# COMPARATIVE ANALYSIS WITH INDUSTRY 4.0 AND 5.0 WITH SUPPLY CHAIN MANAGEMENT


## ABSTRACT

The main objective of the research is to clarify the significant differences between Industry 4.0 and Industry 5.0 and to demonstrate why the latter is the superior option. In its infancy, the Industry
4.0 phenomenon poses major obstacles to all existing business models and accelerates the need to rethink and digitize operations. The literature on supply chain management was also offered, but as we will see, the Smart supply chain is not advancing the processing of industry 4.0 and its capabilities are in their infancy. However, the relatively recent phenomenon of Industry 5.0 seems to be a more accurate, efficient, and time-saving option for the future of supply chain management in a globalized world. To gather data from the existing body of knowledge on this topic, a systematic literature review methodology was used. The results have shown that the supply chain sector is unprepared for Industry 5.0 approaches.

Based on the essential characteristics of Industry 4.0, the supply chain, and the growing body of literature addressing disruptions to Smart SCs, this research employs a narrative literature approach to provide an integrative framework to shed light on Smart SCs and their blind spots. The four (4) pillars of Industry 5.0 industry strategy, innovation and technologies, society and sustainability, and transition issues were recommended to serve as the basis for the emerging Supply Chain 5.0 framework and accompanying research agenda. Industry 5.0 is still in its infancy and in a great position. Due to the paucity of relevant literature, it is anticipated that this study will generate an abundance of new ideas and conclusions.

**Keywords:** Industry 4.0, Industry 5.0, Society 4.0 And 5.0, Smart Supply Chain, Technological Development, Application, Impact And
Benefits, Digital capabilities, Smart supply Network And Future

# ENDÜSTRİ 4.0 VE 5.0 İLE KARŞILAŞTIRMALI ANALİZ TEDARİK ZİNCİRİ YÖNETİMİ

## ÖZET

Bu çalışmanın temel amacı, endüstri 4.0 ve endüstri 5.0'ın temel farklılıklarının neler olduğunu ve endüstri 5.0'ın neden tercih edildiğini

sunmaktır. Başlangıçta Industry 4.0 fenomeni, tüm geleneksel iş modelleri için benzeri görülmemiş kesintiler getiriyor ve faaliyetlerin yeniden tasarlanması ve dijitalleştirilmesi ihtiyacını hızlandırıyor. Bu bağlamda, tedarik zinciri yönetimi ile ilgili literatür de verildi, ancak

Akıllı tedarik zincirinin daha fazla proses endüstrisi 4.0'a nasıl kötü bir şekilde başarısız olduğunu göreceğiz, ayrıca yetenekleri erken aşamalardadır. Öte yandan, on yılı bile tamamlamayan Endüstri 5.0 fenomeni, tedarik zinciri yönetimi bağlamında dünyaya gelmek için daha önceden hazırlanmış, zaman tasarrufu ve verimli bir seçenek olarak geliyor. Bu temayla bağlantılı mevcut bilgilerden kanıt elde etmek için sistematik bir literatür inceleme yöntemi kullanılmıştır. Sonuçlar, tedarik zinciri alanı için Endüstri 4.0 ve Endüstri 5.0 yaklaşımları arasında güçlü bir boşluk olduğunu kanıtlamıştır.

Bu makale, ana Endüstri 4.0 öğelerine, tedarik zincirine ve Akıllı SC aksaklıklarına ilişkin ortaya çıkan literatüre dayanan bir anlatı literatürü yaklaşımı kullanmaktadır, Akıllı SC'lere ve boşluklarına ışık tutmak için bütünleştirici bir çerçeve oluşturmak. Endüstri 5.0'ın dört ( 4 ) yapısı: Sanayi Stratejisi, Yenilik ve Teknolojiler, Toplum ve Sürdürülebilirlik, ve Geçiş Sorunları, yeni Tedarik Zinciri 5.0 çerçevesinin ve araştırma gündeminin temeli olan tedarik zinciri bağlamıyla bir uyum önerildi. Endüstri 5.0 hala embriyonik ve ideal bir aşamadadır. Literatür azdır ve bu çalışmada diğer birçok kavram ve keşif ortaya çıkacaktır.

**Anahtar kelimeler:** Endüstri 4.0, Endüstri 5.0, Toplum 4.0 Ve 5.0,  Akıllı Tedarik Zinciri,Teknolojik Gelişme, Uygulama, Etki Ve Faydalar,  Dijital Yetenekler, Akıllı Tedarik Ağı Ve Gelecek.

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# CHAPTER 1

# 1. INTRODUCTION

The main focus of this paper is on discussing the newest Industrial Revolution and its effects on the way we handle supply chains today. The first part of our literacy review will focus on the first three industrial revolutions: the ones that mechanization, electricity, and information technology brought about. Now, as we will see in the next sections of the literature, the fourth industrial revolution is being ushered in by the entry of the Internet of Things and Services into the production environment. In addition, this research demonstrates the identification of key enabling technologies constituting fundamental capabilities in support of conventional supply chain methods. Several SSC enablers have been discovered in the literature; however we have only chosen those technologies that have been shown to have a connection to SSC.

## 1.1 Purpose of Study

We uncover why the fourth industrial revolution has research gaps as we go further. Until then, we will study I4.0's good results, which include the following: Recent advancements in networking, machine learning, data analytics, robotics, 3D printing, and other technologies are reducing our dependence on human labor and decisionmaking, to the advantage of industrial processes. The use of digital solutions in manufacturing provides a number of advantages, such as the reduction of human error, the acceleration of product creation and distribution, and the quicker adaption of production processes to new data. "Smart Factories" allow employees to make decisions based on data and even perform tasks autonomously. Smart factories are able to mass produce products while remaining nimble enough to profitably create small-batch products based on individual customer specifications, all thanks to machine-to-machine communication that enables them to track products with pinpoint accuracy as they pass through the facility, using sensors to record progress and collect valuable data. In addition, they can react swiftly to events, such as a change in suppliers that may otherwise disrupt production. This primer will expose you to the core concepts and technology behind Industry 4.0.

## 1.2 Key points of the study

But before we get to it, let's go back and discuss how this problem began. When did the fourth industrial revolution begin, and why is it called Industry 4.0? Once we've explored the principles of industry 4.0 in full, we'll go into the large picture of industry 5.0 and its eventual implementation architecture. If industry is to realize its full potential as a source of true prosperity, social, environmental, and societal issues must play a significant role in defining its core purpose. Socially and ecologically responsible innovation not only helps investors, workers, consumers, society, and the environment, but it also enhances the company's bottom line. In chapter 5, we'll take a high-level look at the numerous pillars (including IoT, cyber security, virtual reality, BI, augmented technologies, cloud computing, and many more) upon which the success of i4.0 and I5.0 rests. After doing extensive study on I4.0 and I5.0, we will clarify the famous saying "Industry 4.0 Today, Industry 5.0 Tomorrow" by comparing the two technologies and emphasizing their different strengths and limitations. We cannot disregard people till the end of the world; thus, recognizing these disparities will assist us in selecting the greatest solution. After discussing their distinct core ideas and distinguishing characteristics in chapters 5 and 6, we conducted a brief comparison of both technologies in chapter 7. The meat and potatoes of the study are now presented and explained in Chapter 7: the difficulties and limits of industry 4.0 as they pertain to supply chain management. There is currently a shortage of digitalization-related material in the scholarly literature. The discrepancy between I4.0 and I5.0 has contributed to confusion. To reassure the public that technology is not at an end, we will examine the approach, strategies, and implementation of this cutting-edge alternative in the next chapter. This chapter will be considerably more in-depth than normal since we must illustrate why the smart supply chain system offers more commercial value than industry 4.0. Our major emphasis is on implementing supply chain management utilizing these two technologies; hence, we will undoubtedly discuss the mechanics, strategy, and applications of intelligent supply chain management. ERP is becoming more prevalent and high-tech software not only in the industrial sector, but also in other sectors; thus, I included it in my report despite the fact that we have a multitude of software's and a mountain of techniques to solve this issue. The last two sections consist of a summary and a list of references. In the final chapter, "Conclusion and Future Work," we will elaborate on Society 5.0, which is centered on the use of ever-improving technologies and the stoked innovation of Industry 5.0 to address global challenges such as ageing populations, natural disasters, societal disparities, safety, and the enhancement of quality of life. Drone deliveries, artificial intelligence, big data, autonomous trucks, and robotics are all promising technologies that will need to be integrated into society in the near future for people to benefit from them.

# CHAPTER 2

# 2. LITERATURE REVIEW

The fourth industrial revolution served as the context for the development of cyberphysical systems. Integrating operational, communication, and statistical technologies into the organization's and the supply chain's (CPS). At first, it was predicted that artificially intelligent machines and autonomous robots would displace workers. The fast advancement of contemporary technology gives rise to a new ideology, which causes a societal change that has an impact on many areas, including business, technical standardization, security, education, law, technology, and research, the labor market, and the social apparatus as a whole. (al).

Industry 4.0 is taken into consideration the important thing to ensuring more efficiency and flexibility for production corporations in the destiny (Hofmann E., 2017). It has grown to be a fundamental a part of human life and served as an accelerator of manufacturing procedures and concepts, together with a virtual manufacturing unit in the direction of which production engineering and related branches will pass (Faller C., 2015).

The transition of the industrialization process from I4.0 to commercial I5.0 has been driven by the need to emphasize the role of humans in cyber-physical structures (CPS). The outcome might be an innovative company plan that invites people to collaborate with cutting-edge technology. The phrase "human cyber-body gadget" describes the emerging paradigm for designing the factories of the future (HCPS).
(Longo, Padovano, & Umbrello, 2020).

Nevertheless, digital business, globalization, utilization, client centricity, and other business parameters make certain companies' ongoing development, transition, and transformation. The Company to be able to find and expect destiny traits and the related changes want are defined as Innovative and could be triumphant in the next step of the industrial Revolution. Organizations need to keep in mind this possibility within the context of this record, the studies evaluation the prevailing transformation status of industry 4.0 within distinct industries however with the concept of a wise factory might be discussed under the supervision of SCM and smart SCM later. Furthermore, the scientific information base and befell commercial enterprise values of the enterprise I4.0

are analyzed, which incorporates all of the center components of industry 4.0, along with huge statistics analytics, which matches on the idea of great volumes of records to enhance efficiency and productivity. Combining it with large facts analytics and independent robots protecting place production, logistics, e-commerce, and education. Inside the future, its miles anticipated that these robots may be more low-budget and will have a broader variety of competencies than the ones used currently. In response to the possible issues connected with keeping AI data in on-chip structures and memory, information technology (IT) and robotics inventors have invented cloudcomputing, which backs up and stores massive amounts of real-time data in faraway data centers. The use of a virtual model provided by data processed and collected from big data and cloud systems to analyses all possible outcomes connected to product design, development, production, and SC network using a simulation commercial business model is an invention of the fourth commercial revolution. The Internet of Things is the most important component of Industry 4.0. (IIOT). (A commercial internet of things) The Industrial Internet of Things platform may function as a centralized manipulation machine with which only certain devices and systems may connect and interact. Using distributed analytics and decision-making, the IIoT provides real-time tracing and tracking. The layer-by-layer construction of three-dimensional objects is a characteristic of additive manufacturing and three-dimensional printing. In a smart factory, augmented realities are not the only option for decision-making; business intelligence can do the job just as well. Cybersecurity is critical to I4.0 buildings' long-term sustainability and is a critical component of the process.

