public actors to develop alternative solutions that address social needs and often face comparable sociopolitical challenges.

Source: Elaborated by the authors.

Due to the existence of different perspectives, this article builds on the following concept of social innovation: a new service solution to social challenges, through co-creation, co-implementation and co-production of value between multiple interested and trained actors, aiming to increase the well-being and the construction of a more inclusive society (Mouleart et al., 2013; Gallouj et al., 2018). In this sense, it is important to carry out research aimed at understanding the concept, in order to establish a reference on the subject, especially in the context of Industry 4.0.

Social innovation and Industry 4.0

The relationship between Industry 4.0 and Social Innovation is still little explored in the literature, not covering different elements that may be included in this common ecosystem, leaving open questions relevant to this topic. For Buhr (2015), Industry 4.0 needs to be promoted through appropriate and systemic innovation policies, which include coordinated strategy and implementation, so that technical innovations become social and important contributions to social progress can be made.

Focusing on the social and organizational effects of the Fourth Industrial Revolution, Mazali (2017) examines the change that workers, along with the organization of work, are undergoing in smart digital factories. In particular, this author analyzes the links between digital society, digital culture and Industry 4.0, in addition to studying people's participation in the process of change, in a case study in the railway sector. The study concludes that, in addition to the technological aspects, one of the key elements of the analysis is participation and a "person-centered" culture.

According to Morrar et al. (2017), to deal with the exponential growth of technologies, a holistic approach is needed that encompasses innovative and sustainable systems solutions, not

just technological ones. In this sense, the authors propose a framework that can facilitate the interaction between technological and social innovation to continually arrive at proactive and, therefore, timely and sustainable strategies. These strategies can leverage economic rewards, enrich society, and protect the environment.

Karajz (2021) understands that technical developments significantly affect the processes and effectiveness of social innovation, and in this regard, he examined the relationship between digitalization and social innovation. The findings of Industry 4.0 reveal that there are a growing number of social innovation solutions based on digitization and automation; the current digital revolution is radically changing societies and opening up new opportunities for social innovation; and, finally, Industry 4.0 results in social innovation solutions that use artificial intelligence to improve and optimize processes.

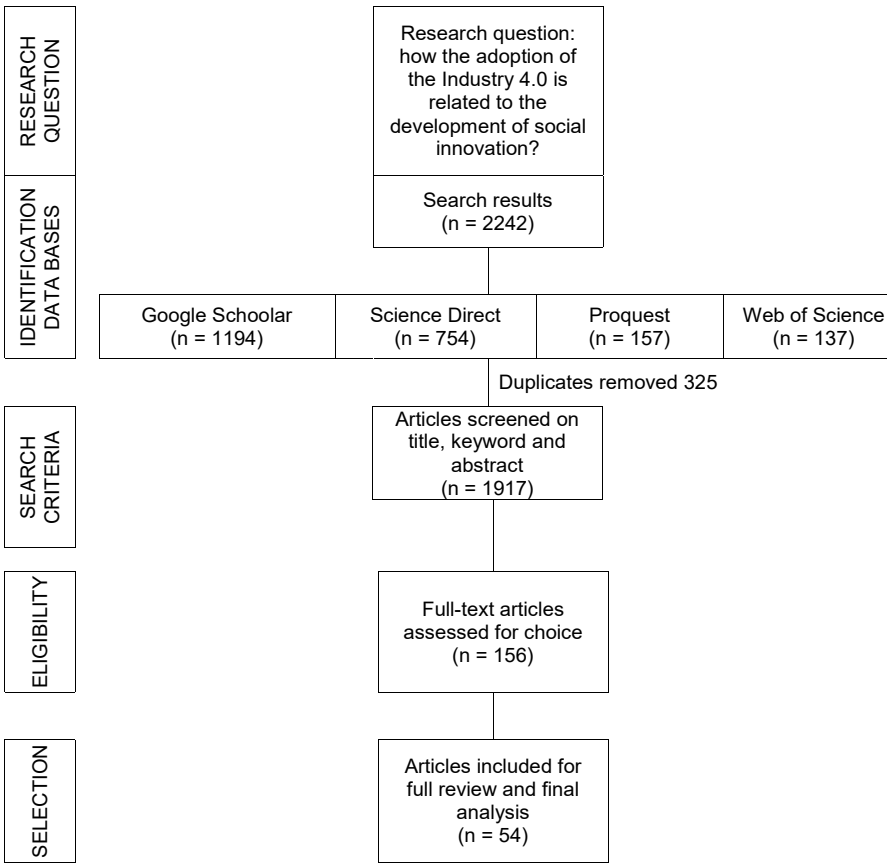
Method

Once this article consists on a systematic literature review, it can be classified as qualitative and descriptive. We used the protocol proposed by Cronin et al. (2008), which delimits the literature through a well-defined approach and criteria for selecting and analyzing sources in a given period of time. Thus, the criteria comprises the following steps: (a) formulate the research question; (b) set the inclusion and exclusion criteria; (c) select and access literature; (d) evaluate the quality of the literature included in revision; and (e) analysis, synthesis and dissemination of results (Cronin et al., 2008).

