

Review

The Challenges and Opportunities of Era 5.0 for a More Humanistic and Sustainable Society—A Literature Review

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Abstract: We are in an increasingly disruptive context, in an Era in which the world presents challenging and growing levels of uncertainty, unpredictability, and complexity. As a result, society is facing, at all levels and in all areas, more and more global challenges, challenging its stability and prosperity, whether at a technological, economic, social, environmental, or educational level. The new Era, Era 5.0, which places the human being at the center of innovation and technological transformation, can and must make its contribution to improving the quality of life, solving social problems, and human well-being, with the support of technology. Thus, this work intends, based on a systematic review of the literature, to analyze the challenges of Era 5.0 and its impacts on industry, society, and education as engines and promoters of the path to sustainable development. The results of this work show that the challenges for industry and education on the road to a “new” society are immense, in order to achieve a more humanistic society, centered on human beings, quality of life, and sustainability. We believe in contributing to the state of the art in Era 5.0 and providing an analytical reflection in the field of education and industry, on the path towards a society that places the human being at the center of innovation and technological transformation.



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1. Introduction

During the last decades of human history, technology has made remarkable progress and growth, especially with the introduction of the Internet [1]. The world is in a new era, in which globalization and the rapid evolution of digital technologies such as the Internet of Things (IoT), Big Data (BD), Artificial Intelligence (AI), robotics, 3D printing, Cloud Computing (CC), Mobile Devices (MD), among others, are pushing for major changes in business and society, and creating an entirely new environment [2–5].

The development of new information technologies (IT) has allowed the world to shift to Industry 4.0 [6–8], so IT has become a key element in everyday life, affecting all dimensions that involve people and society [9]. The introduction of Information and Communication Technologies (ICT) has pushed the industrial society towards an information society, a society in which information is regarded as a valuable resource, which citizens can create, use, share, manipulate, and integrate for the benefit of their economic, political, cultural, or other activities [10]. Thus, the use of ICT in industries is a distinctive feature of Industry 4.0 compared to previous revolutions [11], initiating the creation of Cyber-Physical Systems (CPS) [12,13]. The emergence of increasingly advanced ICT solutions has increased the research effort on how lean manufacturing and ICT can cooperate to achieve better performance [12].

In the contemporary world, digitization, the virtual world, and being permanently online have become the new normal, corresponding to the current and future expectations of individuals, in their most diverse forms, contexts, and uses, having a growing impact—without

forgetting those excluded from this reality [14]. This digital transformation means development, creating a new relationship between man and machine, completely changing work and our economic, social, and environmental visions [9]. On the one hand, Era 4.0, which is smarter, more connected, economical, agile and automated, has brought countless advances and benefits to the industrial sector, but, on the other hand, it has brought challenges to the social and environmental context, in particular to human beings and sustainable awareness.

Changes in requirements caused by Industry 4.0, such as greater flexibility, more diversified tasks and higher-order decision making, will highlight the importance of good usability and ergonomics in scientific and industrial environments. This is specifically true in the face of a shift in demography and values in a globally connected world [15]. In this sense, in recent years, Industry 4.0 has emerged as one of the most discussed and popular concepts [12]. The European Commission believes that the transition to a green and digital Europe will require public acceptance, trust, and commitment if the industry's transformation is to succeed. Industrial modernization strategies must place people and the needs of society at the center [16].

Since the beginning of the 21st century, humanity has been undergoing complex innovative transformations that provide the Era of a phase transition to a new socio-economic process. Thus, the development of human civilization is related to the constantly changing economic formations, and the current social and economic situation is determined by concepts such as Society 5.0 and the fourth and fifth industrial revolutions [5]. For this, technology and innovation need to be used to help humans in their daily lives and advance society—not to replace the role of humans [17]. Thus, Era 5.0 is not only concerned with how tools, methods, and ideas will add better results to the business, but also how these factors can influence everything around organizations, institutions, and societies, adding a more humanitarian and sustainable vision to their processes of society.

Savanevičienė et al. [3], in their quantitative study of different generations in Lithuania (Baby Boomers, Generation X, Generation Y, and Generation Z) show that different generations ensure the innovation capacity and potential of society, which is a prerequisite for the creation of Society 5.0.

Mihardjo et al. [4], in his questionnaire study of senior leaders of ICT companies of Indonesia, with the aim of assessing the concept of an experience-agility innovation model and supporting the transformation in the context of digital transformation to face Industry 5.0, demonstrates a model of transformation that focuses on exploiting the customer experience and organizational agility concept. This can be a source of competitive advantage in Industry 5.0.

Melnyk et al. [5] presented a study to estimate the change of the human role in each economic formation caused by industrial revolutions, using a structured review methodology with a focus on the biological, labor, and personal entity of humans within the industrial revolutions. They found that the human as a personality was overloaded during the first four industrial revolutions, while the Fifth Industrial Revolution creates the opportunities for deeper personalization development. The Fifth Industrial Revolution also tries to change the biological entity through augmenting the physical capacity, which creates definite threats to the human entity in general.

Carayannis and Morawska-Jancelewicz [9] argue that digitalization opens new perspectives for universities and can become one of the main drivers of their change, producing knowledge for new technologies and social innovation and incorporating the assumptions of Society 5.0 and Industry 5.0.

Advanced technological opportunities are expected to contribute to individual and social development and economic growth [18]. As Lantada [19] points out, our global society is facing relevant challenges and exceptional threats, such as those presented in the 2030 Agenda and the Sustainable Development Goals (SDGs) without technological singularity, particularly now that we are in a transition from Industry 4.0 for Society 5.0. This transition brings new challenges, from the outset to Industry 5.0, which brings a

collaborative and automatic environment, thus creating a new paradigm for companies in the realization and innovation of business models [4], societies, and educational systems.

As the objective of this work is to analyze the Era 5.0 paradigm and its impacts on industry, society, and education, we will seek to highlight the challenges of the technological development of Industry 5.0, the inclusive change in Education 5.0, and the sustainable transformation in Society 5.0, based on a systematic literature review.

This work aims to demonstrate and make the community aware of the opportunities and challenges of Era 5.0 to improve the quality of life and social well-being of people, creating a more humanitarian and sustainable life. This is an era of change and transformation, with great expectations for the future at a technological, social, environmental, human, and sustainability level. Thus, after this introduction, we present the methodology and then a literature review. This literature review addresses the developments of Era 5.0 in industry, society, and education, followed by the conclusions, which focuses on the main reflections on the challenges of the Era 5.0 industry and its impact on industry, society, and education, referring to the limitations of the study and clues for future research.

2. Methodology

As the theme and the topics under study are new and emerging, we consider that the systematic review of the literature, in an integrative way, will be the most appropriate methodology to address the problem under analysis, as described by Torraco [20] (p. 356): “a form of research that reviews, critiques, and synthesizes representative literature on a topic in an integrated way such that new frameworks and perspectives on the topic are generated”. The “integrative reviews play a unique and important role in advancing our science in the balance that they are able to strike between being evidence-driven and yielding new, value-added insights” [21], serving as a basis for future research and theory [22], as noted by the cited authors.