Supply chain management was often required in addition to the technical pillars of Industry 4.0. Despite this, research suggests that some smart factories have totally ignored the traditional manufacturing tasks of logistics and supply chain management, allowing organizations and factories (both big and small) to become fully self-sufficient. Modern digital SC networks use a wide range of technologies to optimize SC operations including as new product development, production, procurement, planning, logistics, and advertising. Industry 4.0 is already influencing the specialized levels of SCs and supply chain management in general (SCM). Smart Supply Chain is a business version 4.0 features that protects the virtual platforms that connect suppliers, retailers, customers, and partners. Despite the widespread belief that industry 4.0 technologies cannot impose their alternatives on people and must instead be supported, increasing information sharing and synchronization of operations among SC partners can help to reduce overall costs while also increasing the efficiency and agility of SCs as a whole. This book provides firsthand accounts of how operators integrate into Industry 4.0. (Romero, Noran, Stahre, & Bernus, 2015).

The research recorded the prevailing transformation problems to get in mind as classes learned for the transformational technique to industry I5.0. The studies mythology consists of a theoretical and speculation-based totally idea which could have distinctive answers within the destiny by using mathematical system.

The humanization of the constructed technological environment for enterprise 4.zero was one of the first factors within the evolution of industry 4.0 towards enterprise 5.0. Similarly to the human factor, authors have mentioned studies gaps in sustainability, obligation, protection, and other problems in the enterprise I4.0 concept. To guide the advantageous commercial benefits and evolution to industry 5.0, the analyzed troubles of I4.0 and existing opportunities are taken into consideration.

## 2.1 Industrial revolution

In manufacturing and industry, the phrase "industrial revolution" refers to a period of profound change brought about by the introduction of innovative new technology. In 1784, a machine was driven by water and steam, marking the beginning of the industrial revolution 1.0, which continued until the arrival of electricity, steel, and the notion of mass production in 1870. Because of this, several game-changing innovations were made, such as the air brake, the aero plane, the steel mill, the telephone, and the electric light. Electronic automation, computers, and the inventive digital industrial revolution commonly referred to as "industry" may have facilitated massive mass production supports during a revolutionary period, which may have sparked a global upheaval.

Production in today's industrial sector is driven by global competition and the need to rapidly adjust output to meet the ever-evolving needs of the market. An industrial revolution has taken place. The technological aspects of these demands were met by the implementation of the basic concepts of Cyber-Physical Systems (CPS) and industrial Internet of Things (IoT) in industrial production systems, therefore integrating the real world with the digital one. A breakdown of the existing manufacturing system's evolution through the stages of the shift from manual labour to Industry 4.0. Around the turn of the century, advances in machine control and machine-like capabilities sparked the first mechanical rebellion.

It influenced the transition from hand-crafting textiles to the first forms of mass manufacturing. Better living conditions were a driving factor in the shift. Exuberance for machine control and mass production led to the second mechanical rebellion. Henry Ford's reflection on the journey of the Ford T-Model may be clearly reflected in the building's design. They rightly depict the beginning of mass production, but they rule out the potential of product customization by saying, "You may have any colour, as long as it is black."

The advent of integrated computer circuits ushered in an era of industrialization and digitalization, both of which had a role in triggering the triennial mechanical shift. The ability to make a specific product on adaptable result lines using programmable equipment is a big help in the manufacturing sector. (Rojko, 2017)

Industry 4.0's "Execution system" is based on the interconnected CPS components, which originated in the fourth industrial revolution and gave birth to the concept of machines and systems inside the plant. The basic idea is quickly presented using a simple case study: There is no need for human intervention if two machines in a plant each have sensors that detect when the other machine is malfunctioning. A machine can think and make a decision just like a human. If two factories are connected in this way, the overwork at one may theoretically be transferred to the other. The equipment and machinery in question might be managed from afar with the use of technological devices and smartphone applications. Industry 4.0 is the next phase of the industrial revolution, which involves

The use of ICT and operational supply chain management systems to facilitate the intelligent networking of industrial gear and processes. The significance of this new science for technical result schemes lies in the fact that it enables for the transition from rigid hierarchical computerization arrangements to a self-arranging high-tech tangible result method that permits adaptable bulk rule outcomes and elasticity in result part.

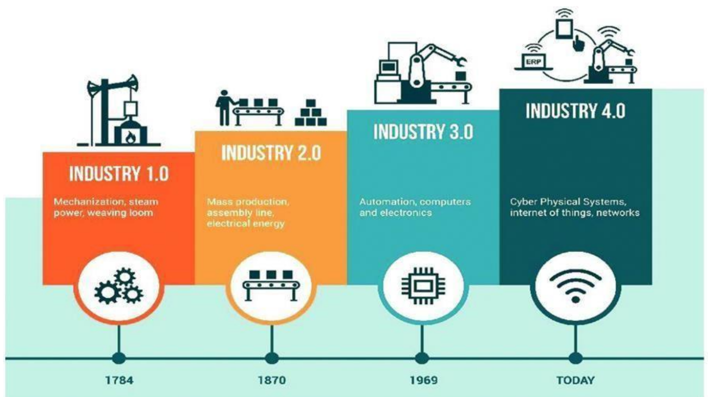


**Fig 2.1:** Stages of Industrial

## 2.2 Basic idea of I.4.0 with SCM collaboration

Cooperative smart for industry 4.0. A manufacturing plan that can be changed mathematically is the central process. A recent development in the development of a production scheme is reconfigurable production schemes. As a first stage, result lines were produced to go along with the robots' laborious efforts at differentiating jobs so that a single brand may be created. A responsive outcome layout was the next stage. Accompanying programmable machines that permitted the output of diverse goods but did not exhibit any degree of adjustability in the output capability

As a consequence of the new expansion, there are intelligent manufacturing schemes that can be reconfigured to match their fittings and operating system components to address changing retail needs for product kind and volume. Cyber-

Physical Systems, which are material systems that have been connected with ICT components, are machines associated to the manufacturing 4.0 workplace. They are autonomous systems capable of drawing their own judgments based on scientifically proven machine intelligence algorithms, physical-time dossier acquisition, and logical analysis outcomes, and previously recorded lucrative behaviors. Programmable machines (CNC and NC) are often used, along with a large number of mobile devices and androids that can add and subtract themselves. Products in a particular workshop are more "smart," accompanying embedded sensors that mean they collect secondhand real-time data over a Wi-Fi network for geolocation, for weighing quantity states, and for atmospheric settings.

Once again in charge and in possession of power is smart production. As a consequence, they may control the results in a procedural manner and even manage or improve the result system that affects the ruling class. Additionally, intelligent production are deserving of paying attention to their own condition throughout the whole biological clock, which contains throughout their career or request. This permits enthusiastic, condition-located perpetuation, which is especially important for goods included into the finest plans (such as capacity Converters in energy grids). In Industry 4.0, the outcome fundamentals have a dossier object, which is to say that they are stored in the data cloud, next to their physical likeness again in essence correspondence.

Such communication may, in essence, include information about the crop in the form of papers, 3-D models, personal identities, current rank dossiers, historical data, and calculation/test dossiers. Interoperability and relatedness are also key components of the Industry 4.0 concept.

The designs and components, Machine-To-Machine Interface (MMI), manufacturing units, and players who acknowledge potential are all at the center of an endless stream of news.

Thus, with the Industrial IoT, the machines, plants, and branches may connect and correlate (mainly established Wi-Fi network). Another key point is that Machine-toHuman Interface (HMI) collaboration is crucial since it has the potential to enhance reality environments and teleoperations. Supplement manufacturing, similar to 3D publishing, is usually noted all at once as one of the essential sciences in the Industry 4.0 production electronics. A direct mathematical fiber may be positioned from design to outcome when used in conjunction with rapid prototyping plans that include 3D forming, making the transition from the plan to production easier. There are still some new textiles that need to be anticipated growing further all process headed toward, and supplement manufacturing procedures are still unable to consistently attain the same sort as a common current process. For management and delivery before a resolution process is focused on the best possible in the computerization monument, it supports place they review the process preparation and prove to ERP consultant or Supply chain expert. A good query is enhanced if there is a lack of customer satisfaction while not delivering an on-time transfer, and the majority of appropriate ERP replies do not allow quick compliance in result preparation. (Rojko, 2017)

## 2.3 Background and Origin

In 2011, a larger audience was first introduced to the phrase "Industry 4.0." With the workout tips for the Industry

4.0 project and the aftermath of the plank Industry 4 incident. The projects received additional support. First, this was further supported by workout models and promotional campaigns on a national and international scale. The occurrence of mechanical results, similar to the Industry 4.0 strategy, has persisted in countries like the USA, China, Japan, France, and at the EU level, leading further the German-expressive nations (zhong, 2017).

With Industry 4.0, a wide range of objectives are roughly related within the framework of the intended "two-fold technique”. In order to position domestic manufacturing as the primary bearer of networked intelligent production, creative production and commodity-familiarization tasks must be carried out on an individual basis (Schmidt R., 2015). However, the strategy encourages visitors to use these innovative Industry 4.0 sciences into their profit- adding operations in the interim and therefore create a better presentation for the mechanical application of the new resolutions. (Schlund & Ferdinand Baaij, 2017).

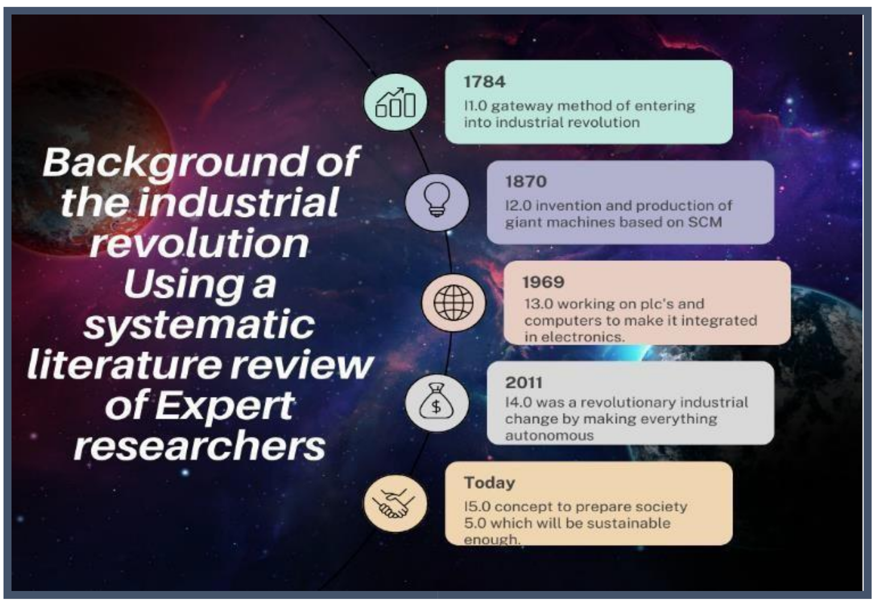


**Fig 2.3:** Pictorial Time-line of Industrial Revolution

### 2.4 Descriptive overview of background Industry 4.0:

The emergence of information and idea sciences and their integration into industry (Dalenogare, 2018). Industry 4.0 as a whole necessitates the development of foundations and/or architectures for combining physical assets and mathematical sciences into a high-tech-physical whole (CPS) (Sarvari, 2018).

The Fourth Industrial Revolution includes the internet of things (IoT), often known as the mechanical IoT (Haddud, 2017).Along with IIoT, other significant electronics, including cloud computing, artificial intelligence (AI), CAD/CAM, enterprise resource planning (ERP), programmable logic controllers (PLCs)., androids, sensors/actuators, additive manufacturing, imitation, and other cutting-edge models of dossier exchange, are crucial to the digitalization of supply chains (Gunasekaran, 2016).