The systematic review considered articles that had, in their title, keywords or abstracts, the terms “social innovation” and/or “Indústria 4.0”, as well as their respective translations into Portuguese. The search took place in the Web of Science, Science Direct, Scopus, Proquest and Google Scholar databases, covering the period from 2008 to 2021. This period is justified because the phenomenon of Industry 4.0 is considered recent and originated from a strategic high-tech project by the German government in 2011 (Rojko, 2017). This survey of articles made possible to build the state of the art and present the main elements of the relationship between social innovation and Industry 4.0.

Obeying these criteria, 2,242 articles were initially obtained. Then, duplicate articles were removed and, from the remaining set of works, the title, abstract and keywords were read. After this step, 156 articles were kept. Based on a more detailed reading and, in some cases, the entire text, this screening resulted in a sample of 54 articles. In order to carry out the analysis of the works, the full texts were read, seeking to identify factors and concepts common to social innovation and Industry 4.0, concomitantly. Figure 1 shows the steps taken until the final sample.

Figure 1. Summary of the steps taken to collect the final sample



Source: Elaborated by the authors.

From the analysis of the 54 articles, it was possible to carry out a systematic review, allowing the construction of the state of the art and present the main elements of the relationship between social innovation and Industry 4.0.

Results and discussion

The analysis of the articles revealed that the constructs 'social innovation' and 'industry 4.0' were little explored together in the literature: only 4 articles were published in a period of 14 years. This result reinforces the importance of carrying out studies with the two themes, as highlighted by authors such as Mazali (2017) and Morrar and Arman (2017).

Social innovation can be understood as a means for the development and implementation of new ideas (good, services and models) that respond to social demands, using social relationships or collaborations (Mazali, 2017). At the same time, Industry 4.0 can also be considered a mechanism that brings countless opportunities to add value to customers and increase the productivity of processes, contributing to the solution of social demands (EC, 2013; Vaidya et al., 2018). This can occur through collaborative relationship networks, or through the generation of individualized products, services and models to meet new social needs (Moulaert et al., 2013; Morrar; Arman, 2017).

In this sense, the transformation provided by Industry 4.0 can lead to social progress from new windows of opportunity, provided by social innovation. This relationship essentially involves the creation of an integrating industrial ecosystem that enhances economic development and a knowledge society (Buhr, 2017; Mazali, 2017). In this ecosystem, the way of integrating this new production model presented by Industry 4.0 occurs through the application of some main concepts, here called inputs. Among these inputs, as shown in Table 1, we can list: Internet of Things; Artificial

Intelligence; Cybernetic Physical System; the analysis of Big Data; Virtual and Augmented Reality; Advanced Robotics; Cybersecurity; and finally, Blockchain.

Moving on to social innovation, in the context of the ecosystem analyzed here, elements as a way of mitigating demands or rearranging social aspirations, aim to present new or improved results and solutions for society (Mazali, 2017; Gallouj et al., 2018). In addition, based on the results of the analyses, it was possible to include the following aspects in this list: collaboration, social entrepreneurship, sustainability and the use of technology.

For Mazali (2017), digital culture places the user at the center of the processes; builds relationships on a horizontal network model; and develops processes using collaboration through co-production, co-implementation and co-creation (Gallouj et al., 2018). User centricity means user-centered design for digital applications and devices (more specifically, design that embraces user needs, expressed through co-design practices), enabling the user to move from being a passive consumer of information to being a co-producer user (Manovich, 2009).

It is possible for all human beings to develop collaboration to obtain an improvement in the quality of life, which goes beyond the new form of division of labor and the basic self-management of the enterprise provided by Industry 4.0 in an economic environment (Waardenburg et al.,2020; Galego et al., 2021). Collaboration expresses a way of supporting the sharing of manufacturing activities that encompass the interaction between universities, companies and other government agents in the process of development and manufacturing transformation of the new industry. This results in the improvement of new production techniques that end up generating new knowledge that, in turn, is also shared (Gallouj et al., 2018; Van der Voet; Steijn, 2021).

