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Engineering Management

Industry 5.0: Man-Machine Revolution

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Affidavit

I, **FRIDOL MEKKUNNEL**, hereby declare

1. that I am the sole author of the present Master's Thesis, "INDUSTRY 5.0: MAN-MACHINE REVOLUTION", 70 pages, bound, and that I have not used any source or tool other than those referenced or any other illicit aid or tool, and
2. that I have not prior to this date submitted the topic of this Master's Thesis or parts of it in any form for assessment as an examination paper, either in Austria or abroad.

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Abstract

This paper gives an exact idea of Industrial Revolution version 5.0, and it discusses different aspects of the implementation of Industry 5.0. It is based on extreme connectivity and communication between man and machine. The high speed of change we are undergoing in this environment means that not everyone can follow. A polarized workforce, unequal income distribution, heightened cybersecurity risks, and geopolitical threats mean that flexibility is essential to be a winner in the industrial revolution. In this generation, the rapid revolutions and globalization of technologies such as robotics, Internet of Things (IoT) and Artificial intelligence (AI) are made a massive change in the world. So, the role and lifestyle of humans change according to technology revolutions. The digital transformation is bringing revolutions like the 4th Industrial revolution, the Industrial Internet which improves the personal lifestyle from time to time. This paper shows better results of Industry 5.0 over previous Industrial Revolutions. The production is limited to the supply of products adapted to the needs of the customer. The methods are created by several research and surveys. Production and process management in such conditions need new techniques and the use of new technologies to maximize the efficiency and productivity of the system. Entering the 5th industrial revolution, globally companies adopted new technologies to meet the demands of quality customers and value-added products successfully and in the production, using new techniques in transparency, smart components, smart products, time-saving, real-time product monitoring, availability of information, new software possibilities, more significant data, and information security. These are just some of the results of the adoption and use of new Technologies in companies. The implementation of Industry 5.0 brings back human to the industry again and reduce unemployment and reduce dangerous jobs, which makes overall positive development for the future society.

Table of contents

1 Introduction

We may not know what the future clutches for man and machine or if they are. Until now, but companies are currently around the world. Benefit from the advantages of combining man and machine. This combination is part of the last industrial revolution known as "Industry 5.0". Industry 5.0 sees the blending of human analytic thinking with some of leading Internet connectivity technologies, including the Internet of Things (IoT), Cloud, Cobots, Artificial Intelligence (AI) and Big Data. This radical movement sets the stage for the new modern business and will significantly impact the business. To enter this late period, companies need to understand the technological environment and steer the new key developments to work in their favour.

In the presently quickly changing industrialized world, globalization, personalization, and robotization is assuming a convincing job in the advancement of the production area. These days, the imaginative ideas of Artificial Intelligence (AI), The Internet of Things (IoT), Factory of Things (FoT) and Industry 4.0 are meant to upset the way innovation and new technologies can help upgrade manufacturing system in a global level. While in some universal enterprises these ideas are in effect profoundly considered furthermore, are beginning to be executed, likewise in moderate size and substantial makers it is clear they could contribute with various preferences, in any case, doubt and vulnerability are yet present among supervisors and partners. In this paper, the latest and upcoming innovation and usage of the Factory of Things worldview exhibited, and instances of the current execution in worldwide assembling organizations are broke down. The industrialization deals what more is, how it can help increment the control and productivity of manufacturing, material handling, inward coordination and manufacturing planning. The technological revolution is changing production, assembling and many other sectors. By bringing machines, artificial intelligence, and IoT into the workforce, it is empowering an undeniably versatile, change-prepared, and responsive workplace: An Associated Industrial Workforce in which men and machines, cooperating, rehash the manufacturing administration forms by which producing results accomplished.

As many articles define, Industry 5.0 isn’t yet present, but it directs to the revolution to combine human and machine by giving the option to customize the manufacturing and the product. Industry 5.0 is finding ways to make it able to let human and machine work together. Besides, the direction of Industry 5.0 is to prevent waste. As the Connected Industrial Workforce guarantees to help productivity exponentially, just as improving operational effectiveness, and upgrading security, hazard the executives. Moreover, as work costs in such beforehand low-wage nations like China proceed to rise, the Connected Industrial Workforce offers makers a chance to alleviate the effect on the rival plants in the locality. Since automation and modernizing are becoming mostly imperative over the years, the human association has rapidly been undermined. There's a consistent discussion about whether machines will supplant the human workforce or on the off chance that there is space for both later. While machines can produce likely work at a speed and exactness past what's humanly conceivable, people have individual aptitudes that enable them to intellection thinking.

The robots came into the industry since the 1960s; they were introduced as firstly as Industry 3.0. The Robots changed the total production culture all over the world and started a new revolution in the industry. Robots grew up mainly in the car field in which they were utilized basically to weld structures to get the bodies together. As requests developed, robots began seeing use in other diverse areas like Logistics, agriculture and health field. They changed the car manufacturing and many other manufacturing facilities. As technology evolves, the robots are used for some other purposes like logistics, medical field, and site work. The primary reason behind the evolution of industrial robots to eliminate the D factors, dangerous, dirty and dull jobs. But the other elements are to keep quality, speed, efficiency, and continuity in manufacturing. Robots are intended to encourage people and improve our lives. All-inclusive Robots utilizes the expression "robots" for communitarian robots to underscore the significance of individuals in automated innovation. Moreover, 2006 was the prime year when more robots were implemented outside the car production than inside. These days, robots are used in enormous facilities, yet additionally progressively reasonable and straightforward to utilize cobots in different organizations.

The Advantages of automation are:

- Robots make better consistency in work quality and provide high-quality products at less cost.
- They can assign for hazardous and dirty works.
- The robots can produce data regarding the process and quality, these data can be used and to improve and optimize the manufacturing and the plant.
- The expense to establish the robots and the system is almost the same everywhere all over the world, so it helps the companies which have been transferred to low manufacturing cost countries.

Just four years after the Introduction of Industry 4.0 Industry 5.0 has been introduced. In comparison to other revolutions of Industry, the Introduction of Industry 5.0 was the fastest.

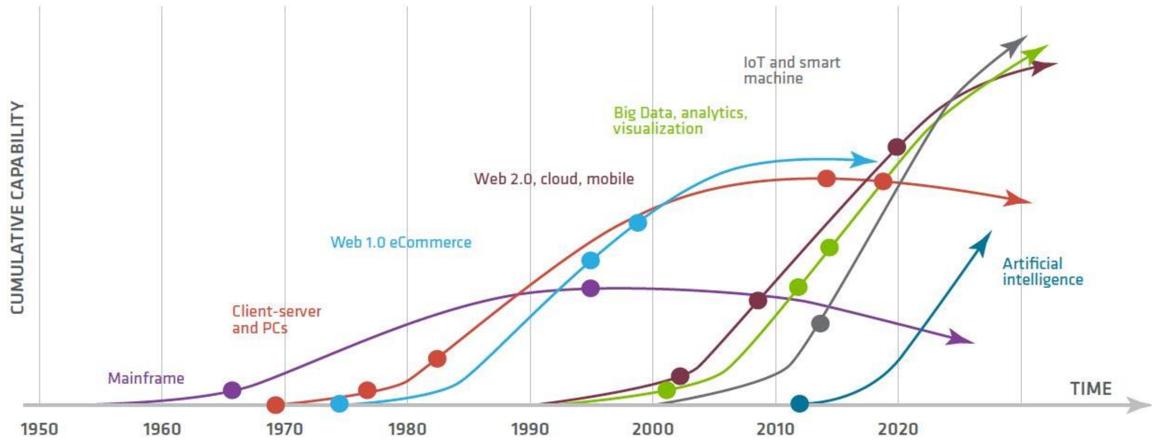

Fig1. Digital transformation initiative mining and metal Industry. White paper, World Economic Forum/ Accenture analysis, January 2017

On a plane, the transformation represented by the industrial revolution is elementary. Since the industrial revolution, prosperous modern economies experiment with constant rates of efficiency improvement. Every year, more production is produced per input unit. Subsequently, the Industrial Revolution: The stock of money has risen as rapidly as production. As well the share of capital in all profits is about a quarter. So, only about a quarter of all the modern growth of income per capita comes straight from physical capital. This is an unallocated increase in the measured efficiency of the economy, year after year. (Future IQ, 2017)

1.1 Internet of Things (IoT)

IoT is the concept or worldview of interfacing various types of physical gadgets improved with implanted hardware (Radio Frequency Identification (RFID), actuators, sensors) to a system or web so they can speak with one another for controlling and checking purposes, to get to web and information mists and to adjust to their very own condition. The interconnection is establishing with technologies like Wi-Fi, Bluetooth or mobile data.

The main aim of IoT is to having sharing and diffusing system which is built up by interconnected smart devices which can communicate with each other to perform assigned tasks. One of the chief merits of the IoT system is the simplification of highly complicated systems. It is like an ecosystem of smart devices which transfer data to each other, creates an intelligent environmental to attain the tasks.

1.2 Factory of Things (FoT)

The idea of FoT is the implementation of Internet of things and IT to expand an application in production systems which combines the inter-machine communication, visualization, and analysis of data about the manufacturing status and completion which helps in manufacturing systems. The smart factory concept is the future for improving and generate highly systemized manufacturing systems. From the initial point of the structure process until the last arranging of the generation and appropriation, all the data can be distributed and examined with the execution directions and enhancements across the life cycle of the item.

1.3 Machine Learning

Machine learning has long been used to research large volumes of data, but the next industrial revolution is driving exponential growth in the use of machines to perform data accumulation and evaluation tasks, particularly in the areas of recognition and Troubleshooting.

Machine learning denotes to the ability of computer systems to advance their performance when exposed to data without openly for programmed instructions. The novelty of this process is that the method allows a machine to further improve its performance without the man having to explain to it precisely how to perform all the tasks assigned to them Essentially, machine learning is about automatically identifying patterns in the data. Once discovered, the model can be used for predictions. Machine learning is used in all industries but is particularly useful in diagnosing medical performance, for instance, to detect disease based on test results and to calculate treatment patterns. (Future IQ, 2017)

1.4 Big Data

Data collection is one of the main drivers of all components of the next industrial revolution. Big data refers to records that are larger than the capabilities of traditional database software tools for capturing, storing, managing, and analysing. The availability of data, a new generation of technologies, and a cultural shift to data-driven decision-making drive the demand for technology, services, and massive data analytics.

Big Data is created by virtually the whole thing we do not only do we leave our fingerprints everywhere, but the data generated by the machines is evolving rapidly. Big Data assumes that the more you know about a situation or situation, the more you can learn new things and make reliable predictions. In combination with machine learning and predictive modelling, big data has changed domains such as health, agriculture, and safety, pushing the pointer into artificial intelligence.

The Big data Ecosystem consists of Services, Integration, Analytics ISV´s, Specialized ISV´s, Big four, Databases, Storage, Infrastructure, Network, Data Centres and Hardware. All these features make a Big Data ecosystem complete. (Future IQ, 2017)

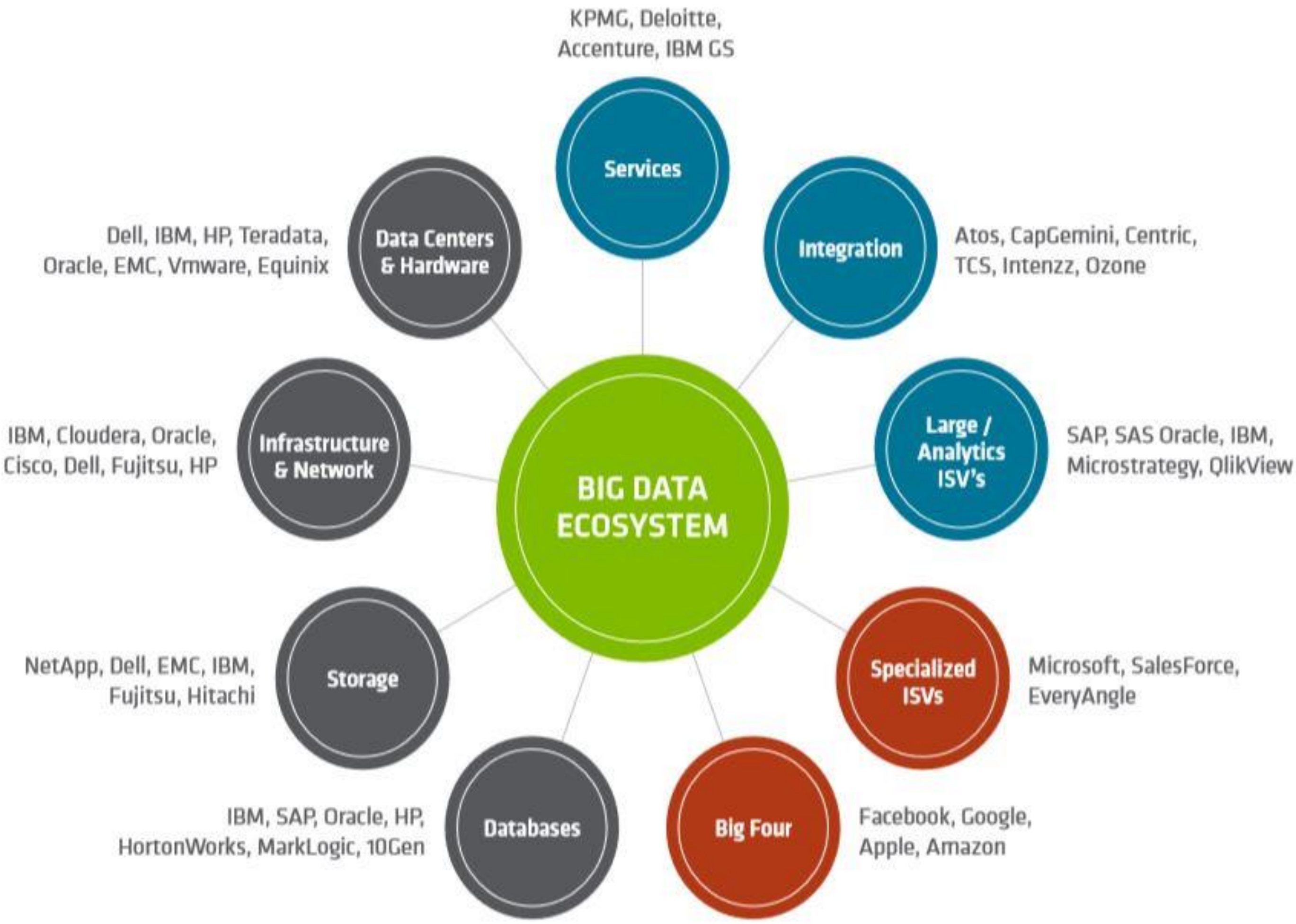

Fig 2. Big Data Ecosystem

1.5 Everything is Connected to Everything Else

Now we are in an interconnected world, and nothing appears to be excessively far. This was not generally so. A remarkable union in the course of the most recent decade in three innovation spaces developed outrageous mechanization, hyper-availability, and at last, the IoT.

The IoT alludes to this certain highly connected registering condition, and the related societal, modern and logical practices, and human qualities in motion, that are aggregately changing how information, learning, and development are as of now created and expanded. Not just people and other living life forms however for all intents and purposes any article, vivify or lifeless, are associated with the IoT and interact with one another through devices, sensors and remote network, followed progressively, what's more, in a condition of consistent gaining from the Big Data they are generating and using at the same time.

Connect the not connected part and make it as a single ecosystem is the saying for the IoT, independent of the idea of the associated things. In other quarters, a virtual copy of the real world, and progressively, copies of natural and the living cases are to be developed, and all are interconnected for the IoT. (Özdemir, Vural & Hekim, Nezih. 2018)

A logistic conference called, 'LOGISTICS RIDE,' was held in November 2016 in Ostrava, Czech, which made Industry 5.0 became to a public speaking topic for the first time, by a presentation of the achieved results by the implementation of principles. Efficient tools, as 6R methodology and L.E.D principles, have been the base of Industry 5.0.

Industry 5.0 focuses on validating creativity, high-quality custom-made products, and living standard. It aims to increase the life quality of human and not only to increase technology. It can be called as the fifth revolution of humankind. Smart services are for both communications of humans and non-humans. The interaction between humans and non-humans is the sharing of information and data regarding the system. It is essential to design and generate organizations, data-sharing platform, and technologies which support the system to interact for the goal.

1.6 6R Principle

In almost all life and business cycles, the 6R principles can be applied. It isn't just meant for one segment like Waste Prevention only.