Automated technologies that are a part of Industry 4.0 provide personalization, dexterity, and speed in production and service operations by sending data from multiple devices, sensors, and finishes.

This encourages new developments in a variety of fields, including new product design, prototyping and growth, remote control, aids and illness, forecasting and preventive maintenance, traceability, unavoidable strength monitoring structures, readiness, invention, deftness, and applications for particular occasions (Strange, 2017).

All stakeholders may gain a lot from Industry 4.0 capabilities, which include customized production, real-time dossier analysis, enhanced perceptibility, independent monitoring and control, vital brand design and growth, and increased productivity.
(Dalenogare, 2018).

The dialogue at the powerful implementation and use of enterprise 4.0 technology is ongoing. On the equal time, a new fashion of the 5th commercial revolution is emerging, going past the manufacturing of products and services for profit. Industry 5.0 brings a brand new appearance to the industry and requires absolutely everyone to trade their minds and behaviors.

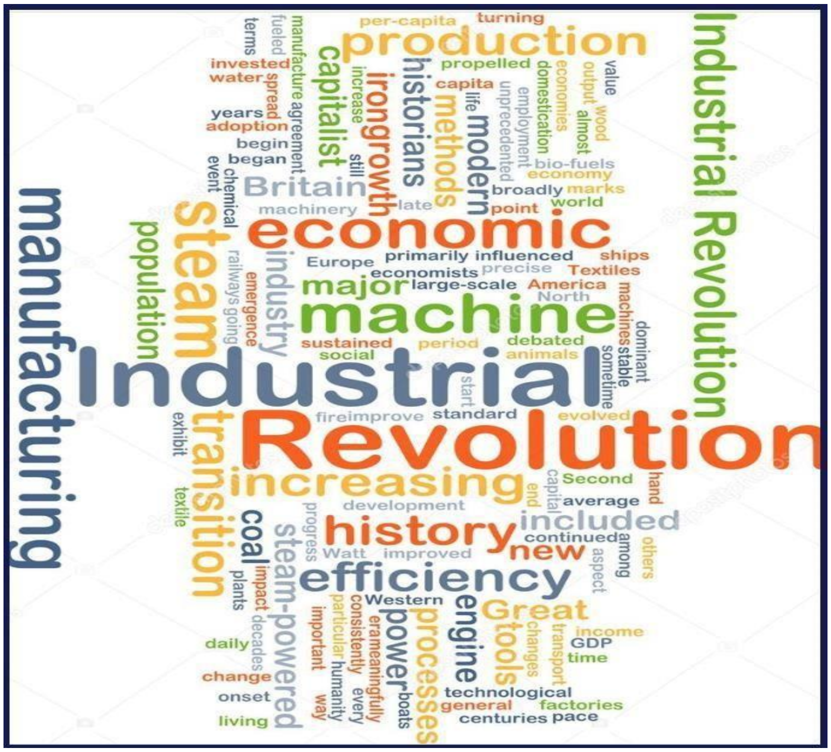


**Fig 2.4:** Effective Dominant Impressions in visual gig description of IR

There are four fundamental and characteristics mainstays of I.4.0.  Digitalization and unification of level and upright worth chains Digitization and unification of upright processes takes place across the arranging, from produce happening, buying, administration, production, management and aids. Vertical processes will be connected accompanying level one inside allied methods that will able to have or do put oneself in the place of another changeful demand for production and duties according to schedule. Horizontal unification is related accompanying suppliers, consumers and additional key.

All data on movements and process preparation maybe acted in actual time for action or event, and utilizing the support of extended real world is possibly the continual addition of result processes.

- Digitization of amount and duties presented

There will be supposed smart output fated in near future particularly capable of being traced and localizable. The digitization of amount is established expanding. The existent device, for instance, by accumulating smart sensors or ideas tools that maybe secondhand accompanying science of logical analysis dossier forms, and on designing new digitized crop that are mean to a completely joined answer. By merging new forms to accumulate and resolve data, guests are intelligent to acquire facts about the use of the amount, that will not only experience allure record and current rank, But likewise alternative habits to better the brand to meet the increasing needs of aim clients. This habit, associations will set pressure on customers expected bendable and Produce tailor-made production in an approximately brief time period. It will help (SW), place in essence prototyping will be likely –that is in essence designs not only of production, but again of result wealth and processes.

- Digitization of trades and approach to consumers

  These sciences are being secondhand previously contemporary. This mainstay is approximately had connection with the Internet of Things (therefore refer to as IoT), and the Internet of Services (IOS). In the client sector, for instance Customer Relationship Management (CRM) plans area secondhand that mix public networks and data reasoning, particularly in buying. Social networks and applicable news connected to the internet have raised client demand for childbirth speed and merchandise kind.

- Customers on friendly networks judgment

  With possible choice, guest fruit and supply reviews offered duties through Internet shopping offers an expansive sort of fruit, containing attire, Convertibles, travel, commercial aids, enrollment, televisions, etc. If parties do not pass this current and do empty the space to correspond accompanying consumers thus, skilled is an excellent risk from the view point of the connection accompanying all or old fashioned shopping. (Poór & josef basl, 2018).

## 2.5 Industry 5.0:

The phrase "Industry 4.0," which was originally used in Germany in 2011 as a future project and part of the country's high-tech strategy to be broadly recognised by industry, science, and decision-makers, is the origin of the term "Industry 5.0." Its origins may be attributed to an analysis of the nation's accomplishments in the first decade of the 21st century and estimates for future productivity improvements that will permit a largely stable workforce. Its principal objective was to meet the specific ecological requirements of "green production" in a carbon-free, energy-efficient business sector. The German Academy of Engineering Sciences (Acatech) proposed a research agenda and implementation ideas in 2013 based on the "National Roadmap Embedded Systems." The Federal Ministry of Research requested this (BMBF). The Internet of Things (IoT) will have an impact on the management of production and a new generation of digital manufacturing applications was described. Industry 4.0 would be implemented by "the industrial outfitter of the world," according to Deutsche Bank (2014). Professor Klaus Schwab, creator and executive chair of the World Economic Forum, has authored two booksviiix comparing the fourth industrial revolution, or Industry 4.0, to past industrial concepts that predominantly emphasized technical improvements. Think tanks, business leaders, international organizations, and policy authorities are just some of the numerous entities that have used this word in fresh situations. Countries with mature economies and significant industrial sectors, like as China, have already recognised its potential advantages. The "Made in China 2025" initiative draws inspiration from "Industry 4.0" with the intention of revitalizing the country's manufacturing industry and allowing a smooth transition. Industry 4.0 has existed for a decade, during which time it has switched its focus from its initial goals of social justice and sustainability to digitalization and AI-driven technologies that boost production efficiency and flexibility. Industry 5.0 presents a new viewpoint, emphasizing the importance of research and innovation in allowing industry to serve people sustainably over the long term, within the planetary boundaries. Society 5.0 and Industry 5.0 are both concerned with the transition to a new social and economic paradigm, and are hence related concepts. In 2016, Keidanren, the biggest Japanese business organization, unveiled the concept of Society 5.0.

Since then, the Japanese government has lobbied for it. Japan successfully raises the digitization and transformation components, which are often positioned at the level of specific companies and parts of society, to that of an all-encompassing national transformational strategy, policy, and even philosophy. According to the "Communities" thesis, how people provide for themselves is crucial to how they organize their societies. The time necessary to attain the number "5" differs significantly from that of industrial revolutions. Both the first and second "Societies" may be dated back to pre-industrial eras (throughout the 18th century) and can be linked to hunting-andgathering economies and agricultural economies, respectively. Civilization 3.0, an industrial society, essentially coincides with the periods of the First and Second Industrial Revolutions, as well as the beginning phases of the Third Industrial Revolution. The "information" era, also known as Society 4.0, may be dated to a highly digitized version of the Third Industrial Revolution and continues to the current day. In Society 5.0, an attempt is made to find a balance between economic expansion and the resolution of social and environmental problems. Merging the actual and virtual worlds, this idea addresses bigger social issues. Society 5.0 employs advanced information and communication technologies, the Internet of Things, robots, artificial intelligence, and augmented reality not just for profit but also for the benefit and convenience of all members of society. Our definition of Industry 5.0 encompasses the work of others as well as our own unique concepts and hypotheses. The first component is an examination of the fast changes in European and worldwide society. While advanced globalization has increased global prosperity, it has also worsened local disparities, made value chains for crucial commodities and infrastructure more susceptible, and led to an increase in the overexploitation of natural resources and environmental degradation. Without technical improvements such as increased automation, digitalization, and networking, these transformations would not be conceivable. In 2009, just one technology company (Microsoft) was among the top 10 publicly traded firms (by market capitalization); in 2019, the top five were all technology companies. This is only one illustration of the meteoric growth of digital technologies (Microsoft, Amazon, Apple, Alphabet and Facebook). The development of increasingly complicated AI, which is attracting significant investments from across the world, will further solidify and accelerate this trend. While modern technology has enhanced many facets of life, they also pose threats to people's safety, liberty, and democracy. The largest companies and their market capitalizations are shown in the graphic below.

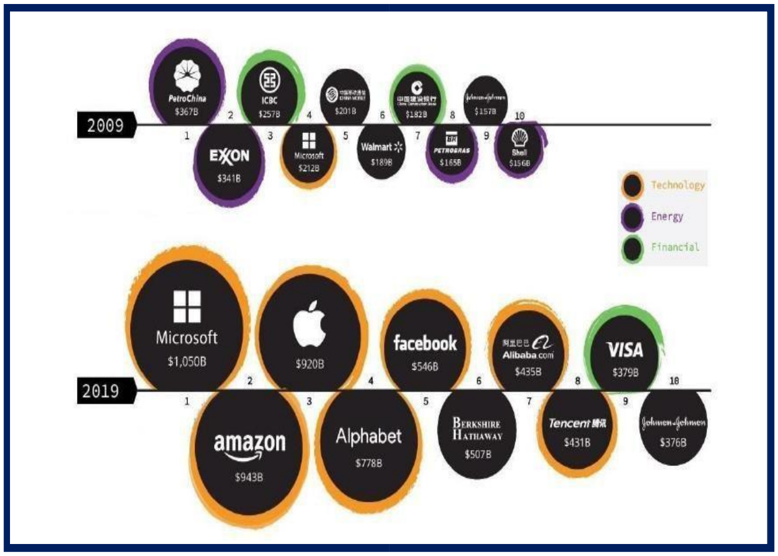


**Fig 2.5:** A picture from visualcapitalist.com

Our vision must also take into consideration the current policy climate at the European level, which tries to better identify and direct these ongoing changes in order to maximize their benefits for European society while minimizing the hazards they pose. This is reflected in two of the top priorities of the European Commission: the "Green Deal," a comprehensive strategy to make Europe climate-neutral by 2050, and a "Europe Fit for the Digital Age," which aims to increase technological innovation in Europe by introducing new and updated rules for technology and the digital economy. Both the European Data Strategy and the recently published White Paper on artificial intelligence regulation demonstrate how seriously the European Commission takes the societal effects of digital technologies. The real rate of digital technology adoption in European businesses has a substantial impact on our hypothesis. Although it has been argued that digital technology is expanding rapidly and becoming more disruptive by the day, European businesses seem to be adopting a more controlled approach to digitalization. Current adoption of digital technology in European industry is linear as opposed to exponential and gradual as opposed to disruptive. This is due to the need for major infrastructure expenditures in some industries and the proliferation of smaller firms (lacking digital skills or investment ability) in others. Europe's industrial scene is technologically diverse, ranging from advanced automated assembly lines to small businesses that still utilize paper rolodexes to follow consumers.