On the other hand, Tardif and Harrisson (2005) confirm that the collaborative relationship in Industry 4.0 represents the quest to meet the aspirations of society, in the sense of creating solutions and taking advantage of opportunities in order to transform or modify individual or small group actions, in broader relationships that can generate new social and cultural relationships in societies. In this sense, the way the new industrial revolution is imposing itself will provide a mix between identities, norms and values, and collective learning, but with individualized and segmented production (Mazali, 2017; Morrar et al., 2017). This makes the concept of collaboration in social innovation change the way people think, learn, produce, and it takes place not only in individual lifestyles, but in the entire industrial ecosystem that supports the socioeconomic system (Brouseau et al., 2012; Moulaert; MacCallum, 2019).

Another important aspect to be considered in this ecosystem is social entrepreneurship. As changes generated by innovations and intelligent systems, with greater transparency and control, allow people to develop multiple competencies in an integrated way, workflows become more efficient. As a consequence, goods and services are produced that benefit local and/or global society, depending on the focus on social problems and society (Lee et al., 2015; Dees, 2017; Biggeri et al., 2018).

For Mazalli (2017), the fact that factories have workers or customers with the power to control the process, often using their own tools, devices and factory automation, allows for better and more personalized services, as well as cheaper products. In this new phase of entrepreneurship, the “make-for-me” approach stands out, a new business model that emerges as an attempt to contribute to the mass customization of manufacturing (Morrar et al., 2017). In this sense, new forms of entrepreneurship provide Industry 4.0 with new business interfaces in manufacturing processes, which aim to meet customer customization requirements, as well as the production of high quality services and processes (Buhr, 2017).

Sustainability should also be considered as a relevant aspect of this relationship because social innovation considers the sustainable development of new products, processes and services that can generate social inclusion, through work and income, and, especially for the improvement of people’s quality of life, workers and other social groups in society (Haxeltine et al., 2013; Haxeltine et al., 2017). Thus, increasing collaborative partnerships in day-to-day activities around resource coordination and real-time learning, along with employing entrepreneurship in redefining work expectations, will require new corporate structures that adapt to the capabilities of the human-to-human relationship machine (IFTF, 2017).

In this context, the sustainability of the entire system will emerge, considering that

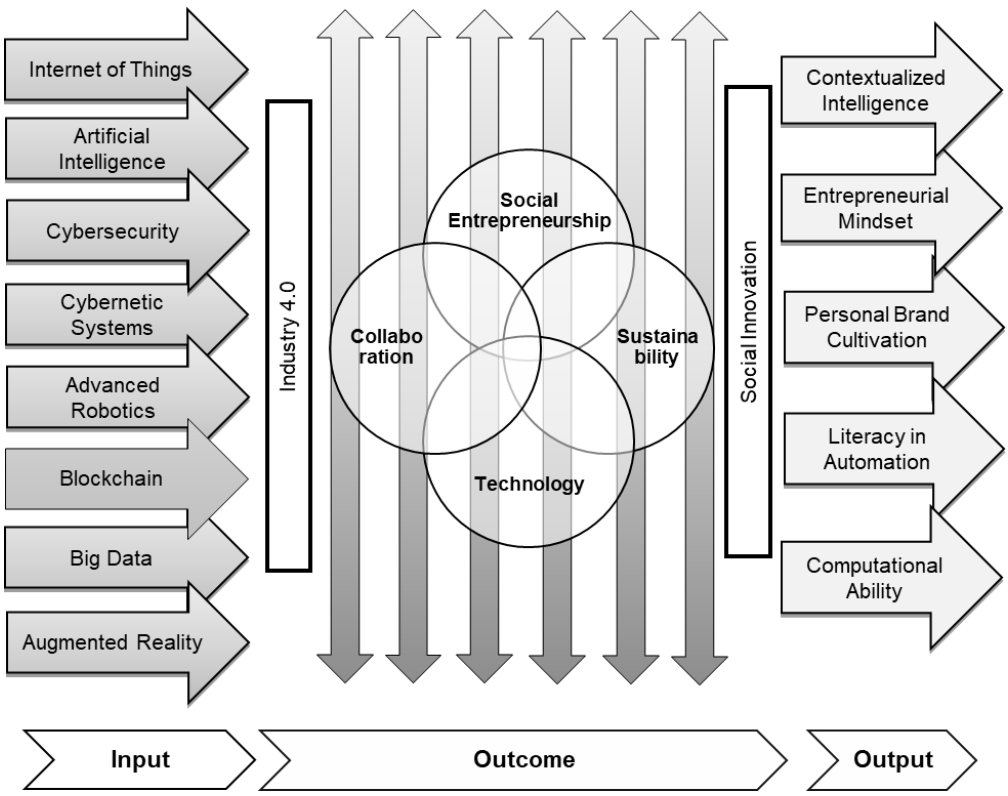
sustainability is the sum of the use of the most advanced technologies, as a means of producing and implementing innovations that can provide agility, automation and good performance. Therefore, resulting in increased productivity and new opportunities in terms of segmentation of production in the market, on one hand, and an increase in professional activities, accompanied by collective learning, on the other hand (IFTF, 2017).