- Recognize

  Recognize from which source, most of the waste comes. Recognize the main waste sources and detail their reasons to be resolved.
- Reconsider

  Reconsider the methods to solve the waste generation and disposal of waste. Reconsider all the possibilities of waste disposal whether it is reasonable or not.
- Realize

  Realize the waste source and methods to dispose of them in safely. The environmental factors should be considered at this time. And we should all the safe practices to reduce and destroy the waste safely.

- Reduce

  The goal of this process is to use fewer resources in designing, fewer materials and transporting products. Another goal during the operational process is to use fewer complex materials. From the design stage to establish a strategy for disassembly is also a goal of this procedure. But there is a practical limitation because for a design with disassembly feature the significant initial cost will be included. This procedure also contains the idea of using a smaller number of components as well as to minimize all seven types of wastes using Lean principles. To reduce pollution is also an aim of this procedure by identifying strategies. To minimize consumer returns and product recalls, increasing quality is also an impact of this procedure. The use of optimized transport even the resource use in reverse, as well as forward supply chains, also belongs to the goals of this process. Trade-off considerations of return policies is also a factor to be identified. Another goal is to reduce materials which may contain hazardous environmental impact. Components with the same functionality must be found to minimize elements which can limit these procedures to make it practical. To execute and monitor improvement progress in all aspects there are continuous improvement programs needed.

- Reuse

  To reduce the utilization of new raw materials products can be reused. One of the goals of this procedure is to extend the component and product life. To develop a secondary market is so another option to reuse products or parts. Still to make these goals practical is not easy, since the complexity, risk of failure and complication in product warranty will increase.

- Recycle

  To achieve this procedure recyclable materials must be utilized. To increase recyclable components with new products a goal is to identify the opportunity to it. Unfortunately, some recycled materials include significant environmental impact which will be followed against the procedure of Reuse. Some quality issue might occur during the process. To maintain the same functional capability might be a challenge with recycled components. To increase recycled materials usage, one of the most significant problems will be to convince customers. (Kuik, Swee & Nagalingam, Sev & Amer, Yousef. 2011).

1.7 L.E.D.

L.E.D means logistics Efficiency Design. A few years earlier the L.E.D. principles have been introduced. In the projects that point to the efficiency of the global supply chain, this principle has been defined.

Transparency, Profit sharing, and efficiency are the principles of L.E.D. Outside the Industry 5.0 the L.E.D. principles are also applicable.

- Transparency
- Profit Sharing
- Efficiency

Industry 5.0 was initially named as INDUSTRIAL UPCYCLING by the founder for his first work. Mainly because without the need for significant capital investment, it’s able to achieve immediate changes. Therefore, the clients renamed it to Industry 5.0.

The circular economy is a regeneration system that aims to highlight the positive merits of society, redefine growth and minimize the influx of resources, waste, emissions and energy leakage. Through maintenance, reuse, repair, repackaging, restoration, recycling, recycling, and sustainable design, this goal can be achieved. Some industries have tried to compare industry 5.0 to the circular economy, which is not appropriate for a simple comparison. The reason is that the circular economy needs significant capital from the beginning. Comparing industry 5.0 with a more accurate tool will be the sustainability tool. From the sustainability tool to industry 5.0, they pursue the same goal of continuous development.

In 2010 the first project of waste prevention was by the founder realized. Even more in late 2013, the first complete scope application took place. From 2014 the only systematic waste prevention tool in the world has been defined as the Industrial Upcycling which applied to the industrial environment. On three levels are the effects of application to be understood:

First Economical

The value of products and materials of the waste and wasting prevention which was estimated, including the logistics costs joined are the results of the First effect on Economy. Zero Waste environment was the achievement, which means all waste management related to the value have been isolated.

Second Ecological

The same activity is the result of the Second effect on Environment. In lack of need for further natural resources exploitation have been valued as the systematic utilization of the On-The-Ground-Mines.

Third Social

The link to human was the concentration factor for the third effect on Social environment, which was completely forgotten in Industry 4.0. Unique skills which must be utilized and to produce high-quality products to establish abilities of highly efficient working environment can be achieved with the practical cooperation of human and machine together.

Some challenges for Industry 5.0 have already been identified, which must be solved for the development of Industry 5.0. One of the difficulties is overproduction. In many processes and industry, there has been a lack of transparency implemented, which is also another challenge. Applications of ‘wrong tools’ pretending to be good are also one of the main challenges. Also, the dependency on electricity and even challenges. Another problem is the general antipathy to change by the stakeholders.

A first-degree autopoietic plant is manufactured because the plants do not breed. Active consideration of the self-limiting feature of using bionic approaches in plant design will be important in industry 5.0, as an autonomous, self-generated plant cannot develop steadily. The stage of expansion of the second level is preceded by modern maintenance methods, such as predictive maintenance and other techniques, for example when thinking about the self-control of production facilities. The growing network of components through Industry 4.0 will provide more steps towards a stand-alone, second-tier factory. As a result, the development of Industry 5.0 will focus primarily on the third tier of Autopoietic Factory and will include self-generation. The first steps have been taken in the development of additive manufacturing processes. Considering also the goods produced in themselves, the stage of expansion of the fourth degree was reached.

1.8 The role of waste prevention

Volume and profit-oriented have been most modern industries. These results the reason for waste and waste produced while production and other stages. The automobile industry can represent efficiency; each car is being manufactured in less than one minute on the production line, which shows the increase in productivity by waste prevention and reduction.

The first type of waste is trash which was defined as physical waste. The loss of opportunity to apply the will of people to work is the second type of waste, which is defined as Social waste.

Urban waste:

Process waste is classified as the fourth type of waste, which involves excess production and surplus stock.

Fig 3. Waste upcycling

It’s fascinating that a single person has started industry 5.0 with his project only. (In comparison to 4.0 → many people who were working for & behind it)

2. Into the Industrial Revolutions

We use this term to explore broader implications that go beyond the industry. The previous stages of the Industrial Revolution have reformed every aspect of our lives, and their effects continue to be felt in society. It is likely that the speed and magnitude of the change associated with this step are greater than anything you have seen before.

The four main drivers of the next industrial revolution are emerging catalytic technologies, machine learning, the speed of change, and the global scale of the revolution. These factors combine Internet technology and operational technology, which has led the industry to automate and optimize. This will happen at an increasing speed and in many other networks of horizontal and vertical sectors around the world. Increased connectivity enables the fast rate of change and fluidity throughout the life cycle of evolving products and services. This leads us to more autonomous decision-making, a changing role for the workforce, new organizational and collaborative paradigms, and new "smart systems."

2.1 History of Industrial Revolutions

The industrial revolution, which took place between the eighteenth and nineteenth centuries, was a time when rural societies, mainly agricultural, became industrial and urban in Europe and America. Before the industrial revolution, which began in Britain in the late 18th century, manufacturing was often carried out in private homes with hand tools or basic machinery. Industrialization involved moving to machines, factories, and mass production for specific purposes. The steel and textile industry and the development of the steam engine played a central role in the industrial revolution, which also improved the transport, communication and banking systems. Although industrialization has resulted in an increase in the volume and variety of manufactured goods and a better standard of living for some people, it has also created jobs and living conditions that are often bleak for the poor and the working class.

Industry 1.0

From the 1800s started the innovation of Industry 1.0 by focusing on the development of water- and steam-powered machines to assist the workers. The effect of production capabilities was the growth of the business, which made a better living standard for some people. A significant transformation was for the textile industry. Also, machines were used more beneficial with fuel sources like coal and steam, which made a reason for widening the idea of machinery manufacturing. Innovations and technologies have been made possible by machine; they also let the production be faster and more comfortable.

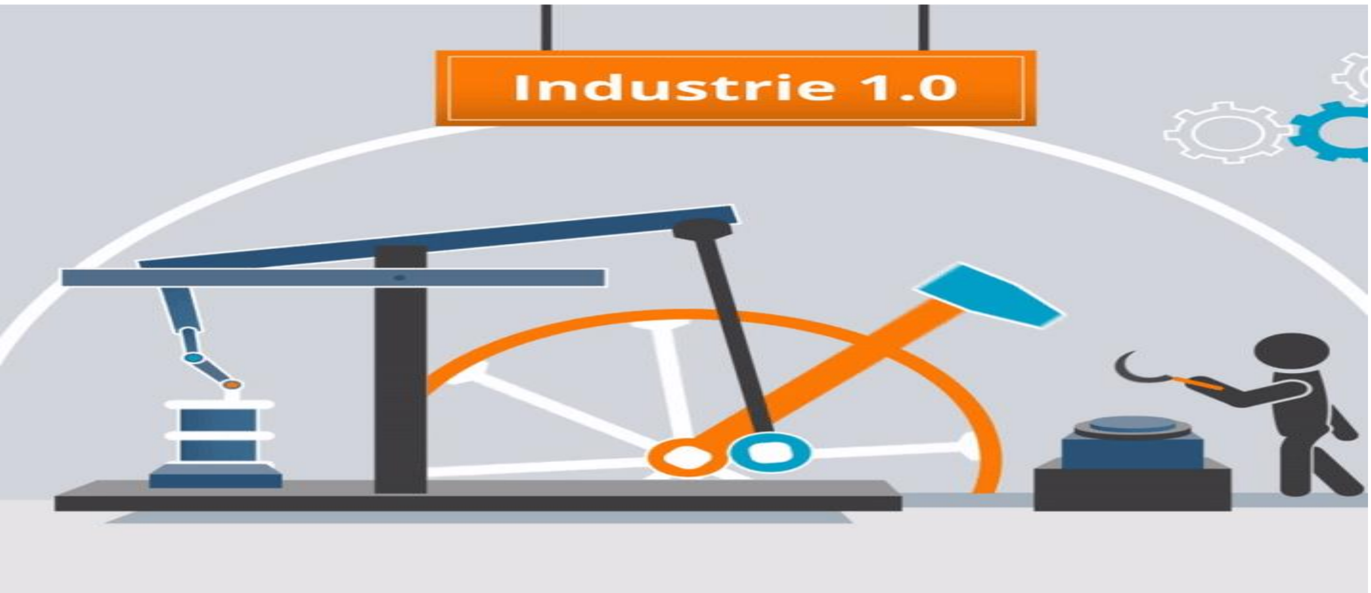

Fig 4: Drawing of the main idea of Industry 1.0, displaying the utilization of water- and steam-powered machine

Industry 2.0

Introduction of new technological systems was made during the period of the 1760s and 1840. One of the primary technical systems, which were introduced was electrical technology; this became the primary source of power at the beginning of the 20th century. More comfortable than using water and steam was making the electricity popular which also made the business possible to concentrate power sources to individual machines.

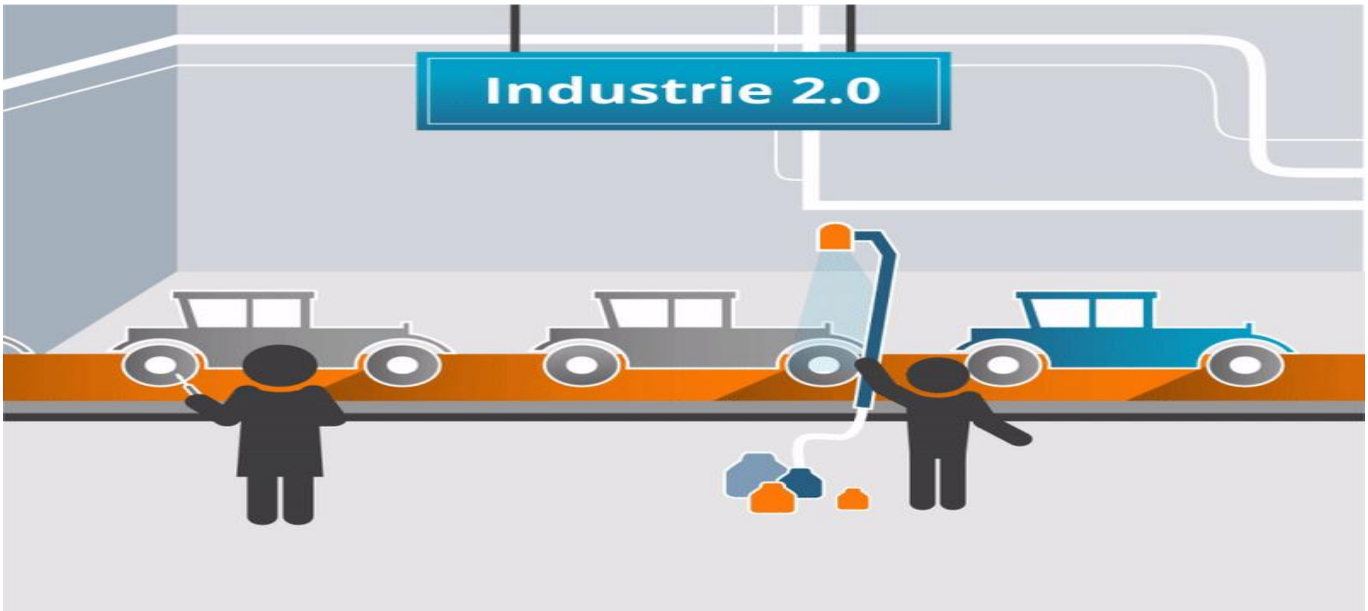

Fig 5: Drawing of the revolution to Industry 2.0, displaying the use of technological systems

Industry 3.0

The third revolution for more automation in production was around the 1970s with the utilization of electronics and IT. The generation of computers started with Industry 3.0. Connectivity, internet access, and renewable energy made manufacturing and automation able to progress well. To replace the work of human many more automated systems were introduced by Industry 3.0, the use of Programmable Logic Controllers (PLC) was one of them. Still, the input and intervention of human were required.

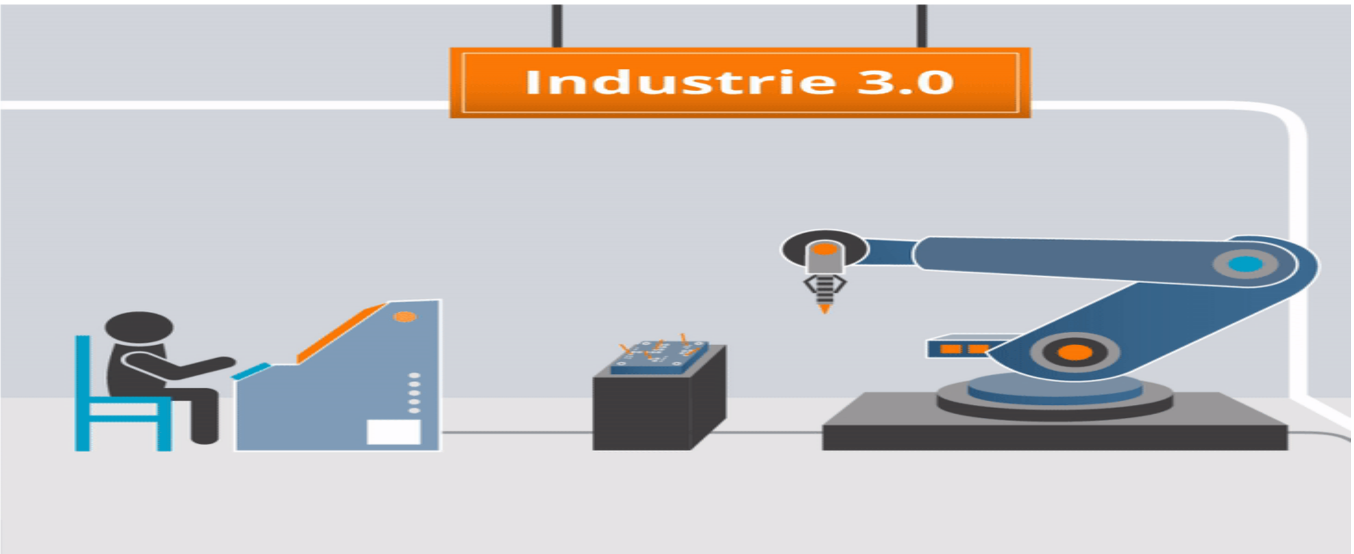

Fig 6: Drawing of Industry 3.0, displaying the utilization of electronics and IT

Industry 4.0

Industry 4.0 was more focused on the usage of cyber-physical systems and technologies, which contains the IoT, cloud computing, cognitive computing, and Big Data.