It is reasonable to be concerned that Europe's industrial competitiveness may deteriorate if additional funds are not allocated to research and development. This is why the European Commission's top objectives include investing money on cuttingedge technology, such as the Europe Fit for the Digital Age programme and the Green Deal. The European Research Area and related policy initiatives are intended to expedite the adoption of cutting- edge technology across Europe's many regions and municipalities, ensuring that they are beneficial to the economy and society. On the other hand, it is likely that the lack of mainstream acceptance of developing technologies such as artificial intelligence is attributable to the fact that their prospective applications have not fully crystallized or are still being conceptualized using old frameworks. Technologically, Industry 5.0 seeks to comprehend the promise of advanced digitalization, big data, and artificial intelligence by emphasizing the role these technologies may play in satisfying rising requirements in the industrial sector, society, and the environment. This involves deploying technology that adapts to the worker, as opposed to the worker adapting to the technology, and applying technology for circularity and sustainability via the use of data and AI to increase production flexibility during disruptions and make value chains more resilient.

Our vision for Industry 5.0 was shaped in part by earlier studies done or commissioned by the Directorate-General for Research and Innovation of the European Commission. Specifically, the research by the Radical Innovation Breakthrough Inquirer (RIBRI) is useful for detecting future technologies since it identifies 100 possible innovation breakthroughs in fields such as AI, robotics, and biomedicine and suggests how the EU should prepare for them. At a high-level seminar entitled "Research and Innovation as a Compass for the Future We Want," held in May 2019 in collaboration with the Jacques Delores Institute, key insights on how research and innovation can be a driving force for the transition of European society to a sustainable future were shared. Finally, we have examined the results and effects of research programmes financed by the Research and Innovation Framework Programme of the European Union. Even if they don't utilize the term "Industry 5.0" per se, a number of Horizon 2020-funded initiatives have provided evidence and further guidance on the transformative elements pertinent to Industry 5.0. The objectives of these efforts go beyond the potential efficiency and economic gains that digitalization and increased automation might bring to enterprises, distinguishing them from the objectives of the Industry 4.0 programme. They address difficulties associated with effective humanmachine interaction and talent matching, and they develop solutions that make manufacturing more durable, sustainable, and competitive over time. By promoting circular manufacturing (as in KYKLOS 4.0, DRALOD, and PAPERCHAIN), considering servitisation (as in MAKERS), designing smart, autonomous, and selflearning factories capable of increased mass personalization production (as in SME 4.0), designing solutions to distributed (multi-site) industrial production (RICAIP), and so on, a number of projects aim to change the business models that companies use (e.g. SYMBIOTIC). Human and social issues about the rising digitalization of our (industrial) workplaces are the focus of a growing number of projects, which contribute to Industry 5.0's human-centric orientation. Multiple research programmers examine human-robot and human-cobot cooperation in production, with an emphasis on maximizing human capital while using the particular skill sets of human employees and robotic systems (e.g. FACTS4WORKERS, EVRYON, Human Manufacturing, Collaborate, and

Rossini). Another category of research analyses how digitalization may impact future jobs and happiness (e.g. BEYOND4.0, PLUS, SemI40). Several Horizon 2020 and ERASMUS+ projects examine the preconditions for a successful transition to Industry 5.0 by focusing on developing skills shortages and customized training. BEYOND4.0, SAM, FIT4FoF, SAIS, FACTS4WORKERS, and TECHNEQUALITY are some examples. Finally, studies study how a totally digital workplace impacts the physical and mental health and job satisfaction of individuals (e.g. Human Manufacturing, SYMBIO-TIC, FIT4FoF, PLUS, MindBot, H-WORK, EMPOWER). Annex 1 provides an exhaustive listing of these projects. Many other Horizon 2020 projects deal with issues pertinent to Industry 5.0, including the development of cutting-edge technologies (artificial intelligence, photonics, smart materials), the promotion of an environmentally friendly and sustainable economy, and the improvement of workers' knowledge, skills, and abilities.

### 2.6 Framework of Industry 5.0

Despite the fact that "Industry 5.0" is a relatively new name, there is already scientific literature defining this movement's fundamental principles. Industry 5.0 study literatures has many unsolved questions, like what it will bring, how it will disrupt enterprises, and how it will affect the real world and the virtual Onex. The literature review and prospective analysis led us to the conclusion that in Industry 5.0, the emphasis will move from producing money to fulfilling a higher purpose. This bigger objective is comprised of four pillars: humanism, sustainability, and resilience. Profit maximization alone is no longer viable. In today's global economy, it would be a grave error to disregard the costs and benefits to society and the environment. If industry is to become a true source of prosperity, its actual aim must include the well-being of people and the earth. Socially and ecologically responsible innovation not only helps investors, workers, consumers, society, and the environment, but it also enhances the company's bottom line.

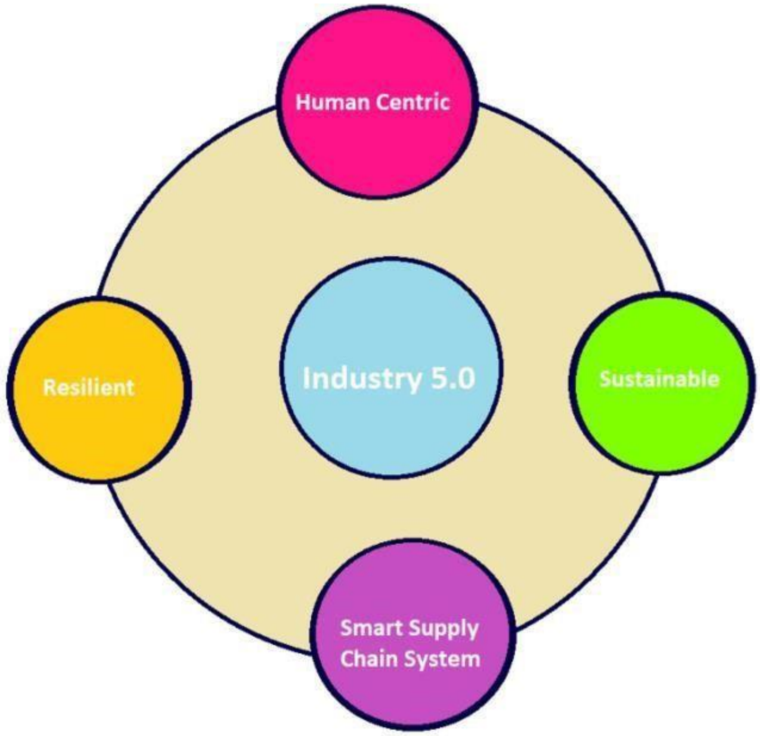


**Fig 2.6:** Cycle of I5.0 A human-centric approach in industry focuses production on underlying human needs and desires, as opposed to the potential for higher efficiency given by rising technology. Today, we are more concerned with what contemporary technology can do for us as opposed to what it can do for us. We want to use technology to adapt the production process to the worker's needs, for example by advising and instructing him or her, rather than expecting the person to adapt his or her skills to the requirements of ever developing technology. It also involves ensuring that workers' rights to privacy, autonomy, and human dignity are protected when new technology are used in the workplace. To function within the constraints of the planet, industry must be sustainable. To reduce its environmental impact, the company must use "circular processes" that recycle previously discarded resources. Sustainability requires reducing energy consumption and greenhouse gas emissions to avoid the depletion and destruction of natural resources in order to ensure that the demands of current generations are addressed without sacrificing the needs of future generations. For instance, artificial intelligence and additive manufacturing may be of great assistance by improving production and minimizing waste. We can make our communities more resilient by bolstering industrial output to make it more resistant to disruptions and

capable of providing and sustaining critical infrastructure in times of disaster. However, our current mode of global production is very susceptible to geopolitical upheavals and environmental catastrophes like as the Covid-19 outbreak. Strategic value chains, industrial capacity, and business processes in sectors where these chains deliver important services, such as healthcare and security, should be resilient to shocks and adaptable to change. As we have previously shown, our vision of Industry 5.0 is an evolving and open concept that may serve as a springboard for the continued creation of a collaborative and co-creative ideal for Europe's future manufacturing industry. Nonetheless, we believe the core of Industry 5.0 is as follows:

Industry 5.0 focuses on the reintegration of employees into the industrial process. In this new age, humans and machines are learning to work together to improve industrial quality and productivity. Enterprise 5.0 prioritizes cooperation between people and artificial intelligence. The 5th industrial revolution is also helpful for the environment due to the expansion of renewable energy infrastructure and better waste management. (ozdemir, 2018).

The power of I5.0, according to the EC, is the social aim of being a resilient issuer of well-being by aiding the manufacturing sector in recognizing the world's issues and making the worker's well-being the focus of the manufacturing process. Members of a conference of research and technology organized by the European Commission (EC) between July 2 and 9, 2020, examined the main principles of company 5.0. (commission, 2021). During this time, the fundamental ideas of the industry 5.0 concept were developed, and significant changes in strategy were proposed to make the sector more sustainable and humancentered. (Breque, De Nul, & Petridis, 2021)

As a result, enterprise five.0 will concentrate on optimizing human-system interactions via the application of AI- based algorithms to boost efficiency and effectiveness. This is an opportunity for human innovation to improve the effectiveness of robotic and automated building technologies. (Aslam, Aimin, Li, & Rehman, 2020). The 6R principles of industrial up cycling are a waste avoidance and logistical efficiency strategy aimed at assessing present living standards, stimulating new ideas, and manufacturing high-quality, one-of-a-kind things. This is the first industrial revolution to be directed by a human, according to the group's founder and CEO. Enterprise 4.0 is currently live, and it works in tandem with Industry 4.0 and a few smart factories to improve human-machine interaction. (rada, 2018).

The research has evolved beyond just exploring techniques to improve industry 5.0 with a smarter supply chain in order to avoid problems like those seen in the study.

### 2.7 Core Pillars of Industry 4.0 and 5.0

What are Most Important The following cross-subheadings cover Industry 4.0 and 5.0 technologies, as well as the associated commodity needs?

#### 2.7.1 Methods for analyzing huge datasets.

The availability of massive amounts of data allows for the use of large volumes of dossiers to increase competence and efficiency (wamba, 2017). Firms may increase their efficiency, flexibility, and output personalization by applying logic to massive data collections (Wu, 2016). The collection and assessment of data from many sources will improve standardization, allowing for the efficient and timely location of evidence in administrative procedures (mckendrick, 2015).

#### 2.7.2 Electronics science

Now widely used in secondary fields such as manufacturing, supply chain management, retail, education, and others (Demetriou & G.A, 2011). Robots may now collaborate, listen to and respond to their operators, work side by side, and aid in manipulation. It's only logical that in the not-too-distant future, these androids will be more inexpensive and provide a wider variety of out-of-the-way conveniences.

### 2.7.3 Cloud Computing

Cloud settings contain massive amounts of data generated by an infinite number of trading plan devices, suppliers, and sensors. Cloud computing allows for the real-time processing and retrieval of massive amounts of data. Improved communication between departments, supply chains, locations, host organizations, and their guests is required. In today's rapidly growing cloud computing environments, more sophisticated and dataintensive SC projects are needed. By feeding processed and obtained data from expanding dossier and cloud operations into an important model, all viable summaries about the product's design, development, outcome, and SC network may be analyzed (zhong, 2017).