According to Transfield et al. [23], the systematic review must follow certain methodological characteristics. That is, it starts with the planning of the review, continues with its realization, and ends with its disclosure. Thus, in the first phase, the search strategy was based on the SCOPUS database. The criteria used in the search strategy was the search for the following terms “Industry 4.0” or “industry 4.0”, for the period 2012 to 2021, in the articles, title, abstract, and keywords, in the subject area “Business, Management & Accounting”. The procedure was repeated for the terms “Industry 5.0” or “industry 5.0”, “Society 5.0” or “society 5.0”, “Education 5.0” or “education 5.0”. For each theme, the 10 most cited articles were selected. However, for the last term, no article was obtained (Table 1).

Table 1. Scopus search strategy.

Source	Scopus: TITLE-ABS-KEY 1 st survey
Keywords (with filter for the years 2012–2021 and in the area “Business, Management & Accounting”)	(TITLE-ABS-KEY (“Industry 4.0”) OR TITLE-ABS-KEY (“industry 4.0”)) AND (LIMIT-TO (PUBYEAR, 2021) OR LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2017) OR LIMIT-TO (PUBYEAR, 2016) OR LIMIT-TO (PUBYEAR, 2015) OR LIMIT-TO (PUBYEAR, 2014) OR LIMIT-TO (PUBYEAR, 2013) OR LIMIT-TO (PUBYEAR, 2012)) AND (LIMIT-TO (SUBJAREA, “BUSI”))
Results	10 documents
Source	Scopus: TITLE-ABS-KEY 2 nd survey

Table 1. *Cont.*

Source	Scopus: TITLE-ABS-KEY 1 st survey
Keywords (with filter for the years 2012–2021 and in the area “Business, Management & Accounting”)	(TITLE-ABS-KEY (“Industry 5.0”) OR TITLE-ABS-KEY (“industry 5.0”) OR TITLE-ABS-KEY (“Education 5.0”) OR TITLE-ABS-KEY (“education 5.0”) OR TITLE-ABS-KEY (“Society 5.0”) OR TITLE-ABS-KEY (“society 5.0”)) AND ((LIMIT-TO (PUBYEAR, 2021) OR LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2017) OR LIMIT-TO (PUBYEAR, 2016) OR LIMIT-TO (PUBYEAR, 2015) OR LIMIT-TO (PUBYEAR, 2014) OR LIMIT-TO (PUBYEAR, 2013) OR LIMIT-TO (PUBYEAR, 2012)) AND (LIMIT-TO (SUBJAREA, “BUSI”)))
Results	20 documents

In the second phase, the authors performed a new search in “Google Scholar”, looking for the terms “Industry 4.0”, “Industry 5.0”, “Education 5.0”, “Society 5.0”, alone or combined, from recent years, to increase the breadth and depth of the topic under study. Since in the previous search no articles referring to education were obtained, in this search strategy 20 articles were selected to compensate for the first search (Table 2).

Table 2. Google Scholar search strategy.

Source	Google Scholar
Keywords	“Industry 4.0”, “Industry 5.0”, “Education 5.0”, “Society 5.0”,
Years	2012–2021
Results	50 documents

Thus, we obtained a final sample of 80 articles. Our systematic review will focus on the analysis of these articles. As stated by Torraco [20] (p. 361) “Critical analysis of literature involves carefully examining the main ideas and relationships of an issue and providing a critique of existing literature.”

3. From Industry 4.0 to New Era 5.0

The history of the development of the industrial revolution is very influential in the development of the economic sector across the world. Moreover, humanity is living in the era of three simultaneous industrial revolutions—Industry 3.0, Industry 4.0, and Industry 5.0. Each one of them solves its own problems, but together they accomplish a phase transition towards an unprecedented socio-economic formation [5].

The emergence of the industrial revolution 4.0 as a fully digitized industrial era has been a high point since 2018 in forums, debates, investigations, and studies by academics and professionals from the economic, industrial, and social sectors [24]. The fourth industrial revolution (Industry 4.0) is based on the idea of merging the physical and virtual worlds through CPS [12] and interconnecting humans, machines, and devices through the IoT [25–27]. This is also known as a hyper-connectivity revolution as it provides a real-time interface between the virtual and physical world [26]. This is changing companies’ strategies, organization, business models, value and supply chains, processes, products, competencies, and stakeholder relationships [28].

The developments of previous Industry revolutions took decades to unfold, while Industry 4.0 was first described in 2011 [27,29]. It was initially developed by the German

government to create a coherent policy to maintain Germany's industrial competitiveness [22,24–35]. Thus, in November 2011, the German Federal Government launched the “High-Tech Strategy 2020 Action Plan for Germany”, outlining a strategic high-tech initiative called Industry 4.0 [12,36]. Industry 4.0 is the fourth industrial revolution that applies the principles of CPS, internet and future-oriented technologies, and smart systems with improved human–machine interaction paradigms [31,37]. In the 21st century, Industry 4.0 began with the widespread use of the internet [25], so it has been proposed to connect machines, robots, and other things to the internet, with the aim of becoming digital and making leaps in productivity [7,36]. Industry 4.0 makes a factory smart by applying advanced information and communication systems and future-oriented technologies to achieve lean and worker-friendly manufacturing [31].

Lasi [30] (p. 214) mentions in his article that:

“The term Industry 4.0 collectively refers to a wide range of current concepts, whose clear classification concerning a discipline as well as their precise distinction is not possible in individual cases. In the following fundamental concepts are listed: Smart Factory, Cyber-physical Systems, Self-organization, New systems in distribution and procurement, New systems in the development of products and services, Adaptation to human needs, and Corporate Social Responsibility.”

The author adds that the term “Industry 4.0” describes different changes in manufacturing systems, mainly driven by IT and, as a result, there will be a shift from product to service orientation and new types of companies are expected to emerge and adopt new models within the manufacturing process or value creation network. Industry 4.0 has emerged from innovative digital technology to create value [38] and distribute opportunities [39], which is a big change and affects the way people work and do business [40].

In Industry 4.0, the main components include CPS, Internet of Services (IoS), and IoT [2]. The heart of the Industry 4.0 framework is the CPS, which consists of integrating hardware and software in a mechanical or electrical system designed for a specific purpose [25,41]. “Industry 4.0 constitutes a technological framework for adoption of cyber-physical integration principles in manufacturing, logistics, and supply chains” [40]. According to Rüßmann et al. [42], this fourth wave of technological advances, with the rise of the new digital industrial technology known as Industry 4.0, is a transformation fueled by nine foundational technological advances: Big Data and Analytics, Autonomous Robots, Simulation, Horizontal and Vertical System Integration, The Industrial IoT, Cyber-security, The Cloud, Additive Manufacturing, and Augmented Reality. Although these are disruptive technologies that trigger the transformation, this Industry 4.0 revolution goes far beyond these technologies, and a completely new generation is needed to deal with the new challenges created by Industry 4.0 [2].

