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The impact of logistics 4.0 on supply chain performance

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PROJECT OF THE END OF STUDIES

Logistics 4.0



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Summary

- Introduction 5
- Chapter 1: Industry 4.0..... 7
 - SECTION 1: Presentation of industry 4.0..... 7
 - 1. Definition of Industry 4.0:..... 7
 - 2. Definition of Industry 4.0:..... 8
 - 3. Evolution of Industry from 1.0 to 4.0: 8
 - Section 2: The components of industry 4.0..... 10
 - 1. The vision of industry 4.0: 10
 - 2. The core component: 11
 - 3. The way forward for implementation of industry 4.0: 12
 - Section 3: Challenges, Benefits and examples of Industry 4.0 14
 - 1. The challenges of industry 4.0: 14
 - 2. Benefits of Adopting an Industry 4.0 Model..... 15
 - 3. Example of industry 4.0 16
- Chapter 2: Logistics 4.0 17
 - SECTION 1: PRESENTATION OF LOGISTICS 4.0..... 17
 - 1. Definition of logistics:..... 17
 - 2. Evolution of Logistics 4.0: 18
 - 3. The fourth revolution of Logistics 19
 - SECTION 2: Challenges, benefits and technologies of logistics 4.0 :..... 20
 - 1. The challenges of logistics 4.0: 20
 - 2. The key benefits of digitization for the logistics sector 21
 - 3. Thetechnologies of logistics 4.0..... 21
 - Section 3: Examples of logistics 4.0 26
 - 1. First example: Toll Group 26
 - 2. Second example: ALIBABA BlockChain..... 26
 - 3. Third example: B &R : 26
- Chapter 3:Case Studies of logistics 4.0 29
 - Section 1:Benefits of RFID on supply chain management ;Case (UPMC and Boeing) 29

1. Overview of UPMC Central Distribution supply Center	29
2. Overview of Boeing Factory in Everett, WA.....	30
3. Implications of RFID :	31
Section2:Kiva Robots : Amazon	34
1. Overview of ROBOT KIVA:	34
2. Design of Amazon Robotics	34
1. The solution of Robot Kiva.....	35
Section 3:KUKARobots :	36
1. Overview of KUKA Robotic:	36
2. Functioning of KUKa robots :.....	36
3. Benefits of using KUKA Robotic	37
Conclusion.....	38

List of figures

Figure 1: Revolution of industry	9
Figure 2 : Component of industry 4.0	Erreur ! Signet non défini.
Figure 4: Boeing factory	31
Figure 5 :Functioning of Kiva robot	Erreur ! Signet non défini.
Figure 6: frame of robot Kiva.....	Erreur ! Signet non défini.
Figure 7:Work area of Kiva.....	Erreur ! Signet non défini.

Acronym list

CPS: Cyber physical System

IOT: Internet of Things

MES: Manufacturing Execution Systems

RFID: Radio Frequency Identification

RTLS: Real-time locating systems

3pl:Third party logistic

3DP: 3D printing

ERP:Enterprise resource planning

Introduction

Today, companies striving to survive in an increasingly ambitious environment need to undergo substantial transformations. They implement organizational and technical solutions to improve their flexibility, respond to customer requirements quickly and efficiently, be competitive. The range of the solutions available is wide and the most advanced in terms of technology are within Industry 4.0 concept. Industry 4.0 offers a broad variety of options and selecting the best/most suitable requires from a company defining its goals at the strategic level. However, it is believed, that nowadays, business models rather than strategy, should be implemented as a navigation instrument towards sustainable success in the market. Dynamic development of manufacturing Industry 4.0 is a result of some processes, for example: internationalization, information technology development and hyperactive competition. The example of such models are maturity models developed to measure the degree of progress and advancement in the given field (Oleskow-szlapka & Stachowiak, 2019). Their goal is to provide insight into continuous process improvement and status quo analysis. Hence, a maturity model can guarantee confirmation of business model management's performance and measure its capability.

Advancement of technology over the past decade has given rise to Industry 4.0 (Labib, Mansour, & Eldin, 2018). The term Industry 4.0 derives from the new (fourth) industrial revolution enabling suppliers and manufacturers to leverage new technological concepts like Internet of Things, Big Data, and Cloud Computing: New or enhanced products and services can be created, cost can be reduced and productivity can be increased. Similar terms are Smart Factory or Smart Manufacturing. The ideas, concepts and technologies are not hype anymore - they are at least partly reality, but many software specification and development aspects are still not sufficiently covered (Petrasch & Hentschke, 2016).

Industry 4.0 is expected to cause disruptive changes in industrial production. Originating from the German strategic initiative Industry 4.0, it is now on the agenda in several European countries and in the US and Asia. It is built around rapidly developing technologies and concepts, the Internet of things (IoT), and is expected to lead to a paradigm shift in industrial production. To remain competitive, Norwegian manufacturers and manufacturers in countries

where labor costs are high should explore the concept of Industry 4.0 to enable exploitation of the specific benefits it can offer in terms of new solutions for industrial production and logistics.