### 2.7.4 Simulation

The widespread use of simulation in business models allows for the manipulation of exact real- time data as well as the replication of the dynamic essence ecosystem of the real world. By experimenting with and optimizing these factors prior to the actual implementation of changes in the physical world, people can reduce the cost of a business transition, the risk of a new arrangement, the time it takes to implement, and the quality of control over future actions and responsibilities (pwc, 2016).

### 2.7.5 IoT in corporate settings

The Industrial Internet of Things (IIoT) foundation is envisioned in Industry 4.0 as a centralized control system, integrating and interacting with many pieces of equipment and orders. The IIoT allows for the real-time monitoring of authentic data as well as the development of the linked decentralized science of logical analysis and decision making (Gunasekaran, 2016). The IIoT may improve the functional and financial possibilities of site visits by allowing fully computerized value chains (Hahn, 2014).

### 2.7.6 Additive Production

It's all about the added value, or 3D items are developed in layers and printed in many dimensions using additive manufacturing and 3D spatial publishing. These new manufacturing processes will soon become the norm in the era of Industry 4.0, allowing for the creation of small quantities of specialized, adaptable objects with tangible advantages (mckendrick, 2015).

### 2.7.7 The real universe with enhancements

Improved realism-located systems may be utilized for a range of tasks, including as building a warehouse or industrial system or delivering maintenance instructions for mobile or more detached control equipment (Vaidya, 2018).These contracts are still in their infancy, but firms will make significant advances in augmented reality in the future to better their commercial operations and decision-making methods (BCG, accessed 2019).

### 2.7.8 Organizational Agility (BI)

Business intelligence (BI) mechanical systems are used to gather, analyses, store, and present corporate data generated from many sources. It supports managers by converting basic trade data into actionable insights.

### 2.7.9 Cyber security

It is expected that widespread adoption of Industry 4.0 would raise cyber security concerns (ghadge E, 2020). Concepts having a convoluted resemblance and approach to others are possible, as are safe, dependable thoughts (Tjahjono et, 2017). Because cyber security is critical to the long-term health of Industry 4.0 infrastructures, it must be included into organizations' information technology and communications strategy (E & S, 2018).

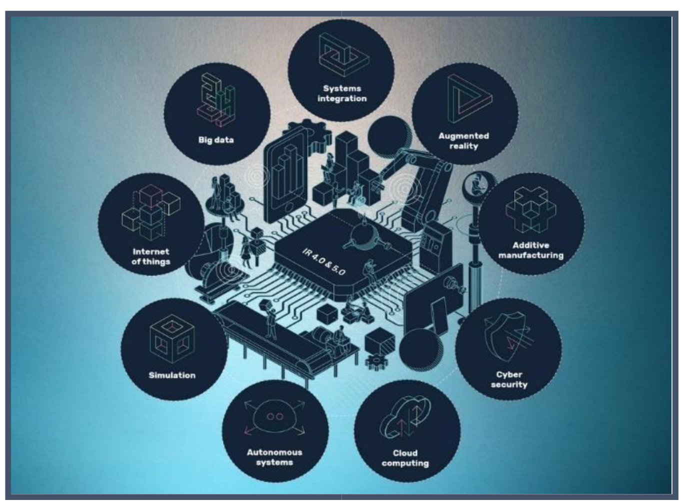


**Fig 2.7:** Technology Demonstration by Graphic View

# CHAPTER 3

# 3. COMPARATIVE STUDY

## 2.8 Characteristics of I4.0 and I5.0

Industry 4.0 is defined by horizontal and vertical technique integration and collaboration. All of the organization's information and ideas science (ICT) is merged into a single, vertical structure, from operational control at the lowest level to higherups in the organization's result, movement, and administration chains (Dalenogare, 2018)

It is possible to get an advantage in one's business or personal life by using hightech, physical socialization techniques that enable one to "step into the shoes" of another person's demand alternative or to "feel" the fluctuations and sins of persons at a higher social level. SC-based networks use ICT to facilitate data flow between the network's different performers (constant competitors) as part of the level-unification process.

It's tough to imagine all of your staff seamlessly connecting many technologies to support collaboration, integration, and data sharing (Hahn, 2014). The use of Industry 4.0 ideas may reduce overhead costs, increase productivity, efficiency, and flexibility, and promote product volume individualization.

Individuals may agree on ideas such as "Industrial Internet" and "Digital Factory" while discussing Industry 4.0.Under any of these circumstances, this viewpoint cannot be fully grasped. Digitalization and integration into a mathematical environment, including supply chain partners, are at the heart of the Industry 4.0 concept.

## 2.9 Comparative study of I4.0 and I5.0

### 2.9.1 Key Drivers: 14.0

We have already filled our minds with I4.0, its form of working, and the technological know-how used. We already know that it focuses primarily on the manufacturing sector, but IoT is now protected in it, allowing it to cover all sectors where industrial/expert device is used, which covers not only the natural connection of assets and data management, but also the digitization of the entire fee chain. Industry four is closely related to governmental and institutional activities and is rapidly gaining popularity in the professional context. The previous decade has seen a large number of demonstrations, testbeds, and use instances for Industry four implementations, the majority of which have been in the shape of smart factories or components of realistic factories, so let's take a quick display up on which the foundations of any tool depend.

**Table 3.2.1**: This table 1 shows the core properties of I4.0 and explains that in which aspects it can be considered a better choice.

| | INDUSTRY 4.0 (2011-present) |
|---|---|
| CONCEPT | SMART PRODUCTION |
| MOTIVATION | MASS PRODUCTION |
| POWER SUPPLY | ELETRICITY FOSSIL , FOSSIL BASED FUEL |
| TECHNOLOGY | BIG DATA, AI, IIOT, CLOUD, CYBER,BI,AUGMENTED,VIRTUAL REALITY |
| INVOLVED AREAS | PROCESS IMPROVEMENT AND INNOVATIVE BUSINESS ADMINISTRATION |

**3.2 2 Barriers of I4.0**

Issues with M2 communication reliability, which has not yet achieved the levels of average performance and stability anticipated by Industry 4.0 proponents. Furthermore, there are significant IT security risks when previously abandoned facilities are reopened. Many businesses are wary about the Internet of Things because of the likelihood of costly mistakes until AI has had more opportunity to demonstrate itself in

real-world scenarios, such as with huge IoT networks. The main barrier for I4.0 is a shortage of adequate skill-devices for Industry
4.0 adoption among production unit engineers. There is widespread concern that the adoption of Industry 4.0 would result in enormous job losses in the industrial sector, as well as the elimination of employment for those with less education

To stay future-fit, enterprise desires to make investments and rework closer to absolutely digitally included processes. Before COVID-19, we had now no longer observed a massive funding with inside the adoption of Industry 4.zero and 5.zero. The current pandemic has shaken up the whole commercial scenario, however, and has pressured many agencies to include virtual transformation.

### 3.2.3 Key drivers of I5.0:

While some people are still debating the fourth commercial business revolution, the fifth (and soon sixth?) commercial business revolution is being debated.

- Enabling personalized mass production with the prospect of reintroducing the "human touch" to items. The Third Industrial Revolution brought about mass manufacturing, the Fourth Industrial Revolution brought about mass customization, and the Fifth Industrial Revolution may bring about the use of current technologies to not just customize the quality of goods, but also the products themselves (and production processes). A return to creative, handcrafted work, but with unprecedented accuracy and efficiency, thanks to collaborative robots like Universal Robots. Clearly, not every organization will (or should) adopt Industry 5.0 practices at this time. Individualized packaging improves the shopping experience and so adds value to the goods, hence increasing brand confidence and revenues.
- The transition from intuitive human-tool interfaces to ones that is unrecognizable as human-tool interfaces. Brainwave or voice stimulation may help the creative process. As a consequence, artificial intelligence is becoming more readily incorporated into everyday tasks.
- Micro transactions between machines to provide total transparency throughout the whole value creation process, from human to machine contributors. This might be a helpful use of block chain technology since it could make smart contract execution and/or incremental pricing of newly produced value easier.
- The basic fundamental difference of I5.0 with I4.0:

**Table 3.2.3:** This table 2 shows the core properties of I5.0 and explains that in which aspects it can be considered a better choice. This table is actually brief explanation that how these two industries work and pararell important. I5.0 is actually explaining the brief collaboration of human and machine interface and which includes supply chain techniques and useful for coming next years

| | INDUSTRY 5.0 (2022-future) |
|---|---|
| CONCEPT | HUMAN ROBOT SYMBIOSIS |
| MOTIVATION | SMART SOCIETY |
| POWER SUPPLY | ELECTRICITY WITH RENEWABLE ENERGY SOURCES |
| TECHNOLOGY | HUMAN ROBOT COLLABORATION, SUSTAINABLE SMART SUPPLY CHAIN SYSTEM |
| INVOLVED AREA | BUSINESS AGILITY,GREEN SSCM,6R CIRCULAR ECONOMY TECHNIQUES WITH SSCM |

### 3.2.4 Risky Barriers of I50:

- People must increase their competence abilities.
- The human race must invest more time and effort if it is to adopt the next generation. Investments in cutting-edge technologies are necessary. The cost of UR Cobot is high.
- Higher expenditures are associated with training employees for brand-new employment. The businesses are adamant on improving the manufacturing processes for enterprise 5.0.
- Because enterprise 5.0's use of automation and synthetic intelligence poses risks to the company, it was necessary for security to be a priority.

Less than a decade has passed since "Industry 4.0" was initially discussed in the industrial sector, but futurists are now anticipating "Industry 5.0." In contrast to the current revolution, which places a premium on retrofitting factories with IoT and smart technologies such as cognitive computing and cloud networking to improve their global competitiveness, Industry 5.0 is anticipated to place a premium on reintroducing human labour and thought into the manufacturing process. The fifth industrial revolution, or "Industry 5.0," is the optimization of production processes via the collaboration of people and machines. Ironically, companies who are just now applying Industry 4.0 concepts may already be in the middle of the fifth industrial revolution. Even when industries deploy cutting- edge technology, it does not immediately result in the replacement of large numbers of employees by robots.

The concept of Industry 5.0 may alleviate certain firms' fears about the continuing transition. That millions of people will be jobless due to the fact that cognitive computers and cyber-machines will do the labour that was previously performed by humans. On the other hand, Industry 4.0 may end up reorganizing human tasks in the industrial sector in ways that are advantageous to workers. It is feasible that humans may delegate simpler duties to computers and do the more difficult activities themselves.

It is believed that human intelligence and cognitive computing would collaborate to bring about the most important improvements planned for Industry 5.0. Together, humans and automated robots are anticipated to greatly increase manufacturing efficiency and quality. The environmental advantages of the fifth industrial revolution may expand as corporations develop systems that employ renewable energy and decrease waste.

The ambition of Industry 4.0's architects at the start of the century may eventually be realised by the advances of Industry 5.0. As AI advances and industrial robots gain more human-like qualities, computers, robots, and human workers will ultimately engage in more meaningful and mutually enlightening relationships. What could be more beneficial to the health of an industrial environment than amicable worker interactions?

As technological breakthroughs continue to speed, the next decade and beyond may be marked by rapid revolutions. In contrast to the last three industrial revolutions, which spanned decades, the present wave of change will last just as long as it takes for the whole industry to embrace the new technology. Given the pace of these developments, it is natural to assume that forecasts of a fifth revolution will follow the fourth. Industry 4.0 principles will unquestionably have an impact on the future of manufacturing, regardless of how quickly or slowly organizations adopt the model. Due to the benefits provided by IoT devices, cyber systems, and cognitive computing, some firms may see exponential growth as more people join the movement. In the next years, it is feasible that humans and industrial robots may collaborate on designs and divide and conquer the many manufacturing duties.