Industry 4.0 is the bringing together of robots, interconnected devices, and fast data networks within a factory environment, primarily to make the factory more productive and to perform routine tasks that are better done by robots than by humans [43]. It has therefore brought many advantages, such as cost reduction, zero errors with AI-dependent machines, and timely delivery of individualized products to customers [35]. The concept of Industry 4.0 means connecting production machines in the real world with the virtual world of the internet and IT [44]. However, for the European Commission [45], the Industry 4.0 paradigm, as it is currently conceived, is not fit for purpose in the context of climate crisis and a planetary emergency, nor does it address deep social tensions for the journey towards a new economic paradigm in time-span of a generation.

Industry 4.0 has an impact on society and vice versa [46]. Mazali [33] introduced in his case study work, entitled “From industry 4.0 to society 4.0”, the question of people's participation in transformation processes, in which digital culture, digital society, and digital factories, which implemented the paradigm 4.0, have one cultural point in common: a people-centered culture. The industrial revolution 4.0 will bring with it many changes with many consequences, being an influential change of life, and where human and animal power is replaced by machines. It is the transformation of human functioning into

automation or digitalization through innovation [47]. Industry 4.0 is also known as the “information revolution” [48].

The creation of knowledge from information is done by humans in Society 4.0. It is considered that the next phase of human society will be made mainly by machines, through AI—or digital agenda—but at the service of people [49]. Technology and innovation need to be used and integrated to help and advance society—not to replace the role of human beings [17].

In Society 4.0, technology simplified the use of information [26,39] that followed the industrial society (Society 3.0) [18]. Social, cultural, and economic activities are centered around people and on interconnected technological innovations that use ICT and allow for the rapid and accurate flow of information anywhere in the world [39]. The creation of a knowledge society that has transformed information into added value, resources, or real knowledge, allows members of society to improve their human condition and their standard of living. Currently, the concept of a network society describes the world in which we live in quite well [10].

Under Industry 4.0 conditions, a person produces less and less physical work and the use of machines (CPS) in production is constantly increasing. The human is only needed as a final consumer of goods and services [5]. The worker is considered the most flexible component in this CPS and its interface. It is the key component of Industry 4.0, so its individual factors will play an increasingly important role in the future of work [15].

Industry 4.0 was the emergence of the industrial IoT, where automation, machine learning, connectivity, and real-time data became intertwined [26]. The fourth industrial revolution sets a series of challenges for manufacturing companies from a technological, organizational, and management point of view. With the application of new IT and the transformation of processes, significant changes are expected in the field of work and in future production systems that require new skills from employees [7]. This industrial revolution 4.0 is very oriented towards the application of technology, which means that all educational institutions must centralize and apply technology as a base [48], as companies that invest in these emergent digital technologies employ highly qualified workforce [32]. The lack of a digital strategy, along with the scarcity of resources, is the most prominent barrier in both developed and developing economies to the implementation of Industry 4.0 [27].

The sphere of education is seen as the main driver of successful adaptation to new economic realities. Thus, high production capacity with qualified personnel and appropriate management practices promotes national economic development [5]. In this regard, both producers and suppliers must work to adapt infrastructure and education as they embrace Industry 4.0 technologies. This is best addressed through a concerted effort involving governments, industry associations, and businesses to achieve the following: upgrading technology infrastructures such as fixed and mobile broadband services, adapting school curricula, training, and university programs, and strengthening business approaches, to increase the ICT workforce’s innovation skills and capabilities [42].

Modern Education 4.0 is fueled with information and, if it can be qualified and equipped with digitally intelligent machines (Cobots), which will be further enriched with the human touch, it will lead society on the path of personalized education [26]. Education 4.0 paves the way for a new form of university where scholars teach, research, and provide services in different ways, raising the question of the scholars’ readiness to meet challenges that are marked by a new way of solving problems and new methods of thinking, involving the use of several new learning tools [50].

The dynamic development of the fourth industrial revolution, focused on the implementation of Industry 4.0 technologies, raised fears from governments and society regarding the dehumanization of the industry in the future [13]. However, technology and innovation need to be used to help and advance society, not to replace the role of the human being. It cannot replace human emotional intelligence and critical thinking [51,52].

During the 2000s, the fourth generation of education (Education 4.0) appeared. It has also been called the smart generation, integrated with the industrial revolution of CPS, IoT,

and networks [53]. This is the period of Millennials, also known as Generation Y, born between the early 1980s to the early 2000s. This is the first generation of young people to reach adulthood in the information society and, as a result, they very easily learned to use digital technologies and social media [10]. In this Era, Education 4.0 is based on the belief that content is free and readily available [53].

The skills development cycle associated with the Education Era 4.0 is broader than any other generation due to the rapid ICT revolution and paradigm shift in teaching and learning, as well as the market employability requirements. Skills such as ICT, communication skills, and time management are the core competences of students [53]. Industry, society, and the nation in general have looked to universities for solutions to the country's development needs [54].

Although the fourth industrial revolution made it possible to many economic, social, and environmental problems, humanity faces serious challenges: there is a risk that human beings could lose control of the development of AI and technological PHC, as well as the risk of social degradation [5]. Morrar et al. [29] drew attention that society, in general, should benefit from the industrial transformation of Industry 4.0, which should offer both social progress and benefits. Therefore, policy makers should think about their global impact on current and potential social problems through the social dimensions of new technologies. Because the transformation and regeneration of the Earth, as well as our pattern of development, will be useful for future generations, technology 4.0 can be used to mitigate and provide a solution to improve our way of life, through the production of products and sustainable services [38].

Although Industry 4.0 is so far not well developed, the world is looking forward to the next industrial transformation (Industry 5.0), the autonomous manufacturing with Human Intelligence, which in turn will lead to the emergence of the Super-Smart society (Society 5.0) [26]. Through the combination and continuity between the industrial revolution 4.0 and Society 5.0, it can form a better pattern of social order, so as to improve the quality of people's social life. However, it is necessary to discuss the transformational changes in human civilization with respect to the biological, labor, and social human capacity within the major industrial formations [5].

Industry 4.0 and the Society 5.0 phenomena have brought forth a trend of change at the company level and even at the individual level [17]. There is a need to add a value dimension towards prosperity to the concept of Industry 4.0 [16]. Industry 4.0 opens new opportunities to create added value for the customer and stimulate technological and process innovation, which allows for greater competitiveness [44].

The world is witnessing a great tide of change, transformation, digitization, and industrialization that is influencing society in many aspects, including public administration, industrial structure, employment, and an individual's privacy. The ongoing transformations will cause a social change from version 4.0 to 5.0 of the Society [26] (see Figure 1).



Figure 1. On the way to the new era.