The term Industry 4.0 is widely recognized, not only among academics, but also among business. The term that has not gained that popularity and publicity yet is Logistics 4.0 (Oleskow-szlapka & Stachowiak, 2019). As industry needs material flows, and in global economy, they are of high complexity, authors believe that Logistics 4.0 will be the field of research and solutions within it will be sought for and implemented by companies.

Logistics and its self-perception. Logistics has become a core pillar in the value chain for industries and it is crucial for them to have the right good with the right quantity and right quality at the right time at the right place and in the right condition and at right price, otherwise they cannot be competitive in the market. In a dynamically changing and uncertain logistic environment, fulfilling these requirements is getting more and more difficult. The highly dynamic and uncertain logistic markets and huge logistic networks require new methods, products and services. Today's consumer behaviour leads to new logistics challenges and opportunities. The concept of the cyber physical system (CPS), the wireless networks, the Internet of Things and Services (IOT&S), Big Data/Data Mining (DM) and cloud computing .

This project will presents a framework of this new industrial evolution applied to Logistics Processes, where Cyber-Physical System and technologies, which free humans to carry out activities which are repetitive and automatic, play an essential role. It is explained which the technical components of Logistics 4.0, giving current examples are of companies which are applying these technologies. Parts of CPS as Radio Frequency Identification System are further developed in a Case Study, where is attempted to give a clear understanding of how Logistics 4.0 solutions can add value to the actual Logistics.

Chapter 1: Industry 4.0

As we all know, now all objects of the factory world are equipped with integrated processing and communication capabilities. This does not only affect M2M communication, but will also have far-reaching consequences for the interplay of humans and technology. Considering the background of technological progress, one must assume that the range of both problems and demands for humans in the factory space will change (Gorecky, Schmitt, Loskyll, & Zühlke, 2014).

Currently, we are leaving behind the achievements and significant changes brought by digital automation through electronics and IT. We are now at the beginning of the fourth and new phase of the Industrial Revolution: Industry 4.0 and Logistics 4.0. In today's rapidly changing logistic world

In the first chapter, we will treat Industry 4.0 with definition then the concept of industry 4.0, which we are going to talk about the revolution of industry 4.0, and we will discuss the vision of industry 4.0. Furthermore, we will give some examples of industry 4.0. Finally, the benefits offered by the industry 4.0 and its challenges.

SECTION 1: Presentation of industry 4.0

1. Definition of Industry 4.0:

The Industry 4.0 initiative was recently introduced by the German government, since that country has one of the most competitive manufacturing industries in the world and is even a global leader in the sector of manufacturing equipment. Industry 4.0 is a strategic initiative of the German government that traditionally heavily supports development of the industrial sector. In this sense, Industry 4.0 can be seen also as an action towards sustaining Germany's position as one of the most influential countries in machinery and automotive manufacturing.

The basic concept was first presented at the Hannover fair in the year 2011. Since its introduction, Industry 4.0 is in Germany a common discussion topic in research, academic and industry communities at many different occasions. The main idea is to exploit the potentials of new technologies and concepts such as:

- ✚ availability and use of the internet and IoT,
- ✚ integration of technical processes and business processes in the companies,
- ✚ digital mapping and virtualization of the real world,
- ✚ ‘Smart’ factory including ‘smart’ means of industrial production and ‘smart’ products (Cooper, 1972).

2. Definition of Industry 4.0:

Industry 4.0 or the fourth industrial revolution is the creation of a digital manufacturing enterprise that is not only interconnected but also commutates, analyzes and uses information to drive further intelligent action back in the physical world. It drives the physical of designing, manufacturing, distribution, and performance in ongoing cycle as the physical-to-digital-to-physical (Lineberger, Hussain, Hanley, Rutgers, & Sniderman, 2019).

In addition the industry 4.0 is the linking of products and services with one another and with their respective environment through the internet and other network services that enables the development of new products or services so that many functions of products work autonomously without human intervention (Ojra, 2019).

3. Evolution of Industry from 1.0 to 4.0:

Before digging too much deeper into the what, why, and how of Industry 4.0, it is beneficial to first understand how exactly manufacturing has evolved since the 1800s. There are four distinct industrial revolutions that the world either has experienced or continues to experience today.

The first industrial revolution spanned from about 1760 to around 1840. Triggered by the construction of railroads and the invention of the steam engine, it ushered in mechanical production. The second industrial revolution, which started in the late 19th century and into the

early 20th century, made mass production possible, fostered by the advent of electricity and the assembly line. The third industrial revolution began in the 1960s. It is usually called the computer or digital revolution because it was catalysed by the development of semiconductors, mainframe computing (1960s), personal computing (1970s and 80s) and the internet (1990s) (Schwab, 2016)

The Fourth Industrial Revolution heralds a series of social, political, cultural, and economic upheavals that will unfold over the 21st century. Building on the widespread availability of digital technologies that were the result of the Third Industrial, or Digital, Revolution, the Fourth Industrial Revolution will be driven largely by the convergence of digital, biological, and physical innovations. Its technological basis is smart automation of cyber-physical systems with decentralized control and advanced connectivity (IoT functionalities). The consequence of this new technology for industrial production systems is reorganization of classical hierarchical automation systems to self-organizing cyber physical production system that allows flexible mass custom production and flexibility in production quantity (Cooper, 1972) (Banwari, 2018)