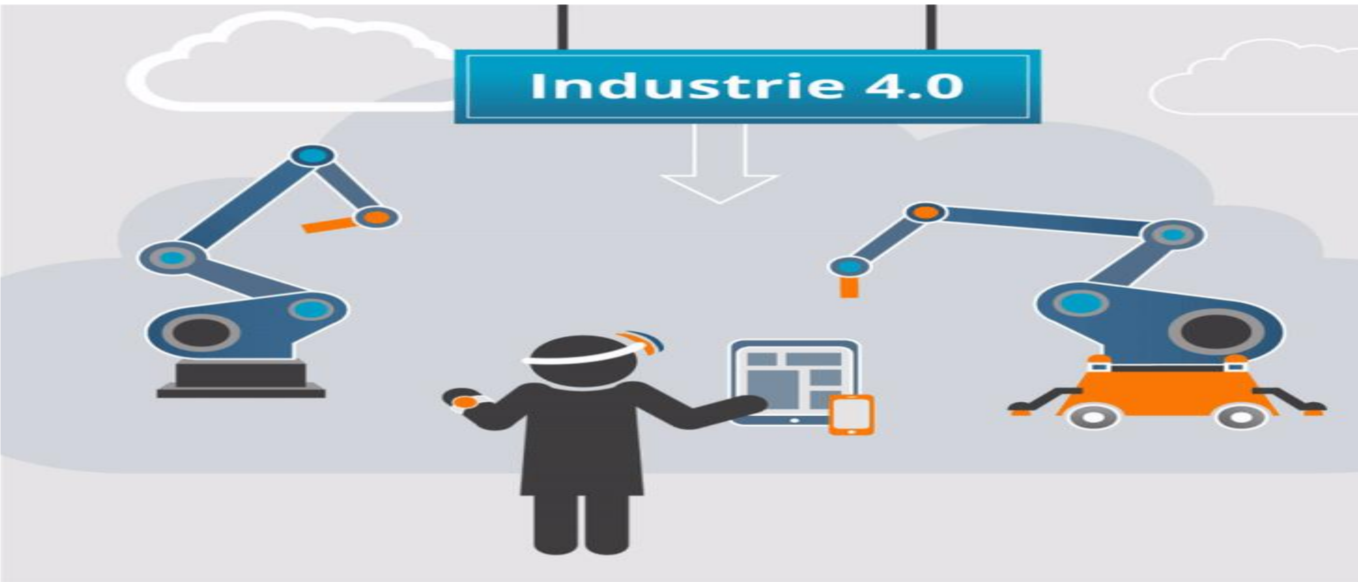

Fig 7: Drawing of Industry 4.0, displaying the use of cyber-physical systems and technologies

The following design principles were used for Industry 4.0:

- Interoperability

  The Internet of Things and the Internet of People should be utilized as the options to make objects, machines and people to communicate.
- Virtualization

  A virtual model of the real world should be created and simulated by CPSs. CPSs should monitor the existing objects in the surrounding environment.
- Decentralization

  To make it able to give space for customized products and problem solving, the CPSs should own the capability to work independently, which builds more formable environment for production. To a higher level can the issue been assigned on cases of having clashing targets or failures. Although the demand for the guarantee of quality stays as a part of the full procedure after all the full implementation of such technologies.
- Real-Time Capability

  To collect, stock or evaluate real-time data and as well as making decisions according to new inventions contains to the needs of being a smart factory. This also applies to internal procedures and not only to market analysis. To identify the bug and to re-envoy assignments to other operating machines are included in the ability of smart objects. This also enables the production to be flexible and optimized.

- Service-Orientation

  Customer-oriented must be production. For creating customer-oriented products, people and smart objects/tools must have the capability to connect accurately through the Internet of Services. This is the reason why the Internet of Services turns to important.
- Modularity

  In a changing market, to be able to adjust to a new market is essential for a Smart Factory. In an ordinary case, to study the market and to innovate its production appropriately it would take a week for an average company. To occasional innovations and market trends, smart factories must have the capability to adapt to flatly and fast.

Making Industry 4.0 reality wasn’t that easy and had the following challenges:

- Security

  The IT security risk is the biggest challenge to implement the techniques of Industry 4.0. To get the room for security breaches and data leaks this online integration makes it possible. Cyber theft is also a big factor of challenges which must be considered. The problem may lead the producers to money loss, and it can also lead to injuring their reputation in such a situation. This is the reason why the analysis of security is critical.

- Capital

  New technology needs massive financing for such a change. Only on the CEO level can be the decision of such a change made. Also, in that case, the consideration of the risk must be taken seriously. A significant number of finds will be necessary for such change, which can lead to making smaller businesses unfamiliar and it may also lead to losing their market share in the future.
- Employment

  Additional or entirely new skills might be needed for the workers. This may take the employment rate higher, but it will also affect the workers negatively by making a big part of workers unfamiliar. It can challenge a portion of workers to match the industry which has an unchanging work. As a solution for this many diverse educations must be launched, yet it can’t be worked out for the elder part of workers. This may take some time to be cleared up.
- Privacy

  As well as a customer also, the producers are worrying about privacy. Stocking and analysing data are necessary to be done by producers in interconnected manufacturing. As a privacy threat to themselves can this taken by the customers. This also includes consumers as well. To be on the path of a more transparent environment will be the challenge for companies which haven't shared the data yet. Also, another big problem is to disclose the space between the customers and producers. Industry 4.0 still has not enabled to cover a critical level of the manufacturing facility, its vision of almost complete automation and the guarantee of coming about cost reduction has caught the industry's conception. (Vuksanović, Dragan & Vešić, Jelena & Korčok, Davor. 2016)

2.2 Needs for the modern industrial revolution system

For Industry 5.0, it is necessary to turn regular machines into safe and self-learning devices to improve their overall performance and maintenance management with the surrounding interaction. Industry 5.0 seeks to build an open and intelligent manufacturing platform for industrial network information applications. The critical requirements of Industry revolution are real-time data monitoring and product location, as well as instructions to control manufacturing.

Industry 5.0 is based on four principles

- Interoperability: The collaboration of machines, tools, and computers in a system.
- Information clarity: The capacity of the sensor-stocked computer systems to create a virtual version of real machines and objects.
- Technical support: Computer systems and artificial intelligence to support workers with strategy, decision making, and work.
- Fragmented decision: The computer systems can complete several and specific task on their own.

The supporters of Industry 4.0 contrast that the latest industrial integration of technology allows for unrivalled autonomy of advanced machines. When it is ultimately applied, Industry 4.0 generates autonomous factory system that can implement most of the work in the factory and reduce and rectify imperfection in production without human help. Some vision behind Industry 4.0 state that the concept will be possible to create a production network globally. The geographical frontiers between factory spots will conclude to exist in effect sense because the IoT of all industry is connected through artificial intelligence and cloud computing. Industry 4.0 practices are distributed to various science and innovation spaces, including Big Data in the health sector. In that capacity, the simulated and the real world are being associated over the planet. Together, the IoT and CPS have empowered this Industry 4.0 development. Anyone can create an electronic and digital copy of everything, alive and lifeless, in a given reality, regardless of whether it is on an industrial facility floor, buildings or anything.

There are also many hitches stand in the implementation of Industry 4.0

- If the Industry 4.0 is once fully implemented, many uneducated or not educated workers to get jobless.
- To implement Industry 4.0, high skilled factory engineers are needed, so highly educated people are required.
- IT security problems: since Industry 4.0 is highly depended on IT, it is essential to keep the IT security efficiently.
- Fear of IT bugs: There are chances for sudden temporary malfunctions of IT, so many of the essential and confidential processes may get misshapen.
- Reliability problems with the machine to machine communication, still it is not reliable at the level of stability and overall performance according to Industry 4.0 standards.

Shortly, it is expected that advanced detection potential in cyber-human technology will abolish the risk of defects which increases the chances of adoption Industry 4.0 by many companies. Now, many of the participants are agreeing that cyber systems are more reliable than manually operated systems producing exact precision.

3. Aspects of Industry 5.0

"Yet, it is precisely this threat that will be ended with the coming of Industry 5.0. In a world in which every individual wants to express oneself fully, there will be increasing demand for unique, customized and personalized products. In such an era, the holy grail will no longer be robot-controlled mass production, but human creativity." (Pieter Simoens, 2019)

3.1 Industry 5.0

It is empowering the customized large-scale manufacturing by re-establishing the "human touch" to items. Industry 3.0 brought large scale manufacturing; Industry 4.0 brought mass customization. However, Industry 5.0 can be tied in with utilizing the most recent technology to alter as well as to customize the items (and generation forms). They are returning to inventive, carefully assembled work paired with extreme exactness and profitability, for example with the utilization of collective robots as imagined by any semblance of Universal Robots. Be that as it may, most likely few out of every odd industry will (need to) grasp Industry 5.0. The attention lies in applications where the customized touch conveys a superior client experience, which brings extra esteem (and incomes) — going from simple to utilize man-machine combination to no unmistakable alliances where the cooperation of man and machine occurs. Empowering advancements could be a collaboration using voice or even waves from the human brain. This consistently coordinates human-made brainpower with ordinary activities. The pint-sized exchanges of the machine to machine is for a total straightforwardness of the esteem creation chain and human and non-human givers. This can be one consistent application for blockchain innovation, which could satisfy regular instalments for made esteem or keen contracts, verifying the creation of quality satisfaction. The development and technologies cannot cause troublesome societal change or an intermittence among at various times sound practices, consequently legitimizing the application of the term fifth industrial revolution.

Currently, production is being switched from mass production to personalized output. Rapid advances in manufacturing technology and its implementation in the industry contribute to increasing productivity. The term industry 5.0 stands for the fifth industrial revolution, which is defined as a new level of organization and control of the entire value chain of the product life cycle. It is increasingly geared to the needs of the customer. Industry 5.0 is still a visionary but realistic concept that includes the Internet of Things, the industrial Internet, smart manufacturing and cloud-based manufacturing. Industry 5.0 refers to the strict involvement of people in the manufacturing process to achieve continuous improvement, focus on value-added activities and avoid waste.

So, the Introduction for Industry 5.0 as a transformative, gradual (yet fundamentally significant) headway which expands the idea and practices of Industry 4.0 — for our motivations, tending to above until now undervalued four asymmetries in the ecosystem of the Industrialization trend before. The plan under innovative worldwide working systems is convenient, and the ultimate target of Industry 5.0. Others may wish to name it diversely as Industry 4.0 Plus, Industry 4.0-S, Industry 4.0-Symmetrical, or another phrasing - in as much as the above conceivably impairing. Problems and irregularities in the Industry 4.0 advancement ecosystem are taken important.

The fifth industrial revolution can majorly affect client needs item improvement community adjusted advancement and hierarchical frames. Skill or ability improvement is remarkably set to manage the impacts these problems can wear business. To assist their organizations to do moreover as exceeding expectations during this evolving condition skilled specialists ought to be proactive intending to a few key patterns: agile culture, AI and utilizing society as a favourable position.

The 4th Industrial Revolution, or as it is called, Industry 4.0, was launched by Germany in 2011 and provided an enticement for the development of the industry through the automation of production using all the modern means of production known cybernetic systems. These systems incorporate techniques for calculating, transmitting and processing data and advanced mechanical systems. In 2015, a new term Industry 5.0 appeared, in response to Industry 4.0. At first, it was a kind of revolt against the dehumanization of the industry that became a concept of collaboration between man and robot in specific jobs. It is from time to time said that this is a return of human touch or contact in production. There are vast differences between Industry 4.0 and Industry 5.0 regarding the place and role of the new product concept, as well as the reasons for defining its use. (Ryann K. Ellis. 2018)

After just four years, when Industry 4.0 was defined as the concept of a modern industrial system that needs to be implemented in business over the next six to seven years, the new idea of Industry 5.0 has been set. Industry 4.0 has not even been massively used, and the original concept of Industry 5.0 has created doubts and different remarks. The logical question that came up was whether Industry 5.0 continued with Industry 4.0 or their replacement. It is expected in professional and scientific circles not only with suspicion but also with ignorance.

The same small number of workers who remain in the industry after reorganizing to the Industry 4.0 concept will work like machines. He agrees that a person needs to return to industrial production with new techniques from collaborating robots or cobots. His company accepted this concept in response to the big companies focusing on the 4.0 industry, and their robots became the most widely accepted cooperative robots. He points out that the 5.0 industry is more "anti-industrial" than industrial because it returns to pre-industrialization at a time when its values craftsmanship and craftsmanship, rather than any product as the desired Customer was unique.

The view that the 5.0 industry is a new form of collaboration between humans and robots is to harness the capabilities of machines and people. The machines are more precise and efficient, and the workers have skills, reasoning, and critical thinking. This mode is appropriate for jobs that lie between fully manual and fully automatic manufacturing lines. Working with Cobotics enables companies of all sizes, the implementation of automation and in places where this is not profitable or difficult to implement. This is also due to the rising demand of customers for personalized products that meet their needs and desires.

Some researchers call it to progress in production processes through the collaborative work of robots and related humans and the revolution of human touch. It is believed that this is a return of workers to the production process, taking advantage of automation and human cognitive capabilities. Cobot cannot be considered as a revolutionary invention but as a logical evolutionary step in the development of robots. They are gaining more and more sensors to identify the environment, identify objects in space and their location, and the highest levels of artificial intelligence make it possible to make appropriate decisions. The broad application of Cobots, such as UR or LWR (Hook), is also possible because they are cheaper and easier to program with built-in modern sensor technology and a degree of artificial intelligence. (Gojko Nikolić. 2018)

The Industry 4.0 concept, marketed in 2011, targets an "intelligent factory" that automates all processes from communication to the manufacturing process to maximize profits. The number of employees is pointedly reduced, the structure of employees' changes, only in computer science, new knowledge is needed. This concept is primarily intended for production facilities that produce large quantities of products that may be different and personalized but use the same type of work technology. The factories that provide high-quality products become mass-produced factories as the customer's needs increasingly influence the outcome.

Despite, the 5.0 industry, promoted in 2015, focuses on the interaction between man and machines. This combined work of man and robots combines creativity and human skills with the speed, productivity, and accuracy of robots to create new business and social values. Industry 5.0 is more human; it rebounds the "human touch" or people in production. This work concept is best suited to small and medium-sized businesses where full automation is not possible or is not cost-effective, and where market demand is increasingly looking for products that are tailored to the needs of customers. And in large scale manufacturing industries, some technological operations are not profitable to automate, or automation is very sophisticated, so this form of co-operative work between cobot and workers is the most useful. There is a high potential for cooperative work in the field of maintenance plant.

3.2 When the man meets machine

Although we must wait and see if there is a robot uprising, we are in the early stages of Industry 5.0, which implies greater collaboration between advanced technologies and people. For example, robots can complete the automated manufacturing of products, and IoT devices along the production lines can collect vital production data. The Business Process Management (BPM) software controls the data to detect unusual things and, in the event of a failure, activates a process that alerts the suitable personnel, who can act and choose what to do.

With advanced data analysis and artificial intelligence, the BPM software can provide the individual with several options to guide them to determine the best course of action. While In this situation, while technology drives these processes, the human being remains at the centre of the decision-making process. In this collaborative environment, methods are faster, decisions are better, and business results are better.

While Industry 5.0 can't promise a murderous plot, it can promise companies improved adaptability, increased change-readiness, and a more responsive working environment by digitalizing and automating their critical business processes while keeping humans at the centre of vital decision-making. In this collaborative environment, companies can realize digital transformation and attain greater productivity, agility, and profitability. (PNMSOFT, 2016)

If Industry 5.0 seems too good to be true, or a science fiction study, think over. According to a survey, 85% of manufacturers believe that divided environments focused on people and machines will become commonplace in their production processes by 2020, just three years later. Also, the survey showed that 62% of leaders wanted their industries to launch this initiative. Though, only 22% have started to take steps to introduce support technologies.

One of the technologies supported by Industry 5.0 is Robotic Process Automation (RPA), a robotic software that enables organizations to capture and interpret the user interface and actions of other applications used in various business processes. As AI progresses, the RPA software will include specific operations, automatically process transactions, collect, enter and analyse data, and communicate with other existing systems. It reflects how users work with enterprise applications even faster and better. If something goes wrong in one of the automated processes of the RPA, or if it is necessary to make a significant change in a process, the BPM software will launch a workflow that will notify a staff member to review the problem and provide all the necessary information. The essential information needed to make an informed decision that will yield the best economic results. As a result, while RPA and BPM software support backup jobs and repetitive workflows, people remain critical to operations.