4. Industry 5.0 Challenges

The term Industry 5.0 was first introduced in 2015 [11,55] in an article published by Michael Rada with reference to the social network LINKEDIN [56]. Industry 4.0 is still in an embryonic stage [8,32], but it can already be envisioned as the new paradigm of Industry 5.0, which involves the permeation of AI in the life of man, its cooperation with the aim of increasing human capacity, and the return of man to the “Center of the Universe” [8].

Although both Industries 4.0 and 5.0 have kept technology at the center of their respective businesses, to sustain their business, companies will have to provide organizational agility to engage with technology when satisfying customer aspirations to survive in this disruptive era [4]. The transformation from Industry 4.0 to Industry 5.0 causes changes from customized mass production—mass customization—to customized production—mass personalization [48,55].

Ozkaser [43] mentions in his article that in the near future, not only knowledge and digital life, but also robots that behave like a human, will cover a huge amount of time. These are intertwined with the human brain and work as collaborators rather than competitors [57]. So, people will start collaborating with Industry 4.0, meaning Industry 5.0 is coming. Instead of the fourth industrial revolution, where machines replaced human jobs, Industry 5.0 brought people back to production, where humans and machines worked collaboratively. Human tasks are restructured to benefit workers and human intellectual resources, creativity, and an intelligent system is used to increase efficiency [58].

Industry 5.0 is a visionary concept that will have a profound impact on society, governance, human identity, and the economy. It is considered as a transformation of the information society to a super genius society [48]. The vision of an innovative, resilient, socio-centric, and competitive industry that respects planetary boundaries and minimizes its negative environmental impact has been labeled Industry 5.0. This opens up many new challenges related to technology, socio-economy, regulation, and governance [16]. Industry 5.0, which has its roots in the concept of “Industry 4.0”, will have a more transformative vision of growth, centered on progress and human well-being, based on reducing and shifting consumption towards new ways of creating sustainable economic value and circular, regenerative, and equitable prosperity [47,59].

Industry 5.0 also increases added value in production and manufacturing by providing creative and innovative solutions [11]. Industry 5.0 products/services, which collaborate between man and machine, are personalized; called the human touch [60] and where there is individualization of human needs [5]. Products like these can only be made through human involvement. Industry 5.0 is a return to pre-industrial production, but one that is made possible by the most advanced technologies that exist [43].

According to the European Commission [16], the technologies that support the Industry 5.0 concept include: human-centric solutions and human-machine-interaction, bio-inspired technologies and smart materials, real time based digital twins and simulation, cyber safe data transmission, storage, and analysis technologies, AI and technologies for energy efficiency and trustworthy autonomy.

Industry 5.0 is a digital transformation of the existing era; it is a future that also means that change processes are directed towards closer cooperation between humans and machines [11,43]. The aim of Industry 5.0 is to enable humans to spend more time planning and on strategic tasks [48]. Industry 5.0 will significantly increase manufacturing efficiency and create versatility between humans and machines, enabling responsibility for interaction and constant monitoring activities. Industry 5.0 is a future evolution designed to harness the creativity of human experts working together with efficient, intelligent, and accurate machines [61].

To discuss the concept of Industry 5.0, two virtual workshops were held with representatives of Research and Technology Organizations from all over Europe, based on the preliminary definition: Industry 5.0 recognizes the power of industry to achieve social goals beyond employment and from growth to becoming a thriving supplier, making production respect the borders of our planet, and putting the well-being of the industrial worker at the

center of the production process. Industry 5.0 can also be described as reintroducing the lost dimension of a “human/value-centric Industry 4.0” [6,16]. The individual characteristics of people should be used as part of the cyber-physical system. Thus, the performance is higher if Man and Machine work in articulation. It is the human being who assumes the power of decision, as a controlling and supervising entity [62].

Creating the concept of Industry 5.0 around societal and ecological values rather than technologies, disrupting the concept of industrial revolutions in general, could lead to a misperception. In fact, the concept of Industry 4.0 was already centered around values for the human being, society, and ecology. Industry 5.0 nomenclature may indicate an even newer set of technologies than in Industry 4.0 [16]. Human–robot co-working will be a major shift in manufacturing in Industry 5.0 [5]. The advance of this revolution consists of avoiding errors in the systems and accelerating the manufacturing process by digital devices with human intelligence. They add that quantum superiority can lead to the sixth industrial revolution (Industry 6.0) [11]. It should be noted that during the transition from one society to another, changes occur at all social levels. For this reason, social change usually comes after industrial revolutions [39].

Contrary to Özdemir and Hekim [46], who consider Industry 5.0 as an evolutionary, incremental advance that is based on the concept and practices of Industry 4.0, Maddikunta et al. [61], after analyzing the seven definitions of Industry 5.0, consider that this is not an evolution, it is the next industrial revolution where humans and robots collaborate, share, and work together, without fear of job insecurity, thus resulting in services with added value. This fifth industrial revolution [55,60] focuses on an intelligent manufacturing environment, which brings human intelligence and creativity back to production. Industry 5.0 is an industry that focuses on human beings returning to the production system, where man and machine find ways to work together to improve production quality and efficiency. It places the well-being of the industrial worker at the center of the production process [13,60]. In Industry 5.0, AI is intended to work with humans, not to replace them, in contrast to Industry 4.0 [55]. It will once again lean towards serving humanity and will shed more light than ever before on human intelligence and creativity so as to increase the process efficiency by combining workflows with intelligent systems [60]. Industry 5.0 triggers personal human development, creating conditions for creative jobs within the creative economy and updating informational diversity in social and economic systems [5]. This will create more jobs than will be taken away [57].

Industry 5.0 is a concept that was conceived to harmonize the workspace and efficiency of humans and machines in a consistent way. Although Industry 5.0 is in adoption, global norms and policies are still evolving to make it an international standard [61]. This fifth industrial revolution is also more beneficial for society, the environment, the economy, and the planet. The concept of Industry 5.0 aims to reverse the dehumanization of industry, considering the crucial role of man in society and their needs, being closer to sustainable development [13].

Industry 5.0 will be defined by a refoundation and expansion of the objective, going beyond the production of goods and services for profit. Industry 5.0 develops solutions that make production more sustainable, resilient, and competitive in the long term, and addresses the challenges associated with beneficial human-machine interaction and skills matching. This broad purpose integrates three core elements: human centrality, sustainability, and resilience [59]. Thus, in Industry 5.0 there will be a fusion of skills between humans and technology for the mutual benefit of industry and industry workers—not replacing technology, but complementing human beings [16].

A transformation in which Industry 5.0 will lead to Society 5.0 is crucial and considered as an evolution from previous industrial revolutions, which aims at a super-intelligent society [26,48]. Human centrality is an important element in both Industry 5.0 and Society 5.0, and to evade the problems that are propagated in the current level of industrialization and living standards, Industry 5.0 aims to activate the creativity of humans in industry and evolve the industry towards a human-centered, resilient, and sustainable prosperity [63].

