Logistics 4.0 and The Implication to Society 5.0

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Abstract. Logistics 4.0 is a representation of the Industry 4.0 paradigm of supply chain systems. Society 5.0 is a philosophy that complements Industry 4.0 and has the potential to revolutionize society for the common benefit of humanity. This new culture catalyzes social change, intending to have a significant effect on society at all levels, including quality of life and sustainability. The primary objective of this study to comprehend the relationship and the relevance of how emerging technology from Logistics 4.0 might lead to the organization of a new society termed 5.0. It is an argumentative study with a potential aspect that's focused on some recent literature. Logistics is a natural choice for some of the emerging approaches advocated by the Society 5.0 vision, and that is one of the sectors most likely to accomplish advances by data use. To pave the way for Society 5.0, the logistics sector, as a critical component of social infrastructure, must take a pragmatic approach to the implementation of cutting-edge technology that results in significant improvements in supply chain quality and complexity.

Keyword: Logistics 4.0; Society 5.0; Cyber-Physical Systems

1   Introduction

The lack of specific knowledge about what "thinking in category 4.0" can mean for the firm about real gains is at the root cause of the problem with implementing the logistics 4.0 principle in many businesses [1]. Therefore many firms face multiple sustainability to related threats in global logistics activities in today's diverse business world, and new technology solutions may help solve these problems [2]. Smart logistics, also defined as Logistics 4.0, emerged in 2011 intending to address evolving consumer demands and offering long-term logistics solutions [3].

Logistics 4.0 is a representation of the Industry 4.0 paradigm of supply chain systems, which also are increasingly linked into a channel and subjected to continuous control, and according to the theory of revolution 4.0. On the other hand, Society 5.0 is a philosophy that complements Industry 4.0 and has the potential to revolutionize society for the common benefit of humanity. This new culture catalyzes social change, intending to have a significant effect on society at all levels, including quality of life and sustainability. According to Society 5.0 "Recommending to expand the capacity of the individual-technology relationship in promoting the enhancement of the standard of life of all people through a highly intelligent society."[4]. Society 5.0 blends technology change with the ingenuity of various individuals to achieve sustainable growth by problem-solving and value creation, allowing it to fulfill the United Nations' current sustainable development goals [5].

This paper's primary objective is to comprehend the relationship and the relevance of how emerging technology from Logistics 4.0 might lead to the organization of a new society termed

5.0, as well as the collaboration between Logistics 4.0 and Society 5.0. It is an argumentative study with a potential aspect that's focused on some recent literature. As a result, it is a suggestion that aims to cooperate above all else to start this discussion.

2   Logistics 4.0

The key goal of Industry 4.0 is the rise of modern manufacturing, also known as the "smart" factory, which entails smart networking, automation, the versatility of industrial processes and interoperability, collaboration with consumers and suppliers, and the introduction of new business models [6]. The modern approach to manufacturing operations necessitates new logistical requirements. In this sense, a plan for a new Logistics 4.0 model is being presented more and more often in the face of the notion of Industry 4.0. Both words are inextricably linked. The operation and technological aspects of logistics 4.0 are also included (supporting the logistics using the latest IT solutions). To expand the philosophy of Industry 4.0, the latest strategy aims to improve the reliability and quality of logistics activities [7].

Researchers coined the term "Logistics 4.0" to describe the convergence of logistics with Cyber-Physical Systems (CPS) technical advancements. Logistics 4.0 falls together under the umbrella of Smart Services and Smart Products. The technology-driven methodology that was used to describe "Smart Products" and "Smart Services" is now being used to define "Smart Logistics." [8]. "Smart Logistics" is a logistics system that can improve reliability, adapt to industry trends, and get the enterprise closer to the needs of its customers. This would allow for better customer experience, performance improvement, potentially reduced inventory, and cost of production. Since "Smart Logistics" can evolve following real technological advancements, it is necessary to identify the current state of the technology [9].

The new system is the result of excessive usage of the internet, which allows real-time contact between humans and computers, as well as the use of modern digital technology. In our opinion the five major categories, an effective and powerful Logistics 4.0 would focus on and use the preceding technological applications are 1) Resource Management, 2) Warehouse Management Systems, 3) Transportation Management Systems, 4) Intelligent Transportation Systems, and 5) Information Security. To reach a high level of automation, the Logistics 4.0 model can be defined as the convergence of inbound and outbound logistics, which should be assisted by intelligent networks, integrated with applications and databases, from which specific knowledge is generated and exchanged by the Internet of Things (IoT) systems [8].