In this way, the changes will mainly be in the work environment and work arrangements, which will become more flexible, as work tasks will harmonize technique, skill and technological knowledge to a greater degree (Buhr, 2017; Morrar et al., 2017). The ecosystem evidences that the sophisticated capabilities of the emerging technologies of Industry 4.0 will foster a new level of collaboration in society with these technologies, which must develop daily activities around the coordination of resources aimed at learning, redefining work expectations and adapting corporate structures (IFTF, 2017; Mazali, 2017).

As outputs from the analysis of all these factors that will enable sustainability in the relationship between Industry 4.0 and social innovation, we can list the following main aspects: a) contextualized intelligence, which consists of a differentiated understanding of culture, society, business and people in the process of collective learning (IFTF, 2017; Shin; Lowry, 2020); b) entrepreneurial mindset, which applies creativity, learning agility and entrepreneurial attitude to find alternative solutions and circumvent restrictions (IFTF, 2017; Daspit; Fox; Findley, 2021); c) cultivation of a personal brand as a searchable digital identity, due to new job recruitment opportunities, such as basic hygiene at work (IFTF, 2017); d) automation literacy through the agile ability to integrate lightweight automation tools into your own work and home life (IFTF, 2017; Ottonicar et al., 2020); and, finally, e) computational ability, that translates into the ability to deduce the results of human-machine system outputs (IFTF, 2017; Hsu et al., 2018).

The discussion from the systematic literature review resulted in a heuristic framework that brings together the main factors that relate Industry 4.0 and social innovation, as can be seen in Figure 2.

Figure 2. Heuristic framework on the relationship between Industry 4.0 and social innovation



Fonte: Elaborated by the authors.

It is in this industrial ecosystem that the new socioeconomic model tries to guide the individual contribution of the worker towards the mechanistic process, once individual learning skills can be acquired more quickly, due to the new digital devices provided by the Industry 4.0 revolution (Mazali, 2017). A wide range of social innovations can influence the labor market, as the relationship with machines can help the workforce to transcend its limitations in search of greater efficiency (Morrar et al., 2017). Industry 4.0 will involve workers in the redesign of the organization of work, becoming the central engines of technological and social innovation, as they will be able to help people connect with work opportunities where talent and competence are needed (Buhr, 2017).

Social innovations can also affect consumers, as companies are anticipating the needs and desires of those who are eager for new experiences and products, personalized through the Internet of Things (Cardoso et al., 2017). Therefore, a secure digital environment is necessary, in order to generate greater consumer protection, especially in relation to data security protocols, in order to guarantee the right to privacy and the protection of personal data (Brazil, 2018). Furthermore, to ensure the sustainability of the analyzed relationship, collaboration between the various stakeholders related to the Industry 4.0 ecosystem must prepare the basis for technical and social innovations to quickly develop opportunities. It should be noted that the speed of coordination and generation of policies that promote emerging technologies, which will positively impact society, must accompany the speed with which these technologies emerge (Mazali, 2017; Morrar et al., 2017).

Conclusions

This article aimed to investigate the relationship between the adoption of Industry 4.0 and the development of social innovation, by carrying out a systematic literature review, through which it was possible to build a heuristic framework for analyzing the industrial ecosystem. The results showed the main elements to be used as technological innovation for the promotion of social innovation and, consequently, the main outputs and results for mitigating the social problems arising from this relationship.

The discussion carried out in the article, in the light of the results presented, identified groups and described the main elements of the social innovation *versus* industry 4.0 relationship, which reveals the opportunity for the development of concrete initiatives through collaboration between different spheres of society. To that end, political action can be used on the part of governments. For example, the promotion of collective learning for the dissemination of emerging technologies, in the sense of supporting centers of competence and projects with entrepreneurial mindsets, such as smart factories models, and finally, with the development of literacy in automation and computational skills.

Thus, the investigation confirmed the importance of the revolutionary context that advanced manufacturing industry can provide in the form of benefits to society in general, since that consumer and producer are largely connected and must participate collaboratively with the use of new technological mechanisms in the production and consumption process.

In addition, it was possible to perceive that there is a limited number of articles that deal with the two themes together. Industry 4.0, considered as an integrating means of creating social value, presents a gap to be explored by future studies regarding the barriers to be faced by its evolution, such as the loss of jobs generated by the adoption of technological innovations. It is also suggested that more systematic review studies be conducted in order to update the findings of this work, as well as to include new relationships that may arise.

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