The concepts of Society 5.0 and Industry 5.0 are related in the sense that both concepts refer to a fundamental shift of our society and economy towards a new paradigm [59].

5. Paradigm in Society 5.0

The transition to Society 5.0 took place during the fourth industrial revolution (Industry 4.0) based on disruptive technologies [5]. This change in the social paradigm brings the challenge to companies to survive and sustain their business to face Society 5.0 [4]. Thus, Society 5.0 brings an industrial transformation due to technological advances in IoT, a sensor technology; BD, obtained through sensor measurements; and AI, which finds and analyzes correlations in DB [41,64]. In the future, people will work on new jobs using IOT/AI/BD that do not currently exist [65]. However, Mihardjo et al. [4] consider that there is little evidence on how a company could build business model innovation and place the human center as a cultural mindset that allows the company to generate new business opportunities, especially in anticipation of the new Society 5.0.

The concepts of Society 5.0 and Industry 5.0 refer to a fundamental change in the current concepts of economy and society [13]. Society 5.0 is argued as a human-centered society that balances economic advancement with Industry 4.0 [38]. Thus, the changes brought about by the development of Industry 4.0 and Society 5.0 will further affect all aspects of human life. The current lifestyle is increasingly promoting practicality and efficiency [40].

In this sense, and chronologically following the industrial eras, professionals and academics began to discuss the Era of Industry 5.0 and Society 5.0, due to the rise of values and services in industrial life and in all aspects of daily human life [24].

In 2016, the government of Japan called “Society 5.0” or “Super Smart Society” a society that provides a common social infrastructure for prosperity based on an advanced service platform. Prof. Anzai adds that, in addition to just increasing the power of technology, it is a society that aims to increase the quality of life, calling it the “fifth revolution” of humanity, following, for example, the agricultural and industrial revolutions, among others. He stated that a better understanding of human–human and human–nonhuman interaction is needed to fully develop intelligent services. It is a human society, in which all people need to share information [41,59,66]. A “super-smart society” that will bring wealth to the people, merging physical space (real world) and cyberspace, leveraging ICT in fullness [36,41]. IoT links cyberspace and physical space, providing the foundation for Society 5.0 [67].

Toprak et al. ([18], p.172) stated that “the Industry 4.0 concept of the Germans has manifested as Society 5.0 in Japan”. They added that “Japan has, for a long time, been developing its standing under the Society 5.0 umbrella to correct the deterioration in the quality and level of its economic growth.” The Japanese vision of Society 5.0 proposes a human-centered society, a society that provides comfort and happiness through a high degree of cyber-physical convergence [36,68]. According to Zengin et al. [35], the aims of Society 5.0 are to increase the growth rate of Japanese society and eliminate effects such as an elderly population on the social structure with the help of technology and achieve SDGs [39].

Society 5.0 is a concept with a more synthetic and eclectic content that follows the four previous descriptions of society [18]. It is based on the information society (Society 4.0) and promotes the development of information networks to create value, focusing on the use of technology and digital transformation around the advancement of a human-centered society [69,70]. This digital transformation will drastically change many aspects of society: aspects of private life, public administration, industrial structure, and employment, using cyberspaces and their integration into physical spaces [39].

Society 5.0 is a society where advanced IT technologies, IoT, robots, AI, and augmented reality (AR) are actively used in the industry, in people’s ordinary life, healthcare, and other spheres of activity—not for progress, but for the benefit and convenience of each person, seeking to solve social problems with the help of the integration of physical and virtual spaces [39,71]. The concept of Society 5.0 is not just limited to manufacturing factors, but

also solves social problems with the help of the integration of physical and cyber (virtual) space [72], in which they are integrated to support a prosperous and eco-friendly society. Society 5.0 is a socio-economic and cultural system that develops sustainably in a direction that is optimal for humanity, based on processing the results of “big data” [67], in which a physical space and cyberspace become an integral whole for solving social problems, providing security and eco-friendliness of innovations and sustainable economic growth [73]. Thus, emerging technologies of the fourth industrial revolution must be properly explored for the Society 5.0 vision of sustainability of human centrality in governance, industry, and commerce [74]. What differs Industry 4.0 from Society 5.0 are the different general approaches to individuals and their true value to business and society. However, it is the enabling technologies of Industry 4.0 that are the core of the model and that make the transition to Society 5.0 possible [75].

The Japanese origin philosophy of Society 5.0 lies in using the innovation and technological advances of Industry 4.0, such as AI, robotics, and BD, to create systems that harmoniously serve the interests of society. Combining cyberspace and physical space, Society 5.0 aims to leverage the digital transformation of industrial revolution 4.0 to create economic balance, to alleviate social problems through the provision of products and services, and to address social challenges, including the challenges addressed by SDGs [70]. In Society 5.0, people, things, and systems are all connected in cyberspace and the great results obtained by AI exceed the capabilities of human beings, who are powered around a physical space [67]. Society 5.0, which prioritizes science, technology, innovation, and SDGs, suggests that many problems, including unemployment, poverty, and air pollution, will be solved under the leadership of AI [5,35].

The concept of Society 5.0 and Industry 5.0 is not a simple chronological continuation or alternative to the Industry 4.0 paradigm [9]. The basic principle of the Era of Society 5.0 is the solution to the problems created during the Era of industrial revolution 4.0, including the problem of reduced socialization between communities, employment, and other impacts of internalization [72,76]. Society 5.0 is the ‘Imagination Society’ where industrialization will be the central factor of transformation and technological advances [26].

In Industry 4.0, people, objects, and systems are all interconnected in cyberspace. In Society 5.0, a lot of information is accumulated in cyberspace (virtual space) from sensors in physical space (real space), which provides a high degree of convergence between these two spaces [18]. While both views advocate the deployment of CPS, the scope of deployment differs: in Industry 4.0, CPS must be deployed in the manufacturing environment, while in Society 5.0, it must be deployed throughout society [36]. Society 5.0 aims to place human beings at the midpoint of innovation and, exploring the impact of technology and the results of Industry 4.0, integrate technology to improve quality of life, social responsibility and sustainability, which is a pioneering perspective that shares common points with SDGs [9,25]. No individual can be excluded from the advances in the technological world of our current society so as to achieve a better world and SDGs [39].

In the Era of Society 5.0, it is assumed that interactions, interdependencies, and interrelationships are facilitated through the digitized technological platforms of the fourth industrial revolution [74]. In contrast to Era 4.0, which emphasizes only business, the Era of Society 5.0 can be interpreted as a human-centered, technology-based concept of society. Here, technology has created new values that will eliminate social inequalities, age, sex, language, and provide products and services specifically designed for a variety of individual needs and the needs of many people [72].

Society 5.0 allows for the use of advanced technologies such as IT, IoT, robotics, AI, and AR in people’s lives, healthcare, and other spheres of activity, while Industry 4.0 restricts technological advances to the industrial sector only. Society 5.0 focuses on the application of constantly developing technology and innovation stimulated by Industry 4.0 to solve humanity’s problems such as population aging, natural disasters, social inequality, security, and improving people’s quality of life [41]. Society 5.0 is a society thinking of a

social system based on IT, which implies a global change in the reform of the economy, the employment system, society, and education [66].