The principles and strategies for logistics are changing with Logistics 4.0. The Internet of Things (IoT) enables real-time data visualization and logistics flow automation through the integrated connectivity of physical things. The most pressing concerns around Logistics 4.0 revolve around investments (return on investment), the difficulty of information system connectivity, and a lack of sufficient skills [1].

3   Society 5.0

Japan expects to be the oldest society in the world by 2050, with over 40% of the population being over 65 years old [5]. As a result, Japan takes a bold step forward in advocating for future growth as a Civilization 5.0, with reforms affecting all facets of society as well as industrial activity. The Society 5.0 proposal is a strategic concept in Japan for human and social growth with an emphasis on sustainability. "A human-centered society that combines economic development with the resolution of social issues through a structure that strongly incorporates

cyberspace and physical space," Keidanren characterized Society 5.0. Taking a long view of history, the characterize Society 1.0 as groups of people hunting and gathering in peace and harmony with nature, Society 2.0 as forming a group based on agricultural farming, growing organization, and nation-building, Society 3.0 is a society that encourages industrialization and mass manufacturing through the Industrial Revolution, and, Society 4.0 creates more meaning by linking intangible properties across information networks. Society 5.0 is a knowledge society founded on the foundation of Society 4.0, intending to achieve a stable human-centered society [10].

The aim of Society 5.0 is to build a human-centric society in which people can experience a high standard of life that is completely engaged and happy, while still achieving economic growth and resolving social challenges [11]. Employment opportunities, government bureaucracy, people's security, and the industrial structure are all changing rapidly, and new information must adapt to meet these requirements [5]. The implementation of Society 5.0 must take into account the convergence of several aspects such as entrepreneurial skills, entrepreneurship, and development plan [4].

To address today's societal dilemmas, emerging technologies such as big data, robots, artificial intelligence, drone deliveries, and autonomous trucks can be used. Parallel intelligence is the defining characteristic of Society 5.0, in which existing artificial intelligence theories are applied to new cyber-physical-social systems (CPSS). Parallel intelligence allows for efficient handling of socially and engineeringly complicated problems, intending to identify agile, oriented, and convergent solutions to comprehend unpredictable, varied, and complex issues [12]. Even though this new perspective revealed policies and practices on a societal basis, such an effort is built on and heavily reliant on organizations as the most powerful institutions in modern society [13].

Society 5.0, which addresses numerous societal problems by integrating the technologies of the 4th Industrial Revolution (e.g., IoT, big data, AI, robotics, shared economy, and so on) into both business and social life, is the secret to achieving mid-and long-term development. "Extension of healthy lifespan," "Realization of connectivity revolution," "Creation of next-generation supply chains," "Building and growth of friendly infrastructure and towns," and "FinTech" were chosen as five strategic fields that can harness Japan's strengths and appeal to the rest of the world [11].

4 Results and Discussion

4.1 Logistics Transformations

Digital transformation is one of the most important prerequisites for Industry 4.0. Firms must lead the digital transition of their businesses to compete in the modern world, as digitalization has become a significant cause of improvements in the value chain. The "logistics transformation" or development of "smart logistics" solutions is facilitated by the digitization of logistics processes. As an outcome (product) of a logistics system, the impact and interaction between digitalization and logistics processes is a logistics service. Traditional logistics schemes use time and price (costs) as specific metrics for selecting logistics services (from the perspective of end-users) [14].

Logistics 4.0 is described in two directions: processual (supply chain operations are a focus of Logistics 4.0 activities) and technological (tools and technologies that support internal processes in the supply chains) [15]. To arrive at a consistent and broad interpretation of Logistics 4.0 by combining current concepts of logistics, Industry 4.0, and Logistics 4.0, three elements must be identified [3]: 1) The impact of a shift in manufacturing model to mass

production on logistics. 2) The use of emerging modern technology, such as IoT and CPS, to transform logistics procedures. 3) Environmental shifts are followed by the importance of people in their positions as employers, consumers, and other stakeholders.

The benefits of implementing the Logistics 4.0 model are labor savings, high standardization of connecting logistic functions to knowledge pieces, and the use of cutting-edge technology to equip logistic businesses. The drawbacks include high investment costs and the need to own an IT supply network [16].

4.2   Logistics 4.0 in the age of Society 5.0

Human capabilities are assisted to suit the environment rather than adapting structures to fit humans, including the fact that certain technical possibilities are useful in easing human work. From a human-centric viewpoint, a device architecture perspective on human skills could reveal insights into how Logistics 4.0 could be constructed. This is in line with the labor shortage, as well as population shifts and their implications for logistics networks.