Artificial intelligence, robotics, RPA, and BPM set the stage for industry 5.0, which will only be fully realized in three years. So, if you want to be a market leader rather than a successor, it's time to start investing in these technologies as soon as possible. Tomorrow's business will be today's business before you know it. (PNMSOFT, 2016)

3.3 Labour Landscape

Unsettling changes will have a profound impact on the work landscape in the future. A lot of the significant drivers of transformation that currently affect global industries they have a substantial effect on jobs, which range from creating vital jobs to moving jobs and the highest labour productivity to broaden skill gaps. There will be some employment in the future that has not yet been created before. The ultimate change in the workplace will require a new level of cooperation between workers and technology.

Changing the work environment could have a positive impact on the future. For example, it is activated by narrowing the gender gap in the sector, as automation can further reduce work and encourage women to use their skills more and more in the formal economy. The flexible workforce is reforming the existing labour market, which will also offset the gender distribution in the workplace. A substantial change in this flexibility will significantly change quotas and self-employment in the future. Today, more than one in three American workers, Outworkers, is expected to reach 40% by 2020. The transition to freelance work is also being promoted by demographic change with the role of the visionary generation in the current and future workforce. It has been suggested that the expectations of this generation contribute directly to the changing work landscape. If new jobs are created shortly, the industrial revolution, which replaces obsolete forms of employment, will increase Prerequisite for the education system to prepare the employee with these required skills. (Future IQ, 2017)

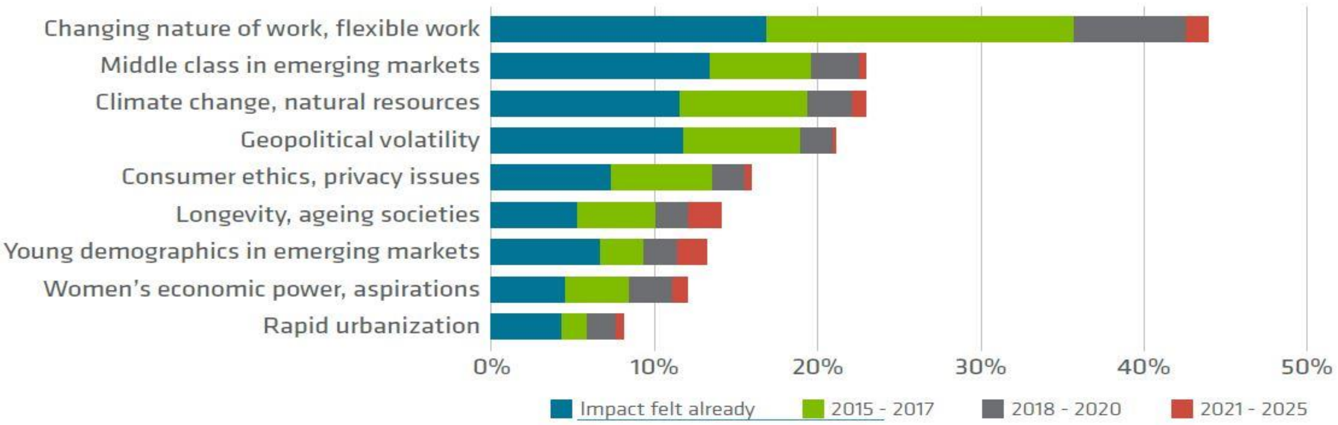

Fig 8: Representation of stages of several factors of the Industrial revolution in a different time period

3.4 Disruption of the white-collar workforce

The low-paid and low-skilled jobs are the most vulnerable, as the next industrial revolution is rapidly increasing automation and robotics. The work of office workers around the world is also threatened by industrialization. By taking artificial intelligence to another level, artificial intelligence is interrupting jobs that have long been considered incapable of technological shifts. The algorithms have eliminated the work of radiofrequency personnel and are now beginning to provide medical care for robotic surgery and the algorithm.

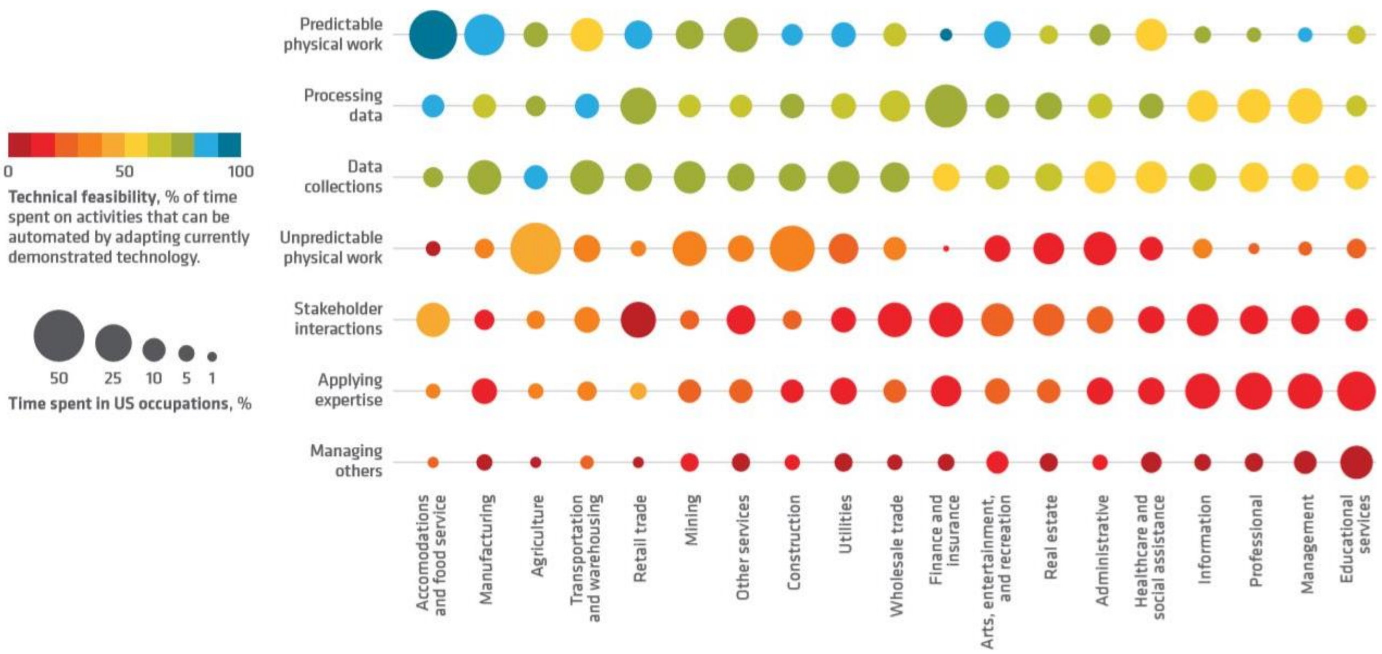

Fig 9: Technical feasibility percentage diagram

Not all jobs are affected, and not all are deleted. Ideally, automation will replace and supplement human labour. Workers need to reinstruct, expand, and return to enlightenment to acquire the skills they need to remain appropriate for the next industrial revolution. Roles that involve creativity, societal skills, and cooperation initially require more people than robots. (Future IQ, 2017)

3.5 Impact on society

The affected changes in society proclaimed by the next industrial revolution cannot be ignored. Artificially intelligent robots, autonomous cars, genetic engineering, mobile computing, and neurological technological improvements in the brain redefine society as we know it. All these developments, together with trends such as massive urbanization, demographic change, and a networked world, will redefine society. The next industrial revolution will be marked by a series of new technologies that combine biological, physical and digital systems.

These things will have an impact on the work as described in the previous section: education, energy, health care, our way of life and all the things it means to be human. This perspective is exciting considering the potential benefits for humanity and the world. It can only imagine the full range of possibilities, but we already see how technology, and access to the information it enables, has changed relationships, networks, and community building.

The next industrial revolution brings many changes in the industries and in the society which are inevitable. The potential rewards are incredible with a higher standard of living; more safety and protection; and much more human skills. The report examines what it means to be human in the face of change and who will be the victor of the next industrial revolution. (Future IQ, 2017)

Fig 10: Society loop

As the distinction between the natural and the artificial differs with the developments of technology and neuroscience, it is essential to consider what effect this will have on humans. Virtual and augmented reality are the leading technologies that contribute to the next industrial revolution.

Neurotechnology open new methods to potentially increase cognitive abilities. This can unlock the potential of the human brain. With a market of 7,500 million human minds, innovation and commercialization in neurotechnology could become big business. While this creates new possibilities in the treatment of brain disorders and mental disorders, the ability to improve brain function is a great opportunity overall. It also presents ethical challenges. (Future IQ, 2017)

3.6 Economical factor for the new industrial revolution

The potential increase in income inequality is a broader social impact of the future changing workforce. The polarization among highly skilled and less skilled displaced persons could lead to high-income disparities and other social problems. A globally basic income may have the ability to offset these income differentials. Many advocates insist on the introduction of this basic income program to deal with the effects of automation.

The machinery industry also promises an unprecedented "entertainment dividend" with profound social implications. Work is a means of earning income, but it is also an activity that gives meaning and meaning to the individual. The next industrial revolution will generate enormous wealth through innovations. All new industrial revolution will bring a wealth of innovations. It is unclear how this wealth is accumulated or distributed among the various types of income. Moreover, some parts of the world will win, and others will lose. This is an area that requires more research and investigation.

Economies with more flexible and adaptable labour markets, education systems, infrastructures, and legal systems will be better equipped to deal with and adapt to the changes we are experiencing.

The world population is becoming more and more urban. According to current trends, the urban population is expected to reach 6.3 billion people by 2050 (66% of the world's projected population). Cities and their inhabitants are becoming one of the most influential factors in the planet's future. Technologies of the Next Industrial Revolution, such as the Internet of Things, Autonomous Vehicles, Artificial Intelligence, and Advanced Robotics. Machine learning is beginning to change and will fundamentally transform urban systems, all kind of energy, waste and water infrastructure, mobility and transportation, logistics, buildings, communications, retail, economy and, cultural spaces and medical care. (Future IQ, 2017)

As urban areas evolve and the next industrial revolution systematically engages technologies, changes in the movements and interactions of people and objects, in the way they work, in the human world, the reduction of congestion and the environment improve health and safety. That could create sustainability through social justice, environmental health and economically.

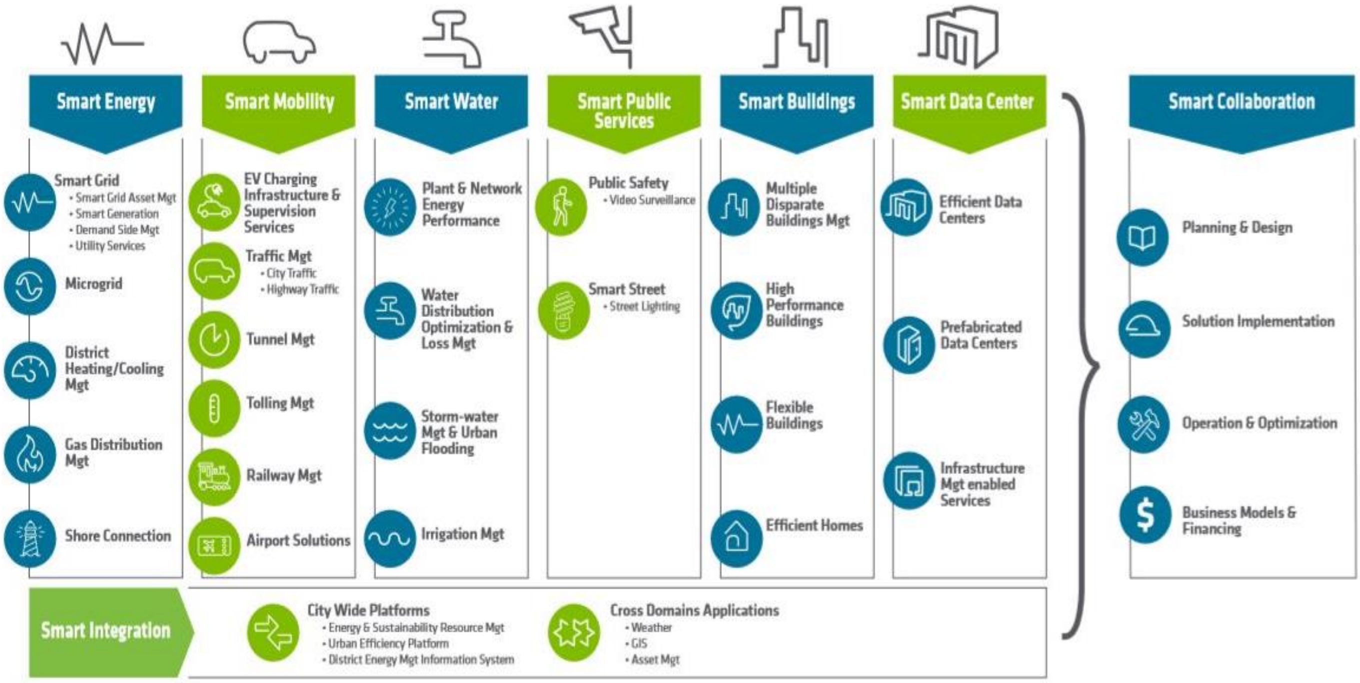

Fig 11: Smart collaboration in the society

As the birth rates decline and the world's population ages over the coming eras, innovative technologies will allow us to lead a longer, healthier and more productive life through the advances of the next industrial revolution. Robots, interconnected devices, and artificial intelligence enhance societal connectivity and emotive health, reasoning, and physical functioning. Neurological and mental disorders have a profound impact on the quality of life and aging. Rapid advances in regeneration genetics and biology have created new tools that revolutionize the capacity to keep brain cells fit. As people live longer, the technological advances of the next industrial revolution are more necessary than ever to support the health of the world's population. (Future IQ, 2017)

3.7 Agility takes the lead

To address the financial, innovative, and social powers ruling the Fifth Industrial Revolution, leading multinational companies are receiving an agile management culture. To label the economic, creative, and social skills governing the Fifth Industrial Revolution, leading multinational companies are accepting active management culture. It works smarter not harder principle while adopting agile practices the inside and outside changes can be adapted as people, technology, strategy and people for a better outcome. Agility in business is indeed not a new thought. Agile techniques rose out of the software development industry, and for about twenty years, organizations have connected agile methods to actualizing and incorporating advanced technical issues. A new trend of agile business helps managers broaden the advantages of speed, responsiveness, and flexibility all a lot of extensively throughout the association. (Ryann K. Ellis. 2018)

3.8 Lean Innovation Method for Industry 5.0

Industry 4.0 plays a vital role in our daily lives. Mobile phones, tablets, and inverted classrooms can be essential examples of the use of digital life. Nevertheless, shortly not only information and digitalization but also robots that behave like humans will cover a big moment. Since then, people have been working together with Industry 4.0. In other words, it means the 5.0 industry is coming. This makes it more important to gain innovation more naturally. Complex projects make innovation very remote. As a result, the simplified approach to innovation management simplifies industrial applications 5.0. Value management is a good solution as a method in this approach. In this thesis, the processes of R & D projects in the industry 5.0. The platform is considered in the lean innovation approach. This eliminates subprocesses that do not add value to the product. Simplicity is based on the logic of lean innovation. Therefore, every step must be considered as a bridge that gains value or not. (Özkeser, Banu. 2018)

3.9 Methods

The methods which are used in Industry 5.0 with the Lean Innovation method and many others. Value management is one of the crucial methods which has to be discussed.

Value Management

When human-machine collaboration is designed with an agile innovation approach, the sources are much larger than before. Automotive; Time, raw materials, personnel, finances, etc. They should be implemented with greater care. At this point, the pivot point must be closed in terms of costs and risks. In other words, we can gain value by eliminating the loss points. Value management can, therefore, be a focus on lean innovation management.

Value Management has been introduced to analyse optional materials and select those that better or better fulfil the same function at the lowest cost. In the early stages of project design, value management was designed and put into practice because innovation, novelty, and evolution of existing methods were required. There are different aspects of the different values of the different participants. The goal of value management, however, is to unify these differences to achieve the declared goals of the project with minimal resources.

The key principle of value management is to compare the results of the analysis of all alternatives. This also means that more options and detailed explanations are available for your fund. More value management teams can generate ideas based on principles and identify the best alternative in terms of function and cost. Costs associated with value management include gathering information, cost (initial cost, annual cost, performance, maintenance), useful life, and the physical characteristics of items or components that make up the consultation with members of the organization facilitate.