# CHAPTER 4

# 4. PROBLEM STATEMENT

Innovations and new technologies such as increasing ICTs and Industry 4.0 will have an impact on how they function in SC and what SC will look like in the future. Previous assessments of both active projects and extant literature have shown the expansion of advanced manufacturing and the use of several developing ICTs in supply chains. Future study paths are offered after analyzing the problems and research prospects of SSCM under Industry 4.0. One of the major research gap is declining effect of supply chain old method by making everything autonomous in industry 4.0. 4.0 is using vast technology but it is not giving systematic approach where as it is more individual. As the theme of 4.0 is not collaborative which has greatly disrupted the market during covid 19 era which was one glaring example for everyone. The theme of connectivity of 4.0 with cyber physical system it is neglecting a very important part of this world which is human connection with technology as robot are man- made thing and they cannot think to change or make agile decisions according to situation and scenarios because there thinking process is given by human and there is no fear of death like human whereas human take decision while considering the life security issues at the same time. The other major disadvantage is also a connection of above given statement as industry 4.0 is self-driven machine system which is not following SSCM and also ignoring the core components of sustainability goal. One major goal is the environmental affect which is destroying the green effect by producing polluted air and there is no cross examination apart from it the idea of I4.0 also laying-off work force in big companies where as we already know that agile decision, lean management and resiliency concept is not efficient without human interaction. Human labor is also require to check the mal functioning of the complete system and it always be need correct logistics route to vehicle routing problem at the time of distribution and lastly, the customer satisfaction which a predefined program cannot solve which includes all the queries and return item details, so the research is mainly about the missing components of SCM in I4.0 which can be come up with a new society named society 5.0 work with I5.0 system working on the same ICT sector with advancement in supply chain to make smart and sustainable decision for society.` According to the study's findings, the new I4.0 technologies do not provide enough aid for decision-making at all levels of the supply chain, including strategic design, tactical planning, and operation scheduling. Case studies and published research show that when organizations embrace ICTs and Industry 4.0, supply chain and organizational performance suffer. As the research analysis progressed, a second significant trend emerged: SC's incapacity to adequately absorb and use new technologies while accounting for consumer preferences and market variety. The

bulk of new technologies, according to the aforementioned literature study, have consequences for the design, strategic sourcing, and network decision-making processes.

After 10 years, the focus of Industry 4.0 has changed from its original goals of social justice and sustainability to digitalization and AI-driven technologies that increase industrial efficiency and flexibility. In order to enable industry to serve mankind in a sustainable, long-term manner while being cognizant of the limitations of the earth, the concept of Industry 5.0 moves the focus to research and innovation. Industry 4.0, according to the introduction, is a brand-new manufacturing strategy that reimagines traditional production methods by integrating a variety of cutting-edge technologies. In an attempt to improve operational effectiveness, the supply chain industry is progressively embracing digitalization, automation, and flexibility. Modern digital SC networks incorporate a broad variety of technologies to provide a solid, adaptable, and future- proof framework for the SC lifecycle (from product conception through manufacture and distribution). Through the influence of Industry 5.0 on aspects of SCs and SCM strategies including real-time information exchange and synchronisation with suppliers, intelligent warehousing, and truck routing systems, improvements in supplier performance may be accomplished. In view of the challenges posed by digitization, which enables more exact forecasting and planning owing to the simplified information flow and better insight into the sources and destinations of inputs and completed items, businesses need to reconsider the layout of their SC networks. The openness and accessibility of e-commerce platforms in terms of where, what, and when to purchase are fueling an increase in supply chain competition. The Internet of Things is crucial for the development of SCs because it opens up a broad variety of opportunities, including the remote and real-time monitoring of vehicle position and speed, perishable product condition through temperature sensors, and machine health and performance. It is vital to investigate how Industry 5.0 has impacted the SC network generally due to the increasing significance of stakeholder connection and the rising value of stakeholder cooperation.

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It is vital to investigate how Industry 5.0 has impacted the SC network generally due to the increasing significance of stakeholder connection and the rising value of stakeholder cooperation.

**Smart Supply Chain,** using digital platforms to link producers, distributors, stores, customers, and partners. Partners in a SC may save costs and improve the SCs' general efficiency and flexibility as they share information and work together more closely. A stronger sense of friendship and trust has grown among SC members as a result of their increased openness and camaraderie. To enhance value chain performance and lower risks, Industry
4.0 combines highly structured connections with real-time monitoring and control of materials, equipment, and SC factors.These networks have allowed the Fourth Industrial Revolution to be integrated, and as a consequence, organizational structures and company management techniques have undergone a significant transformation. New risks and problems are emerging within supply chains, along with the demands and trends that are driving them.

As the business climate and trend of digital transformation change. Insufficient data, information security risk, a shortage of skilled workers, diseases brought on by harsh environments, problems with autonomous machines, a decline in green supply chains, disruptions in lean management, and other problems are all listed as current challenges by the BRICS Business Council and Deloitte. Businesses cannot build supply chains that are effective across sectors and flexible to changes in technology and the market without conceptual frameworks and empirical study.

# CHAPTER 5 5. PROBLEM ANALYSIS

In short, traditional SCM approaches to addressing the pressing problems outlined above will not work for I4.0 or even I5.0. Therefore, in order to direct this study, three research required and fundamental initiatives should be formed, one of which is the building of the I5.0 via the alignment of your previous 10-years' worth of knowledge of I4.0 with modern supply chain techniques. To better link industry 5.0 building with the supply chain environment, we should also create a long-term paradigm strategy.

It is crucial to conclude a research report with an appropriate solution, which explains that a smart factory can also increase its automation work under smart supply chain tools and mobile apps, while also taking into account how people cooperate will result in faster responses to unexpected situations. As 3D printing evolves to accommodate additional materials, bigger items, and a more decentralized and integrated industrial and supply chain network, the benefits of the technology, such as lower prices and shorter manufacturing times, will be amplified. To guarantee that industry can continue to serve humanity for the foreseeable future within the constraints of the planet, Industry 5.0 provides a new viewpoint by highlighting the necessity for continual research and technical progress. Both Society 5.0 and Industry 5.0 need a radical reconstruction of our social and economic institutions in accordance with the SSCM paradigm, hence they are inseparable. As seen in the image above, the Absolute Innovation Framework may be used to depict the trajectory of technical progress and innovation. The three parts of the framework may be reflected in the businesses of participants along these dimensions, and the paradigm of industry 5.0 should be a smart supply chain in order to serve society 5.0. It's able to make use of a tool tailored to the needs of the environment, as well as mobile applications that are both widely available and simple to pick up. The supply chain's control environment also involves the attention of the information technology (IT) and financial logistics (FL) divisions.

A smart supply chain environment is the only way to get rid of completely autonomous sector which is replacing human by machine. The theoretical solution can easily came into being in reality if we follow above framework step by step. Let's put all the important components of I5.0 in smart supply chain grid.

Robots will be responsible for time management in the work process of a smart factory because the presence of this IIOT concept will also be a parallel component of reconfigurable smart supply chain, which seeks to strike a balance between economic development and the resolution of societal and environmental problems. It tackles broader societal concerns in addition to the industrial sector by merging the physical and virtual worlds. Diverse analytic approaches will be employed to analyses both realtime data flows and archive data repositories, highlighting the importance of data streams/digital components. The marriage of cutting-edge technologies, such as IoT and big data, with SC results in an SSCM; this is one of the most significant technological elements of any manufacturing platform. Other well-known SCM technologies, such as SCADA, ERP, BIM, 3D PRINTING, and many more, are on the horizon and may be reached by phone. Smart industrial production cannot run without appropriate materials/parts and prompt delivery to clients. A smart supply chain and logistics infrastructure is thought to support smart manufacturing or services. Our data-driven and real-time transparent supply chain is integrated, optimized, and intelligent. It has several advantages. The crucial and successful consequences of decentralized decision making in logistics are flexibility while adhering to a strict timeline and timely product delivery (lead time must be reduced). The scope is clearly multi-level, multi-function, multi-partner, multi- channel, and dynamically updatable, allowing for high collaboration and coordination across whole supply chains. This innovative business model promises to alleviate environmental damage caused by pollution, deforestation, ozone depletion, and increasing temperatures. Substituting appropriate-sized boxes, avoiding huge boxes for smaller shipments, and using recyclable paper pads for plastic packing are all possible options.

Another significant change that is gaining traction with the goal of minimizing carbon emissions is the usage of electric fleets rather than fossil fuel-powered fleets. EVs have the potential to outperform conventional vehicles in terms of maintenance and range per charge.

The manufacturing sector wants suppliers that have a track record of adopting green practices in their offices and operations as a factor or measure for supplier selection. For all these supply chain solutions society 5.0 is needed to reshape I5.0 by providing all the skills to the generation since their younger age and from schooling which will not be a burden to the organization of any smart factory directly for their training and practices because they already have a general idea of SSCM working not only in manufacturing sector also in other sectors too. So every stakeholders, government organizations business tycoon will get an educated SCM trained employee for their sustainable system which make society prosperous and bright enough which will be better than rest of the societies fromI1.0 to I4.0 because labor interaction will reduce unemployment and in this way we will be able to reach and provide solutions to all sustainable goals.

Smart supply chain involves highly modern and new software's and modules of Sap which is a part of enterprise resource planning. In supply chain management the most famous scheduling and allocation tool is ERP which is an information system that is designed specifically to integrate and optimize the processes of a business and the transactions in a corporation (Moon, 2007). ERP is intended to streamline the process and various sectors of a business, often in a central database, which makes management and supervision of all those processes easier.

Supply chain management has several components, since it encompasses all sectors or divisions of a business. It goes without saying that these components will differ across different organizations, based on their scope and size. However, some typical components exist in all businesses. They are:

1. Customer Relationship Management (CRM) & Sales
2. Inventory Management
3. Time and Projects
4. Scheduling
5. Allocation
6. Finance
7. Hrm (Human resource Management)

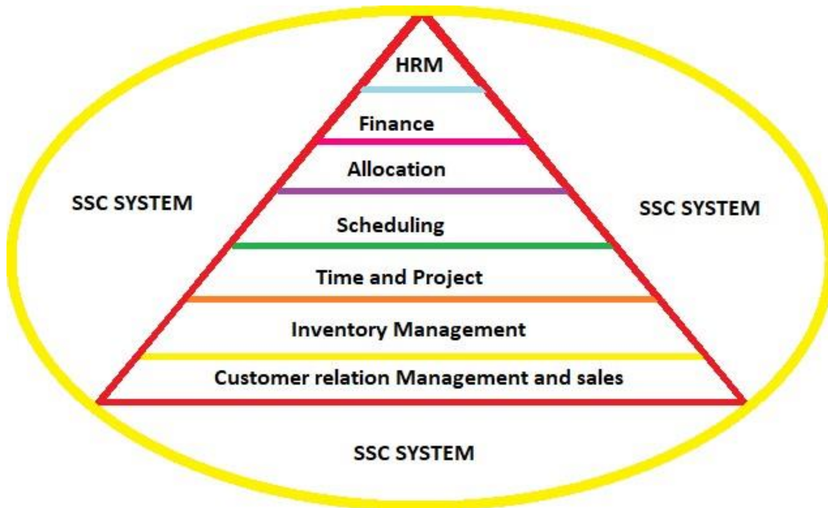


**Fig 5.1:** Typical component of SSC system

Various studies have been carried out that have centered on SCM techniques. All studies can be categorized into the following themes:

1. Implementation of SCM
2. Optimization of SCM
3. Management through SCM
4. The SCM software's (like ERP)
5. ERP for supply chain management

In a broader context, SMART SCM techniques can be applied on any and all businesses. This is because SCM is a very vast concept that can, in theory, be integrated with any organization, no matter the sector it belongs to. Many studies tend to point out the implementation of smart supply chain system techniques or software within an organization is a process that happens over time, rather than being a single event (Kennerly & Neely, 2001). This is because the implementation of smart supply chain technique within a business requires a significant amount of resources and personnel. More importantly, it requires workers to change the way they do their jobs, which can often prove to be difficult and cause friction between employees and management.