Digital transformation has had a significant effect on traditional businesses, as well as heightened societal uncertainty, and certain detrimental effects of a digital environment, such as security challenges and privacy concerns, are now becoming evident. The Japanese society anticipates the forming of a Super Smart Society, with the development of a sustainable society in which different types of principles are linked through CPS and people, can live in safety, protection, and convenience. An intelligent society is a community that makes use of the ability to emerging technologies, digital instruments, and networks to change people's lives. [11]. The core strategies of Society 5.0 are based on the concept of automation, which is the next step in the evolution of artificial intelligence technologies as well as the overall framework for managing and controlling Cyber-physical social systems (CPSS). [12].

Fig-1 describes the relationships and relevance of Logistics 4.0 and Society 5.0 to explaining the human-centric construction. According to the application of the Industry 4.0 model and the application of CPS, resource planning management practices would improve total efficiency, resilience, and agility through supply chain shifts. Throughout the Internet of Things, the level of complexity expected would rise dramatically, as will the degree of specialization of human capital. The implementation of "smart" management through the effective adoption and application of Warehouse Management Systems (WMS), which will turn warehouse practices into future inbound logistics needs following the Industry 4.0 framework. The implementation of the Industry 4.0 model would result in significant improvements in how warehouses operate today. A Transportation Management System (TMS) is a component of transportation logistics supply chain management (SCM, which allows an Order Management System (OMS) to communicate with a fulfillment center (DC) or a warehouse. A TMS system allows an organization to use GPS technologies to reliably identify its vehicles when on the track, control freight traffic, communicate with carriers, consolidate shipments, and engage with Intelligent Transportation Systems (ITS). Transportation administration, regulation, facilities, processes, regulations, and control mechanisms are all interconnected in the Intelligent Transportation System which is new technology such as computing hardware, positioning systems, sensor technologies, networking, data analysis, simulated operation, and preparation techniques are adopted. The advent of cloud-based technologies, the Internet of Things (IoT), Big Data, Industry 4.0, BYOD (Bring Your Own Device) and CYOD (Choose Your Own Device) developments and the explosion of internet-based apps all transformed the way companies operate. Users, on the whole, are willing to embrace emerging technology regardless of their intrinsic security flaws if the advantages outweigh the risks[8].
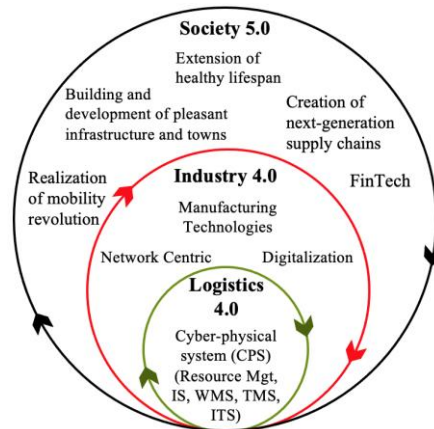
Figure 1. Logistics 4.0 and Society 5.0 relationship and relevance
(Source: author own elaboration)

The relationship to Society 5.0 will be led by logistics innovations driven by Business Process re-engineering (BPR) and cutting-edge technology. RFID and other IoT systems have improved logistics awareness, and real-time knowledge exchange has improved supply chain coordination and optimization. Sharing and mutual use of containers, bins, and recycled delivery boxes; balancing logistics company tools with shipment needs. Logistics processes that save time and resources using autonomous vehicles, cargo ships, robotics, and other technologies. Discovery of future consumer demands and collaboration with manufacturing and distribution to create new value. Reduction damage to the environment with next-generation vehicles (EVs, FCVs, and LNG-fueled ships); accelerated catastrophe intelligence processing with IoT, drones, and other technologies [17].

5 Conclusion

The Keidanren unveiled Society 5.0 in 2016 as a sustainable vision of a modern society that integrates many innovations in all sectors and social practices and achieves both economic growth and solutions to major social challenges in the current society, largely focused on sustainable development priorities developed by the United Nations [10].

Logistics is a natural choice for some of the emerging approaches advocated by the Society 5.0 vision, and that is one of the sectors most likely to accomplish advances by data use. To pave the way for Society 5.0, the logistics sector, as a critical component of social infrastructure, must take a pragmatic approach to the implementation of cutting-edge technology that results in significant improvements in supply chain quality and complexity.

The study focuses on Logistics 4.0 and Society 5.0, which is a relatively recent research subject, and we have looked at some key connections, such as the social impact of developing Logistics 4.0 technologies. The study did not take into account longitudinal evidence and analyzing the recent literature only. Future research should be conducted to clarify the degree of engagement and coordination needs for CPS and smart networks since human employees play such an important role in the preparation and control of Logistics 4.0.

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