The Society of American Value Engineers (SAVE) has adopted the term "value engineering" as the name and public reports published by the agency over time. This means that the term value analysis, originally proposed by Lawrence Miles during World War II, has been translated into "technical titles" in the US. Documents published in the United Kingdom introduced value management to describe the process. The same Value Management Institute (VMI) is also responsible for the most important disciplinary proceedings in the UK. Authors of the United States. The United States prefers to use the term values, especially those from countries where US English is used, while those from Britain and other countries using British English are often referred to as administration. (Özkeser, Banu. 2018)

Value Planning is the first phase in which the value added of the project is managed during the planning phase of a project. In the construction industry, for example, this includes the value of the initial stage, i.e., design, implementation, feasibility, feasibility, and other project-related project activities. Value planning can be considered as a branch of value control and derives from the principle of cost planning and control commonly used to manage development projects. Value control means a direct connection to cost control that is not identical to value management. For this reason, the term is not common among experts, analysts, or value management researchers. The value analysis is linked to the replication or completion phase, indicating that the practice is related to the value of the completed project. This includes the steps to use and reuse a project.

The value flow shows all the phases required to produce the product/service. When determining the value flow and its application, determine when and how to make decisions. The key technology behind the value stream is processed allocation for a reason: Understanding how the value of the product is defined from the customer's point of view.

For a company facing a heterogeneous group of customers, the indication of the value is no easy task. While a customer appreciates the low price of a product, other customers prefer superior quality, good performance, fast delivery or exceptional service. As a result, a company's fair value supply depends in no small extent on the market segment for which it is intended and on strategic considerations as to how it seeks to position itself. Of course, for a company pursuing a penetration strategy, the value of the customer will differ from the value of the customer perceived by a manufacturer of quality products.

Planning and efficient management of valuables are essential. This can be achieved by systematically controlling all decision-making processes. This document was created to highlight the economic need for a more efficient infrastructure transformation. Lean management can be an essential tool and offers integration. The lean approach continues to have a stable currency in most areas. However, it is applied in pockets of isolated knowledge without an integrated notion of how lean processes and resources and sleek design can be implemented together in an integral system and a multidisciplinary lean approach. (Özkeser, Banu. 2018)

4. Study on Industry 5.0 features

Industry 5.0 has specific features which enrich its advantage and efficiency when it is applied to the real world

4.1 Industry 5.0 introduces a Three-dimensional design in the ecosystem

Re-establishing equilibrium in environment structures is conceivable, we propose, by a necessary safe exit procedure from the development ecosystem of Industry 4.0. in the event of the downfall of interconnected dug in advanced digital systems. Significantly, these safe exists must be in orthogonal in shape - in that they can offer 'computerized detox' by utilizing path random/unaffected via robotized open systems, for instance, the electronic medicinal info versus paper trails on certain imperative Medical data. The key reason for 'an orthogonal exit' is that whatever occurs in hyper-associated systems does not affect the symmetrical exit pathways, and thus, our utilization of the protected leave procedure wording. Since the IoT is an open and interconnected worldwide system, and the predominant structure in the computerized time is one of bizarre combination, it is reasonable to keep up symmetrical exits as wellbeing valves for the constituents of systems.

Remarkably, this framework structure thought for a secure exit from the modernized ecosystem could likewise support enhance and advance predominantly applied systems that manage development rehearses, and by the increase, cure the channel bubbles that could exist in an Industry 4.0 creation ecosystem. Indeed, one may contend that the speeding up an account that has generally overwhelmed science and advancement fields can profit by getting researchers those who are orthogonal. Likewise, inconsequential to a development ecosystem to have a symmetrical interpretation of both quickening also, stagnation. A symmetrical way to deal with advancement ecosystem is required for energetic and expectant administration of the social setting and effects orderly to Industry 4.0 functions too.(Özdemir, Vural & Hekim, Nezih. 2018)

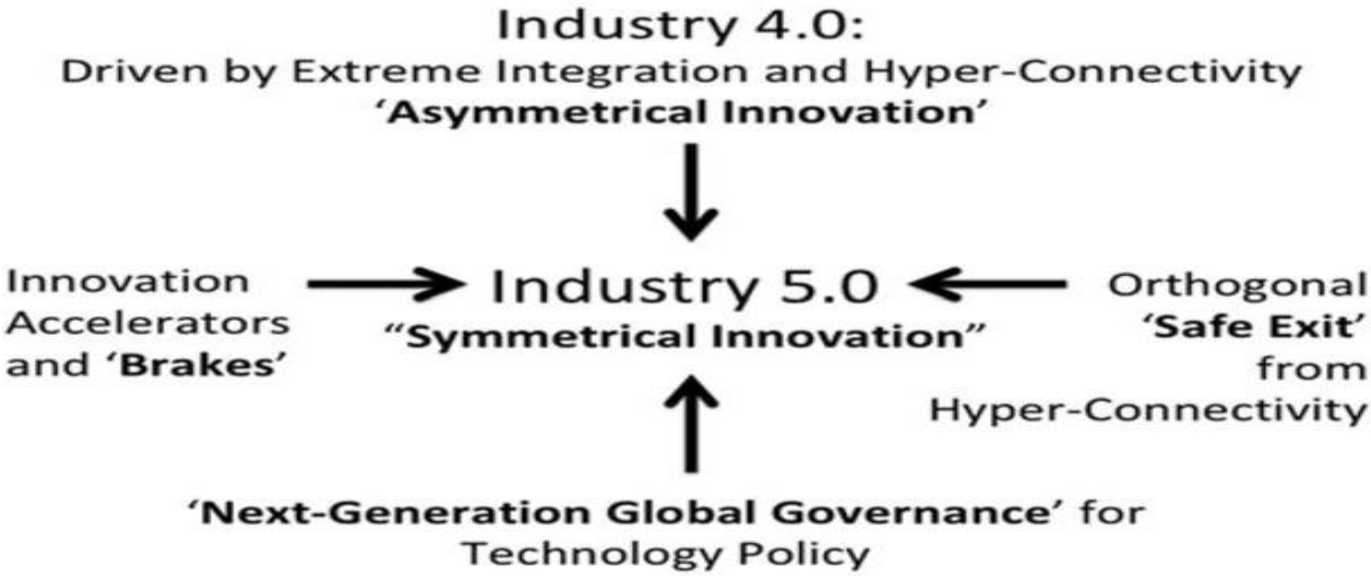

Fig 12: Industry 4.0 to Industry 5.0

A second social problem, one that is moderately undervalued immediately, is that whoever controls the data stages can manage the political power connected with the IoT and the industry 4.0. Big Data is currently known as the new oil of the 21st century (The Economist 2017). Industry 4.0 and IoT, for the kindness of its ability to alter and create a Big Data interpretation to connected Information and progress, any expansion of the forces originated in the Big Data stages. It asks for an ideology to explore in Industry 4.0 to form the new connected power format in society, people and nations with 'have' and 'have,' natural and therefore increasingly responsible. This leads to a different inquiry about the type of SSH exploration. Techniques that are acceptable to look at Industry 4.0. The historical science scene is out. The previous three decades, more unusually since the Human Order Project was sent in 1990, are enlightening in such a way.

We have proceeded onward within recent decades specifically, or are approached to move onward by education directors, funders and innovation initiators, to more and more substantial, costly, worldwide, knowledge domain and associated 'huge science' ventures.

Together with the increase of massive scientific ventures, right smart funding was created obtainable to support SSH analysis; however typically in preordained tries by scientists and funders to acquire societal barriers to the emergence of latest technologies. These brands of SSH research in research project have tended to subscribe, however, to technological determinism instead of nurturing some of the critical goals of independent and critical SSH research: to broaden debates from a narrow technical to a bigger socio-technical context, and importantly, creating power relationship in technology and science a lot of bright and therefore responsible. Other students have argued that certain kinds of SSH research in research project comes, branded under 'societal research,' have LED to compressed, therefore sitting threats and limits in our collective imaginations to creatively answer the unknowns associated with new technology and innovation (Nordmann and Schwarz 2010; Özdemir 2017).

4.2 Demerits of Industry 4.0, which is a cause for Industry 5.0

(a) A familiarity with the unbridled presumptions in development ecosystem system configuration adds to maintainability, strength, and transparency of development forms and their effects, responsibility in the societal conveyance of new energy frameworks made because of creations not to be taken important. In this specific circumstance, most of us have come to acknowledge, uncritically, the surrounding of Industry 4.0 under the scholarly opinion 'connect the unconnected until everything is connected to everything else.' Being interconnected can be helpful from a useful point of view yet such a tight spotlight on the extraordinary mix and create interconnections among the disconnected without any trouble**.**

Regardless of the rising applications and the tremendous capability of Industry 4.0, current advancement ecosystem projects and worldwide administration ought to be tried against the danger of substantial reliance on an epistemological structure, for example, the complete integration to all expenses, and of everything on the world. Besides, the full combination and hyper-network existing vulnerabilities to the size of the framework that have been considered up until this point. Incredibly included continuous/porous networks are at risk of systemic dangers including general network crumble in the event of failure of one among its components, for example, by using hacking or net viruses that could fully invade incorporated systems.

(b) The filter bubbles can rise because of extra incorporation realized by Industry 4.0. Filter bubbles allude to a circumstance when monocultures, for instance, a tenet of integration, or settled in, uncritical considering and tight epistemologies overwhelm how we make sense from science and modernization. Other describing highlights of filter bubbles are

(1) The absence of reflexivity and mindfulness on by what means our qualities impact the kind of decisions we make in science and culture.

(2) Lack of energy about the societal also, human power-related settings in which science and innovation, for example, Industry 4.0 and IoT are arranged.

Industry 4.0 acquiring of Big Data from clients, furthermore, individuals personalization of online inquiries are by internet for instance, Google, Facebook and mostly all social media collects data from login, what we have done or searched before, our interests and other customer qualities are making channel bubbles that undeniably characterize the scope of our online encounters, presentation to elective epistemologies, and how we devour information and data. The personalization done in online brings encounters the preferences of customers previous and current interest. Be that as it may, the channel bubbles and online systems that are customized dependent on past interest likewise limit the imaginative sparkles from possibility experiences with customers and give new innovative or productive ideas to them. They tend to change their attention by the original. .(Özdemir, Vural & Hekim, Nezih. 2018)

All the advanced technology like Internet, remote availability, AI, and their extensions, like the IoT and Industry 4.0 bear the possibility to collect information, learning creation, and utilization, they can likewise oblige open frameworks through unchecked channel bubbles, and constraining exposures to assorted reasonable edges, knowledge, and data by open systems through unchecked filter bubbles

To a certain range, the future is imagined as a direct expansion of past customer experience by Industry 4.0. The genuine risk to the receptiveness, effectiveness, efficiency, and creativity by filter bubbles are foreseen to be developed by the IoT and Industry 4.0.

(c) Developments in science and innovation are, for the most part, future-arranged practices. They depend on activation of desires on and ventures for new openings, opportunities, and abilities, just as a feeling of immediate, which makes a built of future with the present. Governments, societies, economy, scholastics, and humanitarians have contributed to learning based developments over the previous decades and are under immense pressure to give comes back to their speculations. However, by its very description, developments are exceptional items, procedures, and benefits, and could not ever work out as expected or not until after extensive time slack after a venture is made. This appears to embrace for advancements as open innovation and additionally in the private part due to obscure and mysterious nature of improvement that can't be just and barely anticipated as a vertical augmentation of the past practices and thoughts.

The confining of new technical practices furthermore, advances as transformation frequently has an unimpeded political measurement to earn human or hierarchical power, what's more, speculations by advancement performers. Regardless of conceivable transient increases, overpromises of innovative antiquity as revolutions can be hindering in the extended span for powerful and socially adjusted effects, consistency and maintainability inside an ecosystem. Instead, we can grasp many conceivable development Prospects of future, more extensive scope of results, and social possibilities that shape advancement directions. Thinking about both acceleration and deceleration as the twin administration accounts, also the open-door costs for the technology and ideas behind this, would work well for long term manageability of development ecosystems, which is controlled by Industry 4.0 and other new technologies.

(d) The practices and theory of Industry 4.0 have been solved by professions like investors, engineering and the companies which are already for seen that companies are to become digital and development of IoT. Industry 4.0 effects on society have been generally understudied contrasted with specialized research on Industry 4.0. The regulating measurements of Industry 4.0 and arrangements that will define worldwide administration of Industry 4.0 are likewise missing, again maybe because its underlying drivers were for the most part arrangement situated callings as opposed to social science and humanities researchers. The discourses on "Industry 4.0 and Society" have would in global spotlight on either a tragic, terrible future moulded by the IoT where cobots with AI supplant people or a future that will be better with the introduction of the Industry 4.0.

In both cases, be that as it may, to mechanical determinism and as though the growth of Industry 4.0 and its societal forming and effects are destined and inescapable. They don't yet recognize the need to widen our comprehension of Industry 4.0 results and its various conceivable prospects in the public eye. This irregularity from understanding Industry 4.0 as a fixed specialized and logistics issue should be tended to by people to come and comprehensively surrounded SSH, and worldwide administration inquiries about on Industry 4.0 and society, as talked about in the following area. .(Özdemir, Vural & Hekim, Nezih. 2018)

4.3 Industry 5.0 is about people, not robots

Industry 5.0 will make the manufacturing line a place where imaginative individuals can work, to make a progressively customized and human experience for workers and clients. Purchasers will incrementally request craftsmanship and customization of items. Through automation and cobots, the assembling procedure can be streamlined to enable people to make something extraordinary and exceptional. The utilization of robots will convey back the human factor to assembling.

4.4 Industry 5.0 is intended to improve human productivity and efficiency

Industry 4.0 is about the interconnectedness of machines and frameworks for ideal execution. Industry 5.0 takes such productivity and efficiency and further by sharpening the collaboration among human and machines. It can incorporate robots into the assembling procedure to convey high-quality products. Industry 5.0 perceives that human and machine must be interconnected to meet the assembling intricacy of things to come in managing expanding customization through an improved robotized producing process. Industry 5.0 is arrival to pre-modern creation; however, one that is empowered by the most trendsetting innovations out there.

This thought for mass personalization frames the mental and social driver behind Industry 5.0 - which includes utilizing the technology to rebound the workforce to the industry which is now almost entirely automated. The products that made in Industry 5.0 make engaged individuals understand the essential human desire to convey what needs be regardless of whether they must pay a top-notch cost to do as such. Making these items requires what we call the human touch.

4.5 The rebound to human

The rebound to human touch is essential because of market evolvement and client demand requesting a high level of personalization in the items they purchase. The customized product purchasers will request most and pay most for are items that bear the original character of human consideration and craftsmanship. Handmade watches, designer items. This kind of products can only be made by human influence and the human touch, primarily, the consumer's demand is the crucial factor which decides all the needs for manufacturing. The personalization is a feeling of high quality and luxury, so the customers prefer human designers to make their get some uniqueness or special. The Industry for 5.0 is little anti-industrialization than industrialization.

As it is rebound to earlier practices. In previous periods, if someone wants to give some gift like carpentry stuff to someone, they must invest a lot of time and effort to personalize and design it so that it gets a feeling that it made as unique for them with extra effort. While robots are exceptional at producing standard items in standardized procedures in a high manufacturing volume, including this purported "unique something" to every single item is where robots require supervision. In this way, we perceive the need to convey back the human touch to generation forms. (Universal Robots, 2017)

As in manufacturing procedures, computerization can be utilized to its total potential just when there is a sparkle of human innovativeness affecting the procedures also. All alone, automated manufacturing with conventional modern robots will do just what it is being instructed, frequently naturally after long and arduous programming endeavours.

One of the main tools used by companies for manufacturing personalized products is collaborative robots. Collaborative robots (cobots), nonetheless, work in a state of harmony with humans. These two powers supplement one another and develop together, as the human can include this supposed special things, while the robot forms the item further or sets it up for human consideration. Along these lines, the operator is entrusted and utilizes the cobot as a multi-purpose mechanism: as a hand drill, bundling apparatus and so on. The robots are not intended to take over the human workforce, yet to assume control dangerous or even hazardous functions. Industry 5.0 is in truth not a gradual advancement from Industry 4.0. It isn't merely more increase automation. In a critical sense, the finish of robotization – yet an "end" that is empowered in any event to a limited extent by automation.

4.6 The advantages of a machine workforce and collaborative man

The rebound of humans in manufacturing will make a huge change in Industry. Personalization makes a terrific change and decrease of job opportunities and the creation of new jobs.