However, studies also point towards the fact that, when applied properly, Supply chain systems deliver huge benefits to all stakeholders in a business (Matolcsya, Booth, & Wieder, 2005). Owners, investors, managers and even employees benefit from the results as business operations run more smoothly and profits are increased.

In the context of this study, the implementation of smart supply chain techniques on Industrial businesses must be studied to assess its feasibility. There exist many case studies and research articles focused on this niche, all of which point towards the fact that is a great idea with multiple advantages to all stakeholders.

(Karimi, 2017) , Analyzed the impact of Smart supply chain let suppose ERP techniques on the performance on industry of big companies. They concluded that ERP techniques had an overall positive impact on the industrial sector. They also pointed to the fact that ERP techniques were directly affected by a multitude of factors such as communication, training and management support in supply chain management sector.

(Voordijk, Leuven, & Laan, 2003) , Conducted an in-depth analysis of smart supply chain systems implementation in a large-scale industrial based firms especially in EMEA region. They were motivated by the fact that, in the EMEA, many large construction firms attempted, at one point of the other, to implement reconfigurable smart SCM systems for better streamlining and increased efficiency. However, most of them experiences failures. Hence, using one such industrial firm as an example, they sought to find out what factors influence the success of Smart SCM systems in in any of the industry either it is IT, Manufacturing or even Construction.

As this is not a case study base project but a lot of companies have different types and brands of Supply chain software which are now this much advance that they are using modern tools and new techniques for data.

These software in different divisions are making things more easy by their cloud modules. Comparative analysis was carried out of these systems with respect to a select few factors such as IT strategy and business strategy, implementation method, organizational change.

After a thorough analysis of the data acquired, the researchers reached quite a few conclusions that can serve as a lesson for all industrial firms around the world. First and foremost, they concluded that SCM systems play a positive role within construction firms if they are used for streamlining of inter-organizational primary processes. Basically, SCM- ERP systems can be used to streamline and centralize all the different processes happening within a Industrial sector which is including, but not limited to, manufacturing work), office work (i.e. financial documentation, release of funds and resources, correspondence with clients, etc.) and transportation/ logistics cost.

Further, they also concluded that installation and implementation of Smart SCM systems does not necessarily mean that a company has to spend a large amount of financial capital to upgrade its IT resources. On the contrary, SCM systems and software's can be implemented on what is referred to as an AS-IS basis i.e. they can be installed on the firm's existing IT system. In fact, they recommended this strategy for small-scale firms or companies that are just starting out.

On the other hand, for large-scale companies which have various divisions and are involved in multiple sectors of the manufacturing industry (such as the one discussed in the study), they recommended that the IT services be upgraded so that mangers can utilize the full potential of ERP systems and avail maximum benefits from it.

The above sections of literature review also highlighted the attempts of integrating ERP systems in their framework but, more often than not, they have been met with failures and decrease in efficiency and employee satisfaction. Using their analysis, they were able to put forth a few probable reasons for this. The first and foremost of which was the fact that ERP systems, when newly implemented, need constant monitoring by managers. Further, employees also need training in order to familiarize themselves with the new system and new methods of doing their everyday tasks. If care is not taken in this regard, employees will not feel at ease while using the new system and may revert back to their original ways of doing their jobs.

The above highlighted study further reiterates this important fact: Smart ERP techniques are only useful and advantageous when implemented properly. Otherwise, they serve to do more harm than good. This is a key point that organization owners and management must remember when they decide to integrate an ERP system in their firm. If not implemented properly, this endeavor might cause businesses to suffer huge losses.

Society 5.0 is distinguished by its utilization of cutting-edge technology and goods to forge new links between people and things, disseminate information and data, and generate unique social and economic value. While

Industry 4.0 is mainly concerned with deploying these disruptive technologies, I5.0 is committed to developing a human-centered and sustainable Society 5.0 via their implementation. From a business angle, these authors argue that by analyzing the benefits of Industry 4.0 technology, a Society 5.0 environment will release individuals from onerous, repetitive work. Society 5.0 also allows for the removal of various social limitations to aid in the resolution of social issues. Automation and human ingenuity are combined in Industry 5.0, allowing for rapid progress. Thus, the concept of a "cobot" is one of the driving forces behind the next industrial revolution. The cobot system could operate autonomously within the manufacturing environment with the help of AI, big data analytics, the Internet of Things, and other disruptive technologies, resulting in increased productivity, decreased waste, and a greater emphasis on meeting the needs of future generations. The notion of "industry 5.0" was developed primarily to increase the responsibilities of production workers.

The introduction of smart robots and systems, made possible by the confluence of the digitized supply chain and the hub of industry 5.0, will have a massive impact on supply chains. This will allow for the mass production of one-of-a-kind objects, adding tremendous value to the consumer's purchase. Many organizations are debating this new innovative phenomenon even as they begin to implement business four.00s programmers. Industry 4.0 lays the groundwork for the future intelligent factory, but business remains a struggle. The cooperative CPPS (cyber physical manufacturing systems) building blocks may be able to improve communication with people via the company's social networks, resulting in 5.0 the technology of a socially intelligent manufacturing facility. Humans may be required to work with CPPS and supplement the virtual and robot elements of the automatic production structures with disruptive technologies, fostering faster and more intuitive workflows, and the entire system will deliver the start of society 5.0 under a smart supply chain system that includes operations, management, transportation, logistics, and other managerial tasks.

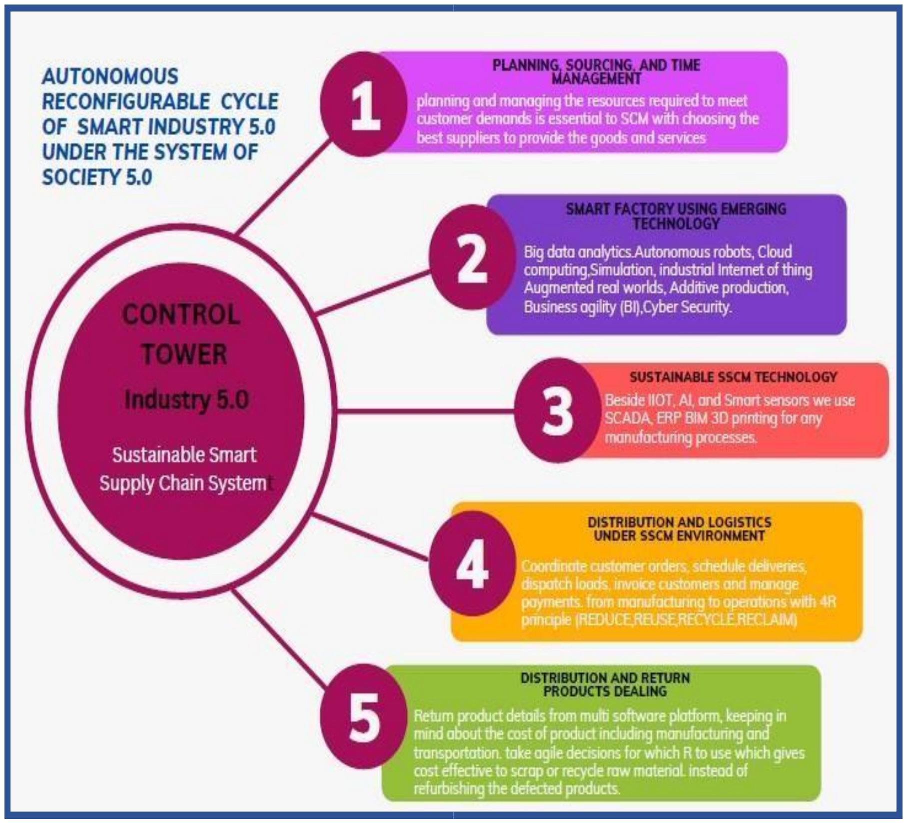


**Fig 5.2:** Illustration Smart supply System framework

### 5.1 Basic Constructs of I5.0

In the following part, we will do our best to explain the majors' responses to the whiteboard question, "How can we develop 5.0 more effectively?" Is it feasible to include Industry 5.0 concepts into the logistical process? Please provide your thoughts on the most pressing Supply Chain 5.0 problems that need more investigation. These guiding concepts will serve as the foundation for the four Industry 5.0 subgroups. The phrase "industry," "technology," "development," "context," "application," "impact," and "future" were used to describe the Industry approach. This article studies Industry 5.0

in its entirety, including this imaginary futuristic scenario, and investigates the potential applications and outcomes of technological breakthroughs. Construct 2, which focuses on technological invention and application, is connected to the other structures once its technologies are applied. Construct 3, which focuses on social problems and long-term sustainability, is directly affected by the growth of the Industry 5.0 plan. However, the transition from Industry 4.0 paradigms presents challenges to the Industry 5.0 implementation plan. There is a link to Construct 4 Transition Issues, where it is said that in Industry 5.0, more use of sophisticated industrial automation and the development of higher-order critical thinking abilities promote cooperation between humans and intelligent systems. Industry 5.0, according to this definition, is all about optimizing the synergy between humans and machines in an industrial setting. This proposal aims to improve the treatment of skilled workers in the industrial sector. Almost everyone believes that the employment of robotics and automation throughout past industrial revolutions caused a global paradigm change in the manufacturing sector. Despite the fact that Industry 5.0 has not yet occurred, the authors think that the same thing will occur with this upcoming revolution. This is due to the fact that the suite of technologies that emerged from the advent of Industry 4.0 is closely linked to new conceptual frameworks.

Several scholars have highlighted, first and foremost, the impact of Industry 5.0 on individualization. Industry

5.0 also has a competitive advantage because of the respect it shows its clients and the flexibility with which it works. According to the authors, the most crucial features of Industry 5.0 are the personalisation and social cooperation enabled by Industry 4.0 technology. This suggests that, despite the tendency toward more concentrated technical applications, the present issues of customization, personalization, and technological advancements can only be solved by humans. The creation of Industry 5.0 might be attributed to the necessity to solve these current issues. It aims to integrate human development with technology advancement. Futures experts have been discussing Industry 5.0. These folks believe that humans and technology may collaborate to create a more personalised touch. The goal of Industry 5.0 is to provide clients with more customised options. In this "period of customization," the primary goal of Industry 5.0

is to optimise the concurrent employment of robots and humans. This promotes cooperation and customization within the context of Industry 5.0. Industry 5.0 allows for substantial customization, such as the fabrication of personalised medical implants.

This alternative notion has five words: innovation, IoT, system, big data, and AI (AI). Despite the fact that these technologies have always been part of Industry 4.0, academics often describe them in terms of a future Industry
5.0 framework. Some argue that the technologies utilised in Industry 4.00 provide the basis for the Industry 5 strategy. Several scholars, on the other hand, have claimed that Industry 4.0 needs the development of complementary new technologies. It is vital to include fresh ideas into the mix.