Society 5.0 has a special focus of placing the human being at the center of innovation, technological transformation, and industrial automation, stimulated by Industry 4.0. This new paradigm of Society 5.0 will play a predominant role in creating a happier, more satisfied, fulfilled, and consequently more productive society. The use of technology for the benefit of society has promoted a new industrial revolution called Society 5.0 [41]. The motto of Society 5.0 is a “human-centered society” [18].

Society 5.0 is a society where value is created; where anyone can exercise various capacities; where anyone can get opportunities anytime, anywhere; where people can safely live and pursue challenges; where humanity lives in harmony with nature, and Industry 4.0 problems are solved [77]. However, there is a danger that data can be misused, and the integration of cyber and physical spaces can end up with a rather bleak society that is far from the picture presented by the Society 5.0 initiative [67].

Society 5.0 ensures the integration of technology with social life [25] and allows for the development of sustainable technology without limiting prosperity [39]. It is the development of the concept of Industry 4.0 with due regard and challenges induced by man towards its humanization that extends beyond the limits of the technological, organizational, and economic transformation of industrial production based on cutting edge development projects [73]. To face Society 5.0, transformations are needed in companies to anticipate change, such as: challenges in improving people’s competence, a culture of innovation and the process supported using technology, to achieve effective and efficient value creation and support sustainable development [4]. Society 5.0 will have an impact on all aspects of life, from health, urban planning, transport, agriculture, industry and education. In Society 5.0, development is focused on human beings [17].

The character of the nation is absolutely necessary in the midst of the Society 5.0 Era, which requires society to be able to control and balance the ability of AI and social intelligence to solve all kinds of national problems [72]. Important consequences, both positive and negative, will occur with the development of the IoT, in particular, with changes in government and companies and in the use of information [5].

The creation of Society 5.0 is also a very important aspiration for Europe and the challenges of digital transformation can only be tackled through close cooperation in the fields of politics, economics, and science [3]. Europe will also be an integral part of this movement, which, like Japan, is witnessing an aging of its population [39,41]. Industry 5.0 represents an opportunity for Europe to restructure the quality of its leadership in the world through international cooperation, openness, and leadership in setting norms and standards for new productions, sustainability, ethics, and a digital economy/society that is in line with the SDGs [45].

It is no accident that the generic names that add up to “Society 5.0.” are: “post-industrial”, “information”, “network”, “digital society”, and “knowledge society”. It can also be called a sustainable economy, as it ensures the realization of SDGs [5]. Society 5.0 encourages the process of forming a society where the digital world is increasingly present at the service of sustainable development (economic, social, and environmental)—a super-intelligent society [14]. It is a sustainable society, which is engaged in sustainable innovation and serves its present without compromising the opportunities of the future, thus organizing itself to improve the common well-being of citizens and social, environmental, and financial considerations are integrated into organizational systems [39].

The future transformation of (Digital) Society 5.0 (the next 10–15 years) will give a more creative and innovative role, senses, knowledge, and skills to humans and smart technologies in the new hyper-reality mix [51]. Society 5.0 will further support dynamic, diverse, and flexible working conditions that lead to the creation of a new category of jobs [48].

Society 5.0 and Industry 5.0 both reflect a fundamental shift of societies and economies towards a new paradigm to balance economic development with solving social and environmental problems, creating social well-being and matching skills, where importance is given

to knowledge, to address the challenges associated with human–machine interactions [9]. The objective necessity of the development of modern human civilization is the transition to a new socio-economic formation, including the urgent capacity to reproduce resources and recycle waste [5].

Society 5.0 is a new concept of community life [72], which is oriented towards the development and use of technology for a better community life, which allows achieving the SDGs [64]. Era Society 5.0 is expected to be more comfortable for humans, as in Technological Society 5.0, AI supports human work [72]. Thus, technology and innovation need to be used to help and advance society, not to replace the role of human beings [17].

Educational institutions, such as universities, can increase cooperation at a national and international level, productivity in the fields of research, and service and research, based on innovation. This leads to the formation of the Smart City/Smart Campus concept as strategies to support the number of licensee profiles that fit the needs and achieve the SDGs [64].

As mentioned by Ellitan and Anatan [64], technology and innovation need to be used to help and advance society, not to replace the role of human beings. The combination of Industry 5.0 and Society 5.0 can improve the quality of people's social life, forming a better standard of social order. With the birth of the Era of Society 5.0 it is expected that its main technology in the field of education will not change the role of instructors in teaching moral education, character, and models to students [72], because in the Era of Society 5.0, education is key to improving the quality of human capital [64].

6. The Changes Resulting from Education 5.0

In the last decade, our lives have been transformed. Digital technology has taken us from an industrial society centered on manufacturing to a society where information is king. Our private and professional lives are saturated with digital data and information technology through which we develop and share ideas, which in turn generate one new business after another [36]. The 5.0 Era represents a quantum leap forward from the 4.0 era, through the use of web-based and mobile technologies, including applications, hardware, and software [64].

The development of education in the Era of industrial revolution 4.0 and Society 5.0 is inevitable. Technological development requires being ready to face the disruptions of innovation that exist on all lines, including education in the age of globalization. It is an Era full of competition for quality and quality in the world of education [47]. Society 5.0 will emerge with the concept of Industry 5.0, causing an industrial revolution that, in turn, will be further strengthened by Education 5.0, generating the “High-Definition Educators 5.0” [26].

In recent years, education has been influenced by the new technologies of Society 5.0, which has led to critical structural changes. The technologies of Modern Society 5.0 have fostered digital teaching with videoconferencing and virtual reality tools, thus reaching more students simultaneously without the physical limitations of the classroom [39].

Industry 5.0 can benefit the workforce through a re-skilling of employees from manual to cognitive work, providing value-added tasks at work alongside an autonomous workforce, i.e., collaborative robots (cobots) that will be perceptive and informed about human intention and desire [58]. However, the impact of the collaborative workplace on workers, associated with the concept of Industry 5.0, has not been sufficiently studied [78].

Industry 5.0 promotes more skilled jobs compared to Industry 4.0, as intellectual professionals work with machines. Industry 5.0 mainly focuses on mass customization, where humans will be guiding robots [58,61]. Creating the conditions for social progress is a complex social task and Industry 5.0 aims to solve this problem, aiming at the “personalization” of production and consumption, satisfying personal needs, ensuring their development (the SDGs) [5].

The demand for skills is evolving as rapidly as technologies [59]. Specialists in systems engineering, new training programs, including programming education, will be needed [65].

Industry 5.0 requires social innovation to increase prosperity and promote good quality jobs, along with measures to support education and skills training to enable workers to adapt to a changing labor market [45].