Capacity to modify, including the imaginative human component

While robots are superb at producing high standard products in traditional methods in a high manufacturing volume, modifying or customizing every single item can be where robots will require instructions. Thus, keeping up the human touch inside manufacturing is highly essential. Along the manufacturing methods, automation can be utilized to its fullest potential just when there is a flash of human innovation affecting the ways. All alone, automatic manufacturing with conventional modern robots will do just what it is being instructed to them – frequently directly after long and active programming. Collaborative robots do work in collaboration with a human. In this state, both man and machine support each other, the human is doing the personalization, while the robot forms the item or sets it up for human consideration. So, the human can work with cobots and utilize it as multifunctioning tools for simplifying complex and hard work.

Job Generation

In some recent studies says that by next decade there will about 3.3 million jobs but with only 1.4 million qualified workers to acquire those positions. The robots are flawlessly adapted for mostly all these functions and the cobots, individually, can work inseparably with humans. Cobots are helpful because they can take repetitive and hazardous, while human laborers move to higher esteem positions. The most significant risk of security of a job is the element that the company is not competitive, and automation gives the companies production more efficient and easier for producing consist of products: the higher production rate and comparably lower costs. For example, let's take the automated food industry, and it is to expect that by 2020 the robots would create about 60,000 - 90,000 job vacancies. The Cobots can increase industrial job opportunities compared to other industrial robots as they can increase productivity and improve skills. Instead of replacing their humans, these devices work with people in production and do the assigned tasks. As makers endeavour to expand their items and grow new product offerings, Cobots can duplicate their workforce and move their workers from repetitive positions to higher work fulfilment and remuneration.

Improved jobs for human workers

The Cobot is not intended to substitute workforce, but to perform determined, repetitive or even unsafe tasks. Subsequently, a human can use their imagination to access more complicated tasks. For example, when robots perform smaller assembly tasks, employees can engage in more sophisticated functions that necessitate human creativity.

At the Australian Plastic Injection Moulding Factory, Prysm Industries' staff spent hours standing in a spot to mark products every 6-7 seconds. After deciding to implement a robotic arm from Universal Robots arm, the manufacturer could automate these monotonous activities and free employees to do other tasks and assignments. Now that the tagging tasks have been resolved, staffs can concentrate on running multiple machines and perform more diverse functions throughout the plant. Employees are proud to have learned to operate the robot, and their capability to work in other jobs has increased their job fulfilment. Furthermore, every day the robot is in operation, Prysm now saves $ 550 in labelling costs.

Without a doubt, the networked and cooperative workforce offers excellent opportunities to increase productivity and innovation in manufacturing. It likewise provides a chance to improve safety and security and job satisfaction while empowering employees with more interesting job creation and job growth.

At long last, manufacturing methods that are becoming smarter and more networked will leave behind less agile opponents that are slow to familiarise. Manufacturers need to be aware that manufacturing plants not only can progress operational efficiency and other benefits mentioned above but also the potential to diminish rising work costs in increasingly competitive markets.

5. Problems of Previous Industrial Revolution

5.1 Mental strain as a field of action in the 4th industrial revolution

Industrial revolutions have changed society through the evolution of critical technologies. The idea of the fourth industrial revolution is activated by high-tech concepts and resolution to understand a mix of economies of scale and economics. This goal is also referred to as "great personalization" and is considered a significant complication by the administration in fully integrating the product network and production processes. These innovation-related deviations also lead to new fields of action in economic and industrial mentality. Significant technologies are expected for the future.

On the other hand, job losses and greater de-industrialization can be frightening. In the current debate, employees typically reflect on ergonomics, integration, and collaboration with technology. Technological change is also changing the demands on mental and psychological work. The work on the mental work of the staff of the socio-technical manufacturing systems is an activity related to the technical progress of the fourth industrial revolution.

About the idea of the industrial revolution, the proclaimed fourth industrial revolution is classified. Consequently, the socio-technical production system is presented as an orientation for human power. So that's one of the basics. This technology identifies changes in work design and determines the capacity requirements that can lead to the regulation of work activities. (Dombrowski, U., & Wagner, T. 2014)

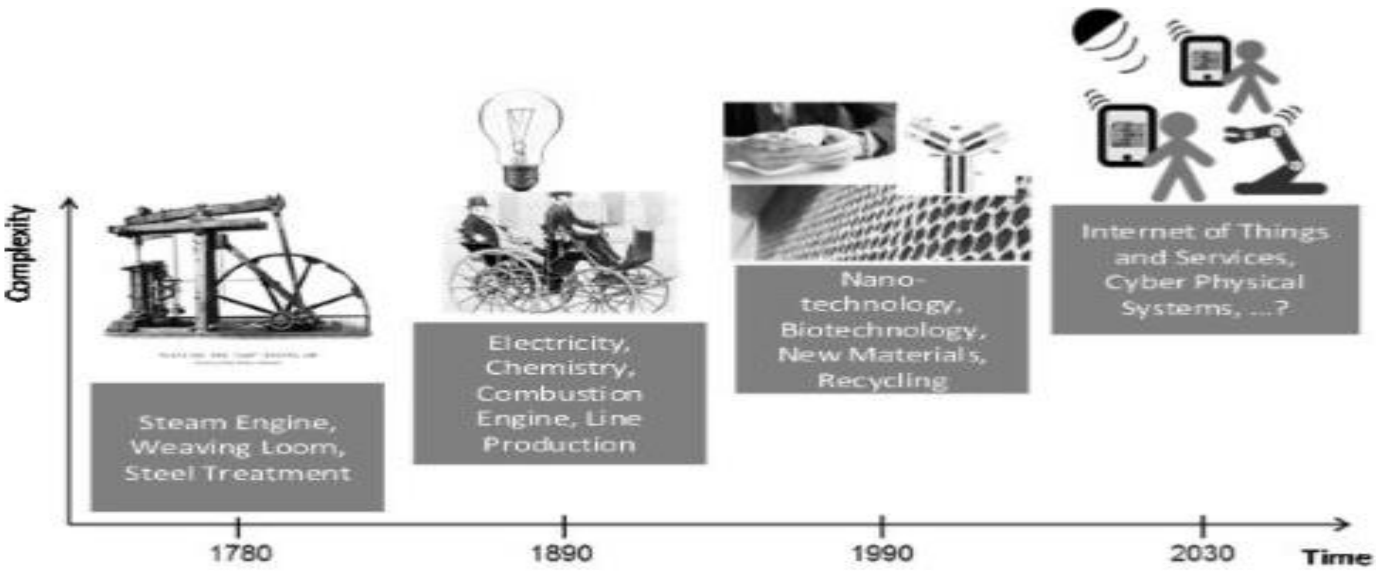

Fig 13: Chronology view on key-technologies of industrial revolutions

5.2 Relevance of industry 4.0 technologies for human competencies and job design in socio-technical production systems

The socio-technical vision of a production system is a combined report on the relationships between the subsystem technology system, the human functioning system, and the organizational system. Once the socio-technical system has understood that an industrial revolution is changing technologies and society, it provides a useful framework for explaining the areas of action of the Fourth Industrial Revolution. Define the effects of subsystems, such as people, technology, culture, objectives, processes, and infrastructure. These components are integrated into an environment of economic conditions, interest groups and regulatory aspects. In this manner, the conditions in one component also affect the other components**.** (Dombrowski, U., & Wagner, T. 2014)

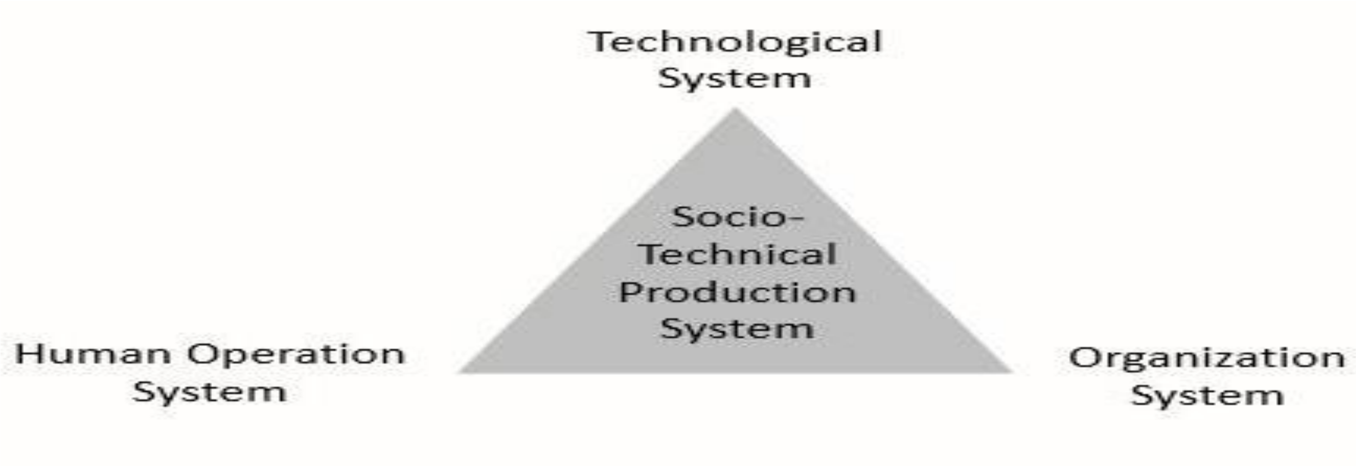

Fig 14: Socio-Technical Production System

It also addresses the need for research on the ergonomic design of work systems, as well as on the qualification requirements of employees. Also, it was pointed out that the ergonomic design of the workplace must consider the growing age of employees. Production systems based on Industry 4.0 technology are designed for mass industrial customization. For this, automation and human skills for solving complex problems will be merged within the DPC. For the management of self-controlled systems, technologies are needed to identify the product and the employee. Using future techniques and the integrated computer manufacturing approach, it will be possible to build a fully automated desert plant. However, the Fourth Industrial Revolution is not meant to replace people in the factory system, but to create a synergistic collaboration between man and machines.

This network of people and machines is characterized by intelligent self-control and self-control of computer-based physical processes. CPS technology is a crucial factor. This human network and CPS results in a functionally integrated operational relationship between reality and the global and digital IT infrastructure. In this manner, the systems connect to their environment and users can interact with their colleagues. First, the interfaces between CPS must be standardized to allow free communication. On this basis, the interfaces between human elements and CPS are one of the next challenges of the fourth industrial revolution. The importance of human-machine interfaces will increase the interaction between the two. The required communication between machines, products, and workers can be designated with the Internet Vision of Things and Services. This concept involves the autonomous connection and communication of objects in dispersed information networks. (Dombrowski, U., & Wagner, T. 2014)

The integration of the concepts of Industry 4.0 into production systems leads to changes in the work organization of the employees. Work tasks based on existing technology become process-oriented tasks with frequently changing contents. In contrast to the concept of Computer Integrated Manufacturing of the 1980s, the goal of Industry 4.0 is to focus on people in the work system. In this way, this leads to the combination of automated processes and manual tasks in hybrid systems. Automation can lead to positive scaling effects of standard sequences of high-volume operations. Trained employees are needed to perform complex manual tasks and to control and control machines and processes. Humans and machines can complement each other in a socio-technical system and exploit their unique potential. Therefore, in future industrial production systems more and more man-machine interfaces will be produced.

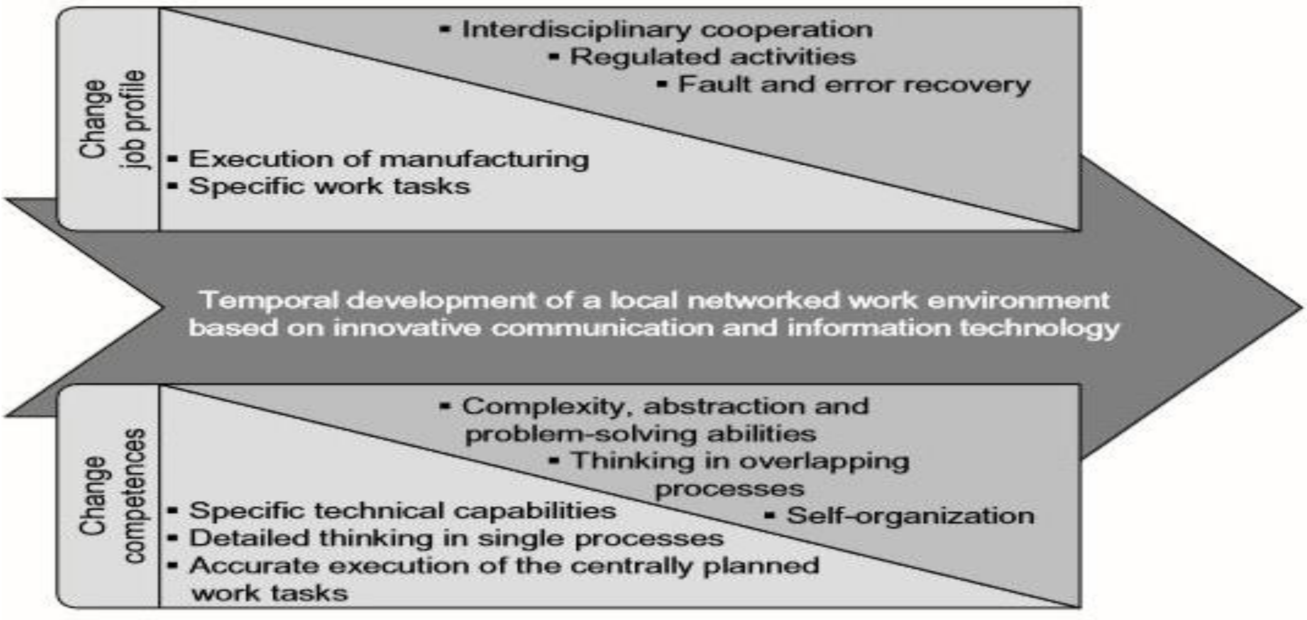

Fig 15: Job profile creation after the industrial revolution

The development of innovative information and communication technologies creates distribution and network environment. This leads to changes in the work profile of employees and leads to different skill requirements. In Figure 14, the evolution of job profiles is mainly characterized by the reduction of administrative production tasks and the less specific work tasks of the subject. All at once, regulatory activities function to improve failures, problem-solving, and interdisciplinary collaboration are multiplying. For the skill requirements of the employees concerned, this translates into a decrease in the demand for technical or professional skills. In the future, the worker will have less to worry about individual processes and centralized and organized planned tasks. The tasks of future work require more and more a global reflection on the process and self-organization of work. (Dombrowski, U., & Wagner, T. 2014)

The 4th Industrial Revolution, therefore, has an impact on tasks, management, and the planning system. Also, these workplace factors affect the psychological demands of the employee. The mental tension can be identified as a field of action for the implementation of the 4th industrial revolution.

In executing the idea of "Industry 4.0", technologies for the plan and manufacturing of complex products have altered radically. The vision of a role of computers in the regulation of companies and, generally, in terms of processes and automation of companies that went from the use of robots and computerization of high-tech operations to the Internet visualization of data and intelligent decision-making support by users are changing.

It is well known that the term "Industry 4.0" was first openly presented in 2011 by a group of representatives from business, science, and politics in Germany. It has been defined as intends to increase the competitive edge of the company by increasing the integration of cyber-physical systems (CPS) into creation. When the idea of "Industry 4.0" was considered by many to be the next advertising course three to four years ago, the curiosity in it has now become investment and real results. As indicated by PwC research results, annual investment in digital technologies in "Industry 4.0" will exceed $ 900 billion by 2020.