Industry 5.0 has 177 more parts, such as big data, collaborative robots (cobots), smart sensors, the internet of things, artificial intelligence, multi-agent systems and technologies, digital ecosystems, digital manufacturing, complex adaptive systems, smart materials, 3D printing, 4D printing, 5D printing, 3D scanning, holography, and virtual reality. I argue that technologies like big data analytics, cloud computing, virtual reality, and what-if scenario simulations are just as useful as those directly related to artificial intelligence (such as cognitive), planning, scheduling, and optimization algorithms). It is crucial to emphasize the significance of innovation management given the rising relevance of Industry 5.0. This demonstrates the general consensus among academics about the need of turning the innovation management framework's attention toward end users. In the context of the fifth industrial revolution, take into account the significance of collaborative robotics, the Internet of Everything (IoE), multi-agent systems and technologies, complex adaptive systems, smart manufacturing, digital ecosystems, and the development of artificial intelligence (AI). Industry 5.0 will be supported by distributed computing, robots, the Internet of Things, multi-agent systems, complex adaptive systems, emergent intelligence, energetics, and a new corporate architecture. More advanced technologies will be required for Industry 5.0 than for Industry 4.0. Examples include breakthroughs in sensing technologies and machine cognition as well as digital twins, shop floor trackers, virtual training, intelligent autonomous systems, and networked sensor data interoperability. I5.0 lays a strong emphasis on environmental and social responsibility. Institutional, social, conceptual, troublesome, protracted, and growing The Industry 5.0 plan, in the opinion of some experts, has the greatest influence on both society and the environment.

Technological breakthroughs, according to the concepts of Industry 4.0, are critical in the attempt to develop a Society 5.0. In this community, sustainability is critical, and new technologies are required to make it a reality. Information and data are required to achieve Society 5.0. This is due to the fact that technical and organisational developments inside the industrial system are simply the tip of the iceberg in terms of what Society 5.0 has to offer. Social and human problems must be addressed in order to develop a technologically sustainable environment. Industry 5.0 is made up of two major components. The first analyses the relationship between people and robots, while the second looks at the bio economy in connection to environmental concerns. Some believe that Industry 5.0 will have a significant and favorable impact on the long-term survival of industrial processes (e.g., algae production). The rise of Industry 4.0 has amply shown that a sustainable economy necessitates the adoption of Society 5.0. The names "Industry 5.0" and "Society 5.0" are based on the growing interconnectivity of digital production and digital society. The idea of Industry 5.0, which emphasizes more sustainable growth, was formed on the basis of Industry 4.0's social focus and technological advancements. Both the Industry 5.0 and Society 5.0 initiatives aim to enhance social development via the use of digital technologies. The fourth Transition problem framework used the phrases "challenge" and "implementation." It refers to the challenges that must be addressed before Industry 5.0 can be implemented. Among the most difficult challenges and paradigm adjustments in Industry 4.0 will be the move from a too technology to a more human-centered attitude. As a result, it is critical to emphasise that establishing Industry 5.0 by merging disruptive innovations from Industry 4 is challenging. According to [80], futurists are trying to figure out what "Industry 5.0" entails, but there aren't many concrete conceptions yet. The benefits and challenges of human-robot collaboration in the workplace are now the focus of attention.

According to these writers, psychological, social, ethical, educational, legal, and regulatory challenges will have a significant influence on human-robot interactions. Similarly, certain steps must be accomplished before Industry 5.0 can be fully implemented. This involves offering the greatest goods, being ecologically mindful, demonstrating excellent leadership, and doing business with integrity. Insist on the importance of a variety of shared resources, such as territorial assistance in development initiatives, in reaching Industry 5.0 goals. It is critical for institutions, entrepreneurs, and managers to recognise these distinctions when designing activities that are tailored to the specific conditions of their respective surroundings. When developing an Industry 5.0 strategy, the four most critical factors to examine are organisation, people, technology, and tasks. Within the context of the Industry 5.0 movement, education and training, the workplace, productivity and remuneration, automation vs. human labour, the most effective products, long-term viability, responsible leadership, and ethical standards must all be assessed.

## 5.2 Alignment with the Supply Chain Context

Academics and business professionals have spent much too much time and effort on Supply Chain 4.0. Several academics have developed Supply Chain 4.0 techniques. The bulk of these recommendations cover the same ground as Supply Chain 4.0 and the previously mentioned Industry 5.0 literature assessment. These factors include the supply chain's own strategy, a set of disruptive technologies, the necessary skills, the difficulty of implementing these disruptive technologies, and their impact on supply chain operations efficiency.

The organized logic of this paper is backed by data from a systematic literature study that confirms Smart Supply Chain 5.0 and I5.0 compatibility.

Intelligent SCM is often associated with highly technology surroundings in the literature. Cobots are a key enabler of the harmonious human-technology environment that Smart Supply Chain considers as part of its ongoing technological emphasis (collaborative robots).

The goal of Supply Chain 4.0 is to gain an edge in mass customization. Furthermore, it aims to increase the transparency, responsiveness, flexibility, waste avoidance, and efficiency of supply chain activities.

Smart Supply Chain 5.0's goal is to maintain current performance improvements while adding value by personalizing goods and services for a large number of customers. In terms of cutting-edge building tools and materials.

Supply Chain 4.0 includes Internet of Things (IoT), big data analytics, 3D printing, cloud computing, robots, block chain, augmented reality, and artificial intelligence. Supply Chain 5.0 builds on these advances while also increasing artificial intelligence. In reality, Supply Chain 5.0 is built on these Industry 4.0 technologies. Collaborative robotics (cobots), multi-agent systems and technologies, digital ecosystems, complex adaptive systems, 4D printing, 5D printing, 3D scanning, holography, intelligent autonomous systems, energetics, and machine cognition are among the technologies covered. It will be crucial to understand how innovation ecosystems will be employed throughout the next technology revolution.

When examining the sustainability of society. The impact of Industry 4.0 technology on society is more subtle in Supply Chain 4.0, making it more passive. The stakes are greater in Smart Supply Chain 5.0, and social engagement is stronger. The fourth industrial revolution's goal is to establish a technologically and intellectually advanced society. The limits of the supply chain as a social network are evaluated alongside the business's own constraints in this unique notion. The primary goal of Smart Supply Chain 5.0 is sustainable development, while Supply Chain 4.0 focuses on the impact of technology on supply networks. Supply Chain 5.00 is a strategy and collection of technologies that must interact with the future smart society in order to provide the most progressive and long-lasting circumstances for businesses and societies.

The majority of Supply Chain 4.0 writers consider coordination and leadership support concerns, digital infrastructure, strategy alignment, and people training and education to be among the most important Transition Issues. These obstacles exist in Smart Supply Chain 5.0, but they are exacerbated by psychological concerns, worker safety concerns, social, ethical, and learning issues, as well as legal and regulatory factors. Finally, the most significant impediment is the paradigm change, which necessitates shifting equal focus from technology to people.

Figure 9 displays Supply Chain 5.0, an industrial strategy aimed at creating a smart, sustainable society by balancing people and technology. Technology, such as Industry 4.0 and other new technologies, as well as an innovation ecosystem, assist this plan. A range of challenges must be overcome throughout the transition to a Supply Chain 5.0 approach, including but not limited to psychological, worker safety, social, ethical, legal, and regulatory difficulties. From a social and environmental aspect, Supply Chain 5.0 wants to make the world a better, more sustainable place to live. It also allows for significant customization of supply chain goods and services.

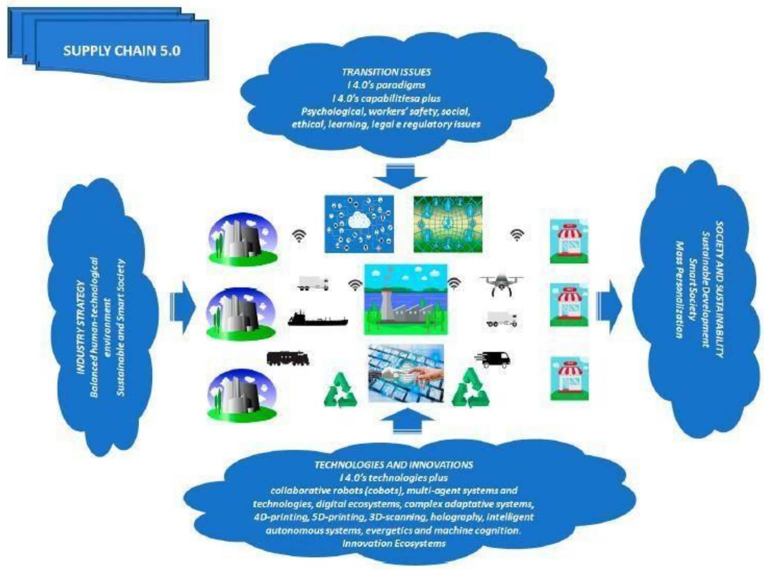


**Fig 5.3:** Model Diagram of I5.0 with SSC Society 5.0

# CHAPTER 6

## 6. CONCLUSION AND FUTURE WORK

Industry 5.0, which is still in its conceptual beginnings, strives to combine the human, social, and sustainability components inside today's purely technological framework. Even though there hasn't been much published about Industry 5.0, there has been an increase in discussions about it among academics and professionals.

By ensuring that manufacturing respects our planet's restrictions and by placing worker health at the core of the production process, Industry 5.0 acknowledges industry's potential to satisfy social objectives other than employment and growth to become a sustainable provider of wealth. Our research investigations and suggested solutions show that our vision of Industry 5.0 is open and evolving; it lays the groundwork for a shared, co-created future vision of the smart factory. Industry 5.0 emphasizes topics such as sustainability, human-centered design, green supply chain methods, and resilience. In our view, a smart manufacturing system cannot function at its present level of performance without include these components. How national policy could incentivize company innovation and future adaptation is relevant to the wider problem of "how can we make Industry 5.0 a reality?"

To better understand how large institutions and average people feel about Society 5.0, and whether or not they are prepared to join it, the research solution includes interviews and questionnaires. Businesses that want to reap the benefits of both technology and people must make investments in both. Therefore, there has to be more cooperation between enterprises and educational and training facilities. Companies are in a prime position to identify skill shortages and plan for the future. Skills research based on societal and labour market shifts should be used as a complement to this technique.

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## RESUME

I graduated from Sir Syed University of Engineering and Technology, Department of Electronic Engineering in Pakistan. I later pursued a joint Master's degree in Industrial Engineering and Operations Management from Istanbul, Turkey.

Over the years, I have developed experience in technical operations, public relations, and international collaboration. I worked remotely as a Technical and Service Engineer for a company based in my home country, while also contributing to humanitarian initiatives through a United Nations-backed project in Pakistan.

Currently, I serve as the Project Manager (Turkey) at *Best Diplomats*, an international nonprofit organization under the umbrella of UNITAR (United Nations Institute for Training and Research), where I engage in global humanitarian and diplomatic efforts.

In parallel, I am leading a fintech-based project focused on developing a digital platform to support displaced refugees. This application aims to facilitate access to employment opportunities and provide secure data management. As Project Manager, I coordinate cross-functional technical teams and partner with UN-affiliated humanitarian alliances to create sustainable, impactful solutions.

This dissertation reflects not only my academic and technical growth but also my commitment to using innovation to drive positive change in vulnerable communities.