Digital transformation is a topical issue that several stakeholders of education must feel concerned about, as not all possess digital competence to apply ICT in every aspect of their life, to be able to face challenges and provide solutions [79]. As educators in a 5.0 society, they must possess digital literacy and the ability to think creatively and respond to students' learning needs [64].

The current demographic, which is called Generation Z, a generation in which young people were born into a world full of technology and have been using ICT tools and, in particular, the internet, since childhood, cannot simply imagine a world without ubiquitous access to internet, with increasingly smaller devices and, preferably, without cost. These young people are now entering higher education [10] and are typified as valuing skills development and enjoying the challenge of new opportunities [24,53]. The question is whether we are ready to face the new digital age, not only in industrial aspects, but also in the revolution of society—Society 5.0.

The environment and learning atmosphere in the digital era are changing very quickly. One of the biggest changes is the widespread use of the internet, which is also used in learning [40]. The digital transformation and the generalization of digital technologies have increased the social complexity, with some negative aspects such as security risks (cyber-risks) and implications for the privacy of individuals, and hence, the need for regulation [32,69].

As we have seen, education and society in the 21st century will face more severe challenges than in the previous century. Society 5.0 is a society that can solve many of these challenges and social problems through the use of various innovations, including new tools, technologies, and pedagogical methodologies.

According to Sudibjo et al. [40] Industry 4.0 and Society 5.0 also bring some changes to the education industry. The future of modern society presents challenges to educational institutions, so the learning characteristics in the Era of Industry 4.0 and Society 5.0 are changing rapidly and need to be accommodated in the teaching and learning process. Thus, mastering the skills and competences needed for the future is the responsibility of the world of education [71].

The Education Society 5.0 system promotes the design of training processes that facilitate the development of skills not only for work, but also for the consumption of culture, adaptation to environments in continuous change, data processing, interaction with our environment and with others, along with personal and social development [39]. Education and training have an important role in the improvement of new skills and abilities. Only this way will the so-called 5.0 Society be improved, a society centered on people, in which all citizens are intended to get involved in a dynamic way, introducing digital technologies for the benefit of the quality of life [80]. Technical skills will be far less important in the future, with personal skills (soft skills) becoming more critical. In addition to technology, digital, and data acumen, soft skills (including the art of communication and also the ability to think in a creative and critical manner) are also going to be increasingly in demand [60].

One of the main discourses of education is growing with the help of ICT and AI for educational development. This educational discourse integrates the potential of the fifth generation of education (Education 5.0) with the fifth generation of the industrial revolution, in 2020 [53]. Education 5.0 is a phenomenon that emerges in response to the needs of the industrial revolution 5.0, in which humans and robots collaborate to develop solutions, address various problems, and identify innovative possibilities for modern human life [64].

Education 5.0 will be a personalized education system. This system will improve the learning process and prepare students to withstand and face the uncertainties of the future with an enriched set of skills, which will allow them to sustainably create new values and services to benefit and balance a society as a whole [26]. Creating immersive

and interactive educational experiences is a real challenge for educators, especially those without technological knowledge and those who do not see the importance of investing in the creation of technology-based educational content [1]. We are experiencing the sophisticated integration of cyberspace, information, and physical space (real world) to be formed by Society 5.0, centered on human beings, on people. This new type of super-intelligent society will be characterized in a society where different occupations are finely differentiated and fulfilled [48,49].

The smart society will be equipped with a new version of Education and Educators 5.0, who are likely to lead the world. Human beings, rather than being replaced, will be equipped with collaborative and cooperative intelligent robots to efficiently perform the tasks undertaken. This new super-intelligent society will be enriched with human touch personalized products [26].

A digital scholar is part of a local community, a society in which the digital scholar is an active participant, as he brings his knowledge and expertise to society and vice versa, it is the society that triggers the work and construction of the digital expertise of the scholar. This is also a global citizen, who collaborates and shares his knowledge with peers around the world [10].

The Alpha generation, born in 2010, and children of the Millennial generation, are known as digital natives, in which there is no separation between digital and “real life”. Their educational needs are different from previous generations, as they are involved in each stage of their learning process [53]. However, in addition to being born connected and living surrounded by technology, this generation does not live by technology alone. They are developing a new view of the world, focusing on social and environmental issues, emotional intelligence, and important values such as kindness and empathy. They care about others, people, animals, and the planet.

Immersive and interactive educational experiences is the future of teaching and learning, combining the best of Education 5.0 and Industry 4.0 learning technologies to engage current generation learners whose learning style is unique, right up to the digital era [1]. The emergence of Education 5.0 highlights skills such as communication, leadership and resistance, curiosity, understanding, and critical and creative thinking [26].

The smart society will be equipped with a new version of Immersive and Interactive Educational Experiences is the Future of Teaching and Learning, combining the best of Education 5.0 and Industry 4.0 learning technologies to engage today’s generation of learners, whose learning style is unique to the digital era.

Industry 5.0 presents significant challenges and a demand for new contemporary approaches to learning and education, as well as a need for the transformation of schools and educational institutions [45]. In the university model required by Industry 4.0 or Society 5.0, concepts such as joint education, cooperative education, integrated learning, sandwich learning, internship, experience-based learning, and work-integrated learning are at the forefront [18]. In this Era of Education 5.0, the teaching and learning theories associated with Education 5.0 are aligned with post-constructivism [53]. The 5.0 Era represents a quantum leap forward from the 4.0 Era and there is a need to strengthen cooperation at national and international levels and conduct skills training on a national and international scale to support the number of graduate profiles that fit the needs [64] (see Figure 2).

Universities should recognize their social role not only as trainers, but also as creators of new knowledge. They must establish partnerships with industry, academia, and the government, in order to have a more significant impact on the knowledge generated, as well as their sense of ownership, in accordance with the requirements and problems of the production sector and society in general [39].

Education 5.0 will be personalized, which will improve the learning process and prepare students to withstand and face the uncertainties of the future with their enriched skill sets that will allow them to sustainably create new values and services to benefit and balance a society like a whole [26]. Education 5.0 is a new curriculum reform that would need the support of educators for a possible problem-free implementation [54].

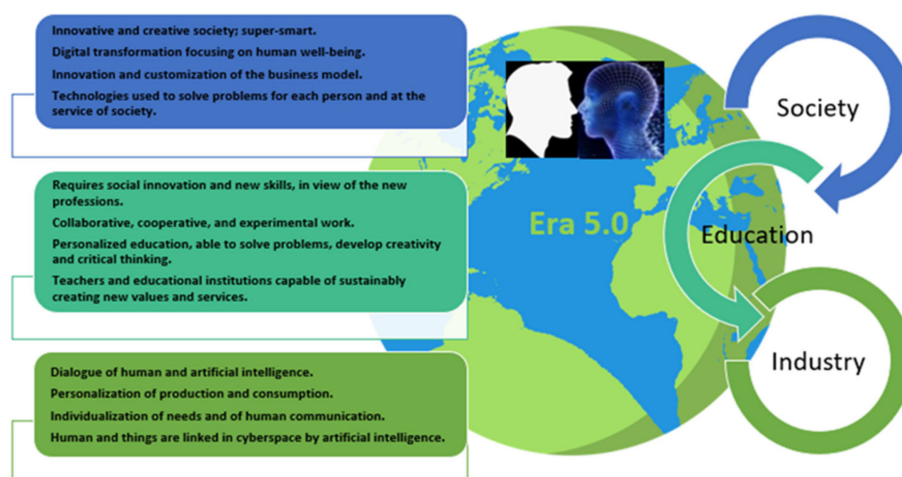


Figure 2. The paradigm of the new era.