Industry 4.0, it is referred to as a "generic term" to describe a group of related technological advancement that gives an establishment for further digitizing the business system. The next phase in the digitization of the manufacturing sector, driven by four disruptions: the astonishing rise in data volumes, computational power, and connectivity, especially new low-power wide-area networks; the emergence of analytics and business-intelligence capabilities; new forms of human-machine interaction such as touch interfaces and augmented-reality systems; and improvements in transferring digital instructions to the physical world, such as advanced robotics and 3D printing". (Vuksanović, Dragan & Vešić, Jelena & Korčok, Davor. 2016)

In general, four key components (CPS, Internet of Things (IoT), Internet of Services and Smart Factory) and six significant technologies artificial intelligence (AI), Big Data, virtual reality, (Internet Industrial of Things (IIoT), CPS, additive manufacturing (3D printing) and collaboration robot (CoBot) and) to advance Industry 4.0. The focus is on the technical aspects of the application. The main thing is human resources exist only in possible changes in the labour market produced by Industry 4.0. This situation is unacceptable and is reflected in several articles related to Industry 4.0. Although Industry 4.0 is only in the early phases of growth and the main achievements cannot be expected before 2020-2025, you can see the image of a new model of Industry 5.0. It means the entrance of artificial intelligence into the common life of man, his "cooperation" with the goal of improving man's ability and man's return to the "centre of the universe." (Vuksanović, Dragan & Vešić, Jelena & Korčok, Davor. 2016)

In such manner, the term "Society 5.0" (Super Smart Society) is possibly the most accurate term rather than Industry 5.0 that was presented the most significant trade association in Japan, Keidanren, in 2016, which is actively promoted by the Council of Technology, Innovation and Science; Cabinet, Government of Japan. Disparate Industry 4.0, Society 5.0 is not limited to one production area, but it resolves social issues through the combination of the physical and simulated space. Society 5.0 is the general society in which latest IT technologies, IoT, robots, artificial intelligence, augmented reality (AR) are actively used in people's daily lives, in industry, healthcare, and medicine the progress. But for the advantage, comfort, and ease of every individual. (Salgues, B. (2018)

5.3 Industry 4.0 vs. 5.0

An innovation ends as soon as all industry-wide has been wholly developed to the revolution itself. As technological advancement accelerates, revolutions can quickly trail in the next decade and beyond. While the first three industrial revolutions lasted for decades, the present revolution only takes the time required to complete the industry-wide execution. Given the swiftness of these improvements, it is obvious to speak of a fifth revolution after the fourth.

Regardless of how fast or how slowly some industry implements the Industry 4.0 system, the standards will undoubtedly form the production world of eventual. With more and more sectors being developed, some industries will grow exponentially, appreciations to the abilities offered by IoT gadgets, cybernetic systems, and reasoning systems. In a couple of years' times, human and factory robots can finish up working together on diverse production processes and allocate workloads. (Dr.Sc. P.O. Skobelev, Dr.Sc. S.Yu. Borovik, 2017)

Chief Robotics Officer (CRO)

The fifth axis of the industrial revolutions is again human. As a result, a new role in manufacturing, called Chief Robotics Officer (CRO), may be required. Since the 4.0 Industry Process, the thought of "CRO" has been inflamed. The main drivers of the "next industrial revolution" are the expansion of IoT, Big Data and the cloud, which contribute to the development of the industry. The CRO integrates them all and focuses on research and development for the current situation and brings a futuristic improvement leading to Sector 5.0. `

5.4 Cobots, do the primary role in industry 5.0

(a) The machine tending: The robot moves parts for machining inside and outside the machine. While the robot is loading and unloading the workpiece, the operator can do other tasks.

(b) Pick-and-place. The robot moves from the process to the input of another. For instance, it could be grabbed and placed on a tray.

(c) Assembly: The robot performs simple tasks when assembling parts that require little skill. (On the same time, assembly tasks that require high skill are perfect for human-robot collaboration: the robot can accomplish the simplest assembly tasks and then move the parts into an area where the man can do the job.

(d) Quality tests: the robot loads the products in a quality test machine and takes away them once the test is finished.

(e) Other lightweight weighing applications: The robot performs basic packaging, refining, gluing and other tasks. Evoke that cobots can do most of the thing’s humans do if they do not require great skill.

Most of these applications include tasks without added value (i.e., functions that are not added something about a product that the customer would be ready to pay for). Because it has no added value, the functions are accessible for the Cobots to do and free the man from boring and repetitive work. For the implementation of Cobot, it is best to start small and keep it modest. They can accumulate more complicated applications after you have more experience with Cobots. (Karabegović, P. D. 2018)

A model Cobot tasks have two characteristics:

1.Very predictable: The job is the same every time, with a few deviations. This can be handled by cobots easily.

2.Repeatable: The work is done repeatedly which makes human demotivated.

3.Dangerous Task: Risky jobs can be done by cobots.

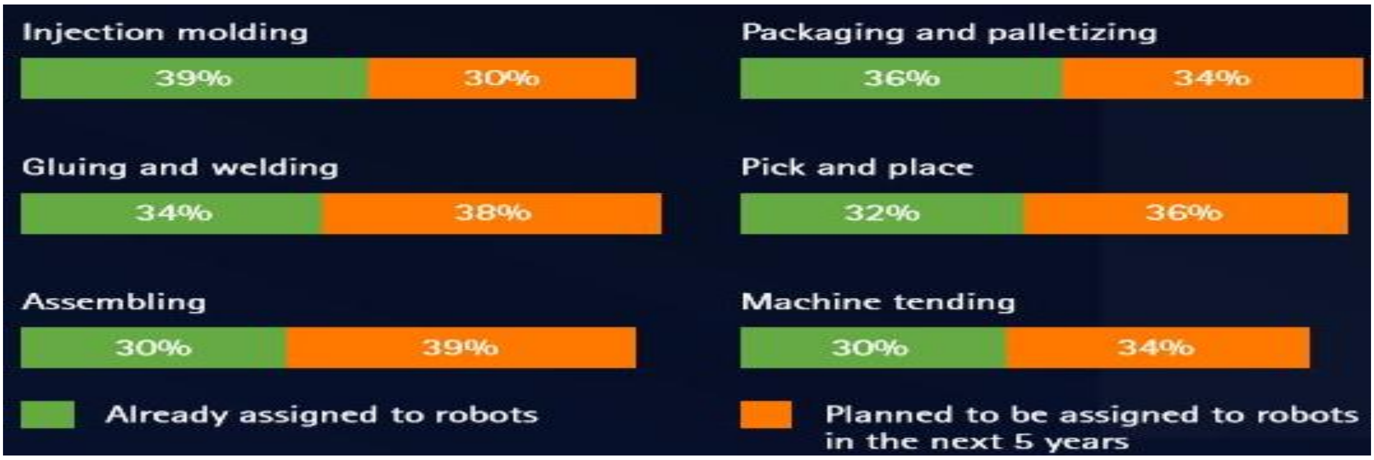

Fig 16: Cobots in Manufacturing

5.5 Benefits of Cobots

The benefits of Cobots are several which includes Job security, Fewer injuries for humans, more interesting jobs.

Job security

Many people fear to lose their jobs when a robot enters production. It is important to address. This concern immediately guarantees your team that their jobs are safe. In every factory where Cobots were introduced, the administration has not eliminated any jobs. In contrast, workers have been transferred to other processes that require more dexterity and human intelligence.

We have even seen Cobots create more jobs. Cobots are changing their way of working in production so that employees can do more value creation and increase their productivity. As a result, companies will likely need to hire more staff to handle this increase.

Fewer Injuries for humans

One of the foremost real advantages of collaborative robots is that they can improve ergonomic issues in the workplace the tasks that characterize robots are precisely those that require monotonous movements, the kind that hurts the workers. Tedious actions can lead to musculoskeletal disorders and, in some industries, many days of lost work because of injuries. One of the recent studies found that 35% of missed working days are attributable to these disorders. Practically anyone can relate to the benefits of cobots, mainly because many people work the front has experienced some muscle problems. Highlighting this benefit, the team will appreciate how Cobots can improve the work experience.

More interesting jobs

Robots are virtuous for monotonous tasks. Taking care of a CNC machine, for example, is neither fun nor motivating. Such functions can otherwise destruct great day at work. On the contrary: configurations, quality checks, and robot programming are much more stimulating tasks. No one likes to do tedious tasks. Though every company has some boring but essential jobs; somebody must do something. Every time you get a cobot for tedious work, it means an employee can be moved to a more exciting position that uses his skills more efficiently.

Exciting tasks lead to a happier and more motivated workforce. The team will appreciate it, the benefits of Cobots as it highlights how their jobs become more interesting. Mostly, the fear of robots that existed before the first application is swiftly forgotten after the first robot is installed. People understand how much the robot can benefit them with their work. (Karabegović, P. D. 2018)

5.6 On the way to Society 5.0: directions and prospects

Society 5.0 comes from the hunter-gatherer society, the agricultural society, the industrial society, and the information society. Although focused on humanity, the 5.0 is a new type of society where scientific and technological innovation occupies an important place, in order to balance the social and social problems to be solved and to ensure economic development. Although it borrows many of its elements, this approach is opposed to that of defenders of decline.

Industrial IoT and people

The Industrial IoT (IIoT) is developing an in-depth technology that accompaniments the traditional and familiar to the Internet of society and is automation based in Industry 4.0 and Society 5.0. As described in the official ITU-Y.2060 - Outline of the Internet of Things, IoT is a typical structure for the information people, providing latest facilities by linking elements both virtual and physical dependency on data and communication enables interoperable and innovative advancements.

Cisco presented the term "Internet of Everything" (IoE) in 2013, which goes beyond the Internet of Things. Cisco determines IoE as" the networked connection of people, data, process, and things. The IoE is made up of many technology transitions, including the Internet of Things".

The implementation of IoT (IIoT, IoE) needs the development of several perceptive technologies, with sensors, telecommunications (Wi-Fi, RFID, NFC), It allows "intelligence" to be embodied in a "thing" at a phase of its creation. In the meantime, IoT (IoE) in Industry 5.0 should not be technology for the technical aspects. The chances should be focused on the advantage of the person and life quality of individuals.

Simulation

Simulations will be used more widely in factory processes to take advantage of continuous information to reflect the real world in a simulated model, which can include people, machines, and products, reducing machine initialization times and expand quality. It can create two-dimensional and three-dimensional simulations for default starting and to simulate cycle times, power usage, or convenient aspects of the manufacturing facility. Simulations of production processes can not only shorten downtime and alternate, but also decrease manufacturing failures while the starting stage. The quality of decision making can be improved easily and quickly with the assistance of simulations created.

System Integration: Horizontal and Vertical System Integration

Integration and self-improvement are the more widely used tools by industries. Three dimensions of integration mainly determine the industry model:

(a) Horizontal and line incorporation across the value generating the network.
(b) Vertical incorporation and network assisted production systems.
(c) Start to finish combined engineering throughout the life cycle of the product.

Full digital incorporation and automation of vertical and horizontal manufacturing processes also involve automation of communication and collaboration, especially along general operation. (Vaidya, S., Ambad, P., & Bhosle, S. 2018)

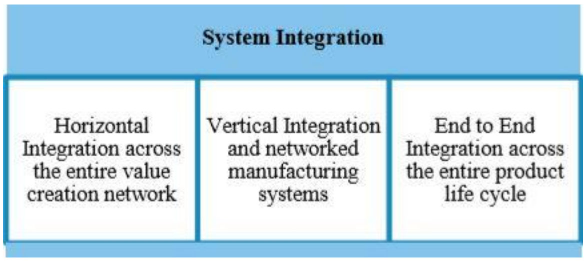

Fig 17: System Integration

Cybersecurity and Cyber-Physical Systems (CPS)

With the expansion of networks and the use of standard protocols associated with industrialization, the need to protect key production systems and lines is increasingly threatened by cybersecurity. As a result, secure and consistent data exchange and advanced uniqueness and access management are critical to machines and users. The stable connection between the real world, the facilities, and the cybernetic world can improve the quality of the information required for the planning, optimization, improvement, and operation of production systems. CPS is a system in which ordinary and artificial systems are closely linked to computers, control systems, and connections. Decentralization and independent measures of production progress are the main features of CPS. The development of CPS depends primarily on the implementation and reconstruction of product structures. Public service networks are common cybernetic systems used in production systems, as well as various cybernetic systems, such as urban traffic management and management systems. The constant exchange of information takes place through the intelligent linking of cybernetic systems with the assistance of cloud systems in actual time. Digital Shadow of Production is defined as the illustration of an element in a simulated world or data. The basic requirement for continuous production and improvement of the real manufacturing system is achieved by extensive consideration of the cybernetic systems. The use of the corresponding sensors in CPS must detect the errors occurring in the machines and automatically prepare the correction of errors in CPS. It also finds the ideal use of each workstation based on the cycle time required for this process. Structure 5C uses cloud computing to connect to machines.

The Cloud

The cloud-based IT platform is the technical pill for connecting and collaborating with various elements of digital Hub Industry 5.0. With Industry 5.0, industrial systems require greater data distribution across their sites and businesses, resulting in response times in milliseconds or even faster. The "digital production method" is an idea in which the associations of different devices are connected to the corresponding cloud to exchange data with each other, and they can be extended to the machine sets in a workshop as well as to the whole system.

Additive Manufacturing

With Industry 4.0, additive manufacturing techniques are generally used to produce small quantities of custom products that offer design benefits, such as complicated and lightweight designs. Systems to deliver dispersed high-performance additives cut transport routes and available stock. Production must be faster and more efficient with additive manufacturing technologies such as Selective Laser Sintering (SLS), Fusion Separation (FDM) and Selective Laser Fusion (SLM). As customer needs change, many organizations face the challenge of increasing product customization and shortening time spent on advertising. These difficulties are addressed by the expansion of digitization and the creation of product networks, IT saturation, production resources, and processes. The reduction of the life cycle of the products in connection with the growing demand for personalized products requires a stronger change to the organizational structures.

Augmented Reality

The augmented reality-based systems are compatible with various services, e.g., For example, to select parts in a warehouse and send fixed instructions through mobile devices. Industry can use augmented reality to provide workers with continuous live data to improve decision-making and work. Workers can obtain fixing commands on how to replace a specific part while watching the real system that needs to be fixed.

Multi-agent system

The application of IIoT technologies requires the transmission of calculations to real-world objects according to the algorithm and the instructions specified. Intelligent agents are used for the communication of the real and the virtual. They can take information from reality, make decisions, and organize it with other things or users in real time. Simultaneously, real things can work independently of each other or be part of a virtual world or an additional problematic "object" ("cloud"), each being a "virtual" twin.

The multiagent system is described as a network of feebly associated solvers of privacy issues that exist in the overall situation and cooperate to accomplish these or these resolutions of the system. The interface can be performed by specialists directly, by exchanging messages, or in a roundabout way, when a few specialists consider the occurrence of other specialists through changes in the external condition with which they cooperate. Multi-specialist systems and technologies can be connected to the arrangement of hard tasks (for instance, arranging and enhancement of assets and learning obtaining of the class of Big Data and

Small Data), and to making of digital ecosystem of the services competent to coordinate and compare among themselves, permitting the change of straightforward IoT in smart Internet of individuals and things. (Dr.Sc. P.O. Skobelev, Dr.Sc. S.Yu. Borovik, 2017)

Emergent intelligence

Emerging intelligence (intelligent reasoning, cloud intelligence) is a phenomenon of unpredicted properties, which develop more significant elements through communications between little or less complex so that more prominent factors have possessions than the more abundant parts. Lesser difficult parts don’t show. The crucial component of evolving intelligence is the dynamics and randomness of the decision-making process through a multitude of communications (hundreds and thousands) that are difficult to understand. Thus, an emergency often involves progress by multiple agents interacting with simpler "smart entities" during their self-organization to achieve a specific goal.

In the meantime, the choice is made based on the accord which depends on common convictions, bargains, concessions, and so on. It complicates the indications of violence, malignancy, aggression, and other defects due to negotiation and decision-making. People who make changes activate the value aspects that they cannot eliminate, but they mitigate these negative phenomena. (Dr.Sc. P.O. Skobelev, Dr.Sc. S.Yu. Borovik, 2017)

5.7 Benefits of Industry 5.0 in Manufacturing

Industry 5.0 standards (flexible operation, data transparency, actionable information, automation) can benefit companies across the entire production area. As companies apply these principles competently and honestly, the Industry 5.0 model can improve the Adaptability, safety and security, perceptibility, client relationships, adaptability, and innovativeness of industries worldwide. All the advantages of the model are the following:

Adaptability

Industry 5.0 automation bases can help improve the adaptability of industries. Automation makes the manufacturers able to forward staff to different departments, move from unsafe manufacturing zones. The automatization makes the overall production quicker and makes the industry to compete worldwide.

Automation will likewise make it less demanding for makers to concentrate on their qualities and achieve other Artificial intelligence actions. Cloud innovation will be at the focal point of these advancements as organizations can lessen IT activities. This is especially valuable for small organizations with constrained

IT properties. Rather than having the nearby staff to oversee programming and networks and look after them, organize structures run remotely on cloud servers.

Safety and Security

The major worries of the 5.0 industry among industries is the possibility of problems due to interruptions in the cognitive calculation. In this regard, some sectors additionally dread that cyber systems in an industrial environment can influence the integrity of the manufacturing procedures.