To educate students with the latest skills and raise their standard of thinking, the need for “High-Definition Educators”, Educators 5.0, arises. These educators will be able to stimulate and apply human intelligence and computer thinking processes, working in a collaborative environment with human beings, hence the so-called Cobots, which will enrich the learning process in Society 5.0 [26]. Saputro et al. [71] consider that the greatest ability to face Society 5.0 is the ability to solve complex problems, critical thinking, and creativity. To build Community 5.0, the future requires an appropriate learning model to overcome the discrepancy problem of the 5.0 community learning paradigm and schools must transform teacher-centered learning into student-centered learning so that students can think critically, deductively, and inductively in this era of disruption.

The creativity and innovations that spring from future human generations and the intellect of advanced technologies will regulate and solve this uncertain problem for the future cyber-physical reality to progress adequately and progressively, providing the necessary resources to live and evolve together with the emerging security challenges, in the sense of establishing a new, resilient, and adaptable digital world [51].

Education 5.0 will enable an individual to master the skills of how to learn, unlearn, and relearn to adapt and embrace the ever-changing environment of the technical world. Education 5.0 would be personalized, which would improve the learning process and prepare students to withstand and face the uncertainties of the future with their enriched skill sets—communication, leadership, resilience, curiosity, understanding, critical, and creative thinking—which will allow for the sustainable creation of new values and services to benefit and balance society as a whole [26]. Some of the requirements for the fifth-generation education transformation (Education 5.0) are 21st century skills: Learning Skills, Literacy Skills, and Life Skills [53]. Students are expected to have the six basic literacy skills (numeracy, scientific literacy, information literacy, financial literacy, cultural literacy, and citizenship) and other skills such as thinking critically, reasoning, being creative, communicating, collaborating, having problem-solving skills, and most importantly, having curiosity, initiative, persistence, adaptability, leadership, and social and cultural awareness [64].

7. Conclusions

As mentioned, with this work we intend, based on a literature review, to analyze the challenges of Era 5.0 and its impacts on industry, society, and education, as engines and promoters of the path of sustainable development and humanization of society and the world.

We started this work by providing an overview of the path from Industry 4.0 to the new Era 5.0, defining some concepts of Era 4.0, from the perspective of academics in particular. Next, we discussed the Era 5.0 paradigm, namely some of the challenges of Industry 5.0, the

transformation in society, with the so-called Society 5.0 and the changes and developments in Education 5.0, from a perspective of its potential strengths and technological benefits for society and humanity.

In summary, Era 5.0 is a true revolution of society and humanity focused on quality of life, human, social, environmental, and economic well-being. These topics, after the impact of the pandemic, climate change, war, social divisions, cyber risks, among others, are at the top of the agenda and deserve more attention and concern from politicians, organizations and communities.

Thus, the Industry 5.0 concept is an evolution of the Industry 4.0 concept, which uses emerging technologies and applications to harmonize the virtual and physical world, placing the human value at the center of the problem. In this way, we will have a society (Society 5.0) with technologies and infrastructures focused on the human being and on solving social and environmental problems, that is, a society based on sustainability, human value, and resilience. However, although technology does not stop providing changes in industry, society, and education, it is not enough to promote the expected improvements in humanity. In this scenario of rapid evolution, transformation, and technological change, there is a need for new learning and skills in education. Thus, Education 5.0 emerges, which must develop in the student/training other skills and competences in an integral and human way, focusing on collaboration between peers and the community, relevant to the improvement of people's lives and the social and humanity well-being.

Note the recent events (COVID-19), which are manifesting unprecedented changes in society in general [74], and which have led to the need for physical/social distancing behavior among citizens globally. In this way, everyone was forced to almost immediately achieve digital skills or develop the ones they had in order to allow for the success of different economic, social, educational activities, among others, as mentioned by Sá et al. [14]. The combination of Industry 5.0 and Society 5.0 can improve the quality of people's social life, forming a better standard of social order.

The changes that occur in education, brought about by new trends in Industry 4.0 and Society 5.0, must be wisely approached by educational institutions. Educational institutions must pay close attention to how the education services provided can respond to the new challenges caused by current changes. In this new era, education is influenced by technologies and educational institutions must be able to accommodate the technological advances of the Era of Industry 4.0 and the new lifestyle of Society 5.0 in educational processes. Therefore, educational institutions need to carefully analyze the characteristics of education in Industry 4.0 and Society 5.0 in order to be able to provide quality, appropriate, and well-targeted educational services.

We agree with Maddikunta et al. [61], when mentioning that there are a series of challenges and open questions such as security, privacy, co-working of robots and humans in a factory, scalability, and skilled labor that must be addressed to better realize the Industry 5.0 concept in the near future. There is opportunity for new businesses, jobs, and companies focused on the balance between technology and human beings, with new economic, social, and environmental values. Education, teachers/educators, and educational institutions, as a basic support in the improvement of the quality of human capital and society's engine, have a great responsibility in the process of change and transformation. There is therefore a long way to go with everyone involved; students, teachers, educational institutions, and external entities.

We have verified that the literature allows us to prove that Industry 4.0 is the basis of the new Era 5.0, which has an influence on industry, society, and education, affecting and promoting the path of sustainable development. We can also see that based on the technologies of Industry 4.0 it is possible to develop launching pads for the progress of the 5.0 Era, with the support of Industry 5.0, Education 5.0, and Society 5.0—a “society of the future”. Thus, there is a need for greater strategic cooperation between governments, universities, companies, and the community in order to work together with a common objective, that is, to put the human being back at the center of innovation and technological transformation.

In short, we present several terms, definitions, and characteristics of the evolution towards Era 5.0 (Industry 5.0, Society 5.0, and Education 5.0), seeking to discuss the most promising applications to be developed and the path to a more humanistic and sustainable society. This work has some limitations as there are many challenges and opportunities of Era 5.0 that have not been analyzed, namely the use of other methodologies that would lead to other research gaps. Thus, future studies may seek to demonstrate, through case studies, the real contributions of different actors in society to a future society centered on human beings, social responsibility, and sustainable development, as well as to analyze whether industry and education, in particular, are moving towards close cooperation in favor of quality of life and economic, social, and environmental well-being, in accordance with the SDGs. This study can be carried out with an analysis of stakeholder perception in education and industry.

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