Cloud technology will take a key role in abating the worries by making the most of the safety and security features of Industry 5.0. With the improvement of IoT's cybernetic and reasoning capabilities, these systems are managed through cloud computing. When all of this enters into force, companies no extensive must concentrate their inner resources on upkeeping data software and backing up files, since these activities are performed in the database at the end of the server.

Control and Clarity

With the globalization of manufacturing networks, it is critical to making digital developments evident to all purpose of the whole system. Once fully executed, the Industry 5.0 standards will help you react by making data and information available globally in a small amount of time. They correspondingly improve the collaboration by interconnecting industries and people in different regions through cloud servers.

The greatly enhanced communication capacities of the Industry 5.0 system also make it easier to simplify compliance necessities. Industry 5.0 consents better prominence of all connections in the production progressions.

Customer satisfaction

At the point when completely connected, Industry 5.0 could be a help for client relations among industries manufacturing sections. The cross-channel abilities of IoT digital system will enable industries to speak with clients along consistently, the satisfaction of requests to the conveyance of completed products. Similarly, Industry 5.0 helps makers to team up with clients and providers. The procedure will be apparent at every state in the production chain as of the instant somebody puts a request or directs a design till the time the consignments reach. Industry 5.0 will enable the creation of joint production opportunities between manufacturers and related industries worldwide.

Personalization

Industry 5.0 could reach a new dimension of personalization with 3D printers, of which 23,000 are used worldwide. This technology enables faster production of re-designed products and quicker production of smaller-scale items, improving personalization options. For example, if you want a new portion for an existing item, you can enter the designs in the printer system, and the printer produces the part automatically. This procedure takes only a small amount of the time that would be required for the manual production of the component.

When repairing and correcting of bad plans, reasoning computing might make the required changes. It could rapidly manufacture the enhanced products and parts without the manual work required in previous production setups, which saves a lot of unwanted manual effort. Also, such products could be stronger and longer lasting, which can ultimately lead to an increase in profits.

5.8 The Development of Robotic Technology With The Support Of ICT Technology

Automation of production processes started in the 1960's last century with the application of industrial robots in the Manufacturing process in the automotive industry — the Automation of manufacturing systems using industrial operations. Robots are an ongoing process and the time has come. Different because of the development of information. Some technologies are affected by automation. Because now, they perform several tasks, with the Possibility to reprogram. One of the weaknesses of the first generation of industrial robots is the one they must be programmed for each operation. The second drawback is that industrial robots have been divided by worker barriers so as not to hurt them during operation in the manufacturing process. Sensor technology, digital technology, and new materials provide the Development of robotic technologies, and their fusion enabled the expansion of the second generation of industrial robots. Understand the speed of convergence of the digital and other technologies with robotic technologies and their Implementation in manufacturing processes in the industry we need to perform the analysis of the representation of Industrial robots and services worldwide in the last decade. The representation of industrial robots worldwide in the period 2005-2015 and the prediction of representation.

Fig 18: Annual representation of robots

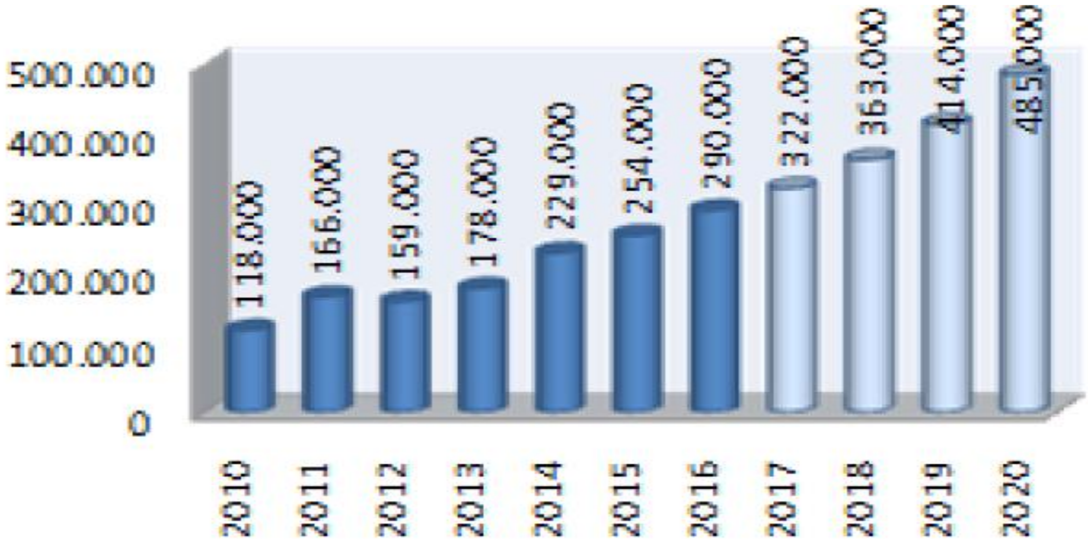

Fig 19: Prediction of representation

Based on Figure 18 a) we can conclude the presentation of industrial robots in production processes globally growths every year, so in the last decade, the number of robot units was increased by 120,000 Units in 2005 to 254,000 robotic units in 2015. This declaration gives us the assumption that the evolution of Information technology and robot technology and the implementation in the production processes is supported by the automation and transformation of production processes increase of efficiency.

The development of digital technology and other technologies contribute to the development of robotic technology so that throughout the year, the representation of service robots for logistics in the production process is developed and expanded. The convergence of digital technologies with other technologies has created the second generation of industrial robots, which will soon lead to the third generation of smaller, cheaper, more autonomous, more autonomous, more flexible and correctly rendered industrial robots, with natural that can be programmed by the workers.

The third generation of industrial robots is intelligent, and the autonomous robots and their improvement will be the following: Identify specific objects, manipulation, knowledge, increase computer performance, numerical distance, Controlling, working with small and sophisticated products that require customization in the installation, reliability, and accuracy that surpasses human capabilities. There are currently industrial, and facility robots at the centre of automation of production processes and in the future will be unbelievable to be Intelligent or smart factory without the participation of a new generation of robots. (Karabegović, P. D. 2018)

Digital technology and robotic technology are at the root of everything that is smart. The latest information technologies have enabled the design and simulation of real installations at all stages of production, such as optimization, quality control, planning, assembly, and production management. From one place. This method leads to high productivity, efficient manufacturing process, low-cost and high-quality production. The development of digital technology, sensors, and robotics. With other techniques and new materials, introduced the intelligent industrial development that leads to smart companies. This is the period of the fourth industrial revolution based on intelligent production processes using the network. The advanced technology and technology monitoring equipment have the means to adjust the production. The production system can reason, predict, simulate, configure automatically, Optimal production system, autonomous learning, automatic analysis of bugs, problem resolving and maintenance. The new manufacturing system will have the ability to interconnect with the machine and to be complement at several stages.

It is well recognized that technology, robotics is evolving quickly and industrial robots the second generation is already installed in the production process, where they work with the workers, whereas in the past they had to be separated by compartments so as not to hurt the workers. Moreover, logistics service robots are being installed in processes of production, which are intelligent, and communication connected to machines. Intelligent automation enables greater flexibility in production, allowing different products to be manufactured in the same production facilities. By creating a digital design and virtual modelling, we can reduce the time between the design of a product and its distribution on the market. In this way, we achieve great developments in product quality and a significant reduction of production errors. The industrial revolution, which includes digital and other technologies, will lead us to "intelligent production" over the next decade. It is proposed the development of Augmented Reality (AR) based assistance platforms for the successful deployment of advanced technology systems. Although, this is precisely the challenge of high costs. In contrast, the alternative Introduction of standardized processes. (Karabegović, P. D. 2018)

6. RESULT

Due to intense competition and customer demand, mass production is no longer mentioned today. The production is limited to the supply of products adapted to the needs of the customer. Production and process management in such conditions need new methods and the use of new technologies to maximize the efficiency and productivity of the system. Entering the 5th industrial revolution, companies adopted new technologies to meet the demands of quality customers and value-added products successfully and in the production, using new techniques in transparency, smart components, smart products, time-saving, real-time product monitoring, availability of information, new software possibilities, more significant data, and information security. These are just some of the results of the adoption and use of new Technologies in companies.

The step between creating new technology and implementing it in business are people who need to adapt to the Internet Technology and preparation of processes before implementation. The human factor is crucial, and there is a certain risk. For this reason, it is essential to recognize the obstacles to the introduction of new technologies with them and neutralize them.

The critical factors in achieving these results, however, are the commitment and understanding of the workforce, i.e., human work. People's resistance to change is the biggest challenge Problem in the lean management application. Although present in the productive area, it is more important in service. Industry, because people do most of the work. The change is perceived differently on several hierarchical levels, which then arises Obstacles to the implementation of the Lean tool. The ability to recognize and resolve these obstacles can lead to success Application of the lean technique in different organizations.

6.1 The Adoption of Modern Technology Specific To Industry 5.0 By Human Factor

The implementation of modern technology leads to changes in conventional processes. The biggest challenge is the human factors that need to adapt and deal with technology and complex data, which is the problem for the greying society. So, it proposes to remove blocks by integrating the human factor into technology. Development is a great way to solve problems related to the introduction of technology. The evaluation of psychosocial risks, because the use of modern technologies causes new stress factors. Determination of the potential stressor is crucial to providing the basis for identifying potential technology-related issues. Assumption The importance of various aspects from a technological preparation perspective on the implementation of technologies. This research only indicated a perspective on technical readiness, but the main restriction is that humans the preparation was not considered as a factor affecting the successful implementation of Industry 5.0 within the organizations. Right to many studies: "The idea of this" fifth industrial revolution "is to link all the elements of the value chain process into one. Nevertheless, the human factor is often overlooked, even if it must adapt to new technologies and obtain new technologies skills. The solution is to include social elements in all phases of technology design and implementation.

The work environment is changing rapidly, both technologically and humanely improvements that affect increased productivity and process improvement. This indicates that some occupations win other dimensions and difficulties encountered by older workers. But to perceive a greater perspective on in industry 5.0, it is required to recognize all the problems faced by the human factor as an employee in the process of technological convergence. In the same way, a human-centred approach as an advantage within the industry 5.0 concept differs from the technology centred Approach Industry 4.0. It is righteous to design and evaluate systems in organizations and to highlight their interconnections with humans using the example of the systems of artificial self-organization. The results of the investigation have underlined this the approach improves the performance in terms of energy consumption. The necessity of important employees Skills to operate with advanced machines in various activities within the progression of production.

The result of study is the Introduction of Industry 5.0 makes drastic change in the society. As it makes a new revolution in the industry. The major problem faced by many of the countries are unemployment, which affects both uneducated and educated people. Due to the automation in the industries many people lost there jobs. Even huge companies introduces the robots and automatic systems in under developed or developing countries. Which affects the people in the society. It brought many problems in the society like unemployment, depression and proverty. Even there were some news that some people made strike againt the automation and someone did suicide Which makes a bad impact on many countries. So the complete automation creates big problems in the society and industry. This has to be solved. Even in developed countries people faces this problem but in smaller intensity. Only highly educated and skilled people can survive or get a proper job. This problem has to be solved.

Industry 5.0 brings the man back to industry. Creates many job opportunity. All industry exist for humans and by humans. So it is to be continued. All automations are invented by humans so they can return to manual culture for their need and future. The society should be balanced every time. If something gets upscaled or under scaled it creates problems in the society. So everything should be balanced in the society to get everything in normal. There is an upcoming generation, so we should keep the world for them also. So for better future humans should rebound back.

7. CONCLUSIONS

From the study which I have done gives information on the implementation of industry 4.0 in organizations, focusing on the main problem, the lack of human factor perspective, to solve it now, implementing Industry 5.0. Also, the successful technological application, while there is a shortage of approach to the adoption of modern technology by employees as a human factor in processes before Industry 4.0. The aim is to consider all possible problems when adopting modern technologies for users.

From my research about the introduction of Industry 5.0 into the current world brings several advantages over any disadvantage. To establish Industry 5.0's successful implementation model, it is significant to consider all perceptions, both human and technology. Also, at the starting of the application of conventional technology to the process, it is essential to find the process in the process analysis. This investigation proposes the first step in recognizing all the obstacles that prevent the successful adoption of modern technology by a human factor. The review of the literature served as a basis for the creation of potential problems in the adoption of advanced technology by human factors. The issues are identified as follows:

1. The absence of standard instructions for the use of modern technologies: Creating and using standardized guidelines in multiple organizations is not new, but there is a great need for users to make modern use of devices Employees This is especially necessary to ensure safe and accurate operation. Improper professional instructions can lead to errors, injuries, faults, etc.

2. Lack of pre-training: many employees confronted with modern and sophisticated technology are often not sufficiently knowledgeable and are major. For this reason, it is more difficult for them to adapt to changes in the workplace. The right solution would allow them more pre-training to learn all that is critical for effective work.

3. Insufficient Equipment: While many companies struggle to implement necessary modern equipment and spare parts in the event of a breakdown.

4. Fear of mistakes: Even if "the mistake is human," at the beginning of the application of the innovations, most of the employees considered their mistake as a personal failure, which was very discouraging for their performance.

5. Fear of repercussions: about the dismay of errors, this fear is an effect of causes linked to fear of consequences. Employees are afraid of making mistakes so that they do not receive sanctions,

discouragement or, in the end, dismissal. Also, depending on the area of activity, there is concern that the error will affect other parties and participants in the process.

6. Technical problems of the system and how to deal with them: If there are changes in a single operation, failures and delays may occur, especially at the beginning of the application. Employees are particularly concerned about how they will handle these mistakes.

7. Fear of Change: The implementation of modern technologies is not the only segment that roots fears and resistance to change. Any change that affects habit changes with panic and fear causes resistance. The biggest worry is that employees cannot take the update and often make mistakes.

It is evident that modern technologies offer many advantages for both the process and a human factor as participants in the process. It refers to accelerating and facilitating the process, which increases the efficiency of the process, ultimately leading to higher productivity and employee satisfaction. On the other hand, it will be difficult to deal with sophisticated equipment, machines, and high-tech systems if the employees are not trained and have no training. This poses a challenge to Human resource management, also because the right skills are much more important.

The optimum method to resolve these problems is to involve the end user's employees in the design of the technology. This enables the adoption of successful technologies. For most sections of the population, it is easy to apply modern techniques. The research constraints relate to a small number of respondents and to the fact that the Croatian industry has not yet used complex. All obstacles to the successful introduction of modern technologies exist and persist.

On the other hand, identification enables better management and preparation of all necessary activities related to waste disposal and the successful application and introduction of modern technologies by the user. Also, this ultimately leads to an improvement in the process. Moreover, the potential problems identified are not considered justifications, they not only affect the performance and quality of the execution of the activities of the process, but also the revolt of the employee can be caused by uncertainty and disappointment.

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LIST OF FIGURES

Source: Dombrowski, U., & Wagner, T. (2014): Mental Strain as Field of Action in the 4th Industrial Revolution. *Procedia CIRP*, *17*, 100-105. doi:10.1016/j.procir.2014.01.077

Fig 14: Socio-Technical Production System
Source: Dombrowski, U., & Wagner, T. (2014): Mental Strain as Field of Action in the 4th Industrial Revolution. *Procedia CIRP*, *17*, 100-105. doi:10.1016/j.procir.2014.01.077

Fig 15: Job profile creation after the industrial revolution
Source: Dombrowski, U., & Wagner, T. (2014): Mental Strain as Field of Action in the 4th Industrial Revolution. *Procedia CIRP*, *17*, 100-105. doi:10.1016/j.procir.2014.01.077

Fig 16: Cobots in Manufacturing
Source: Accenture. (2018): *Machine dreams making the most of the connected industrial workforce*. Retrieved from https://www.accenture.com/us-en/_acnmedia/PDF-13/Accenture-Connected-Industrial-Workforce-Research

Fig 17: System Integration
Source: Vaidya, S., Ambad, P., & Bhosle, S. (2018): Industry 4.0 – A Glimpse. *Procedia Manufacturing*, *20*, 233-238. doi:10.1016/j.promfg.2018.02.034

Fig 18: Annual representation of robots
Source: Karabegović, P. D. (2018): The Role of Industrial and Service Robots in Fourth Industrial Revolution with Focus on China. *Journal of Engineering and Architecture*, *6*(1). doi:10.15640/jea.v5n2a9

Fig 19: Prediction of representation
Source: Karabegović, P. D. (2018): The Role of Industrial and Service Robots in Fourth Industrial Revolution with Focus on China. *Journal of Engineering and Architecture*, *6*(1). doi:10.15640/jea.v5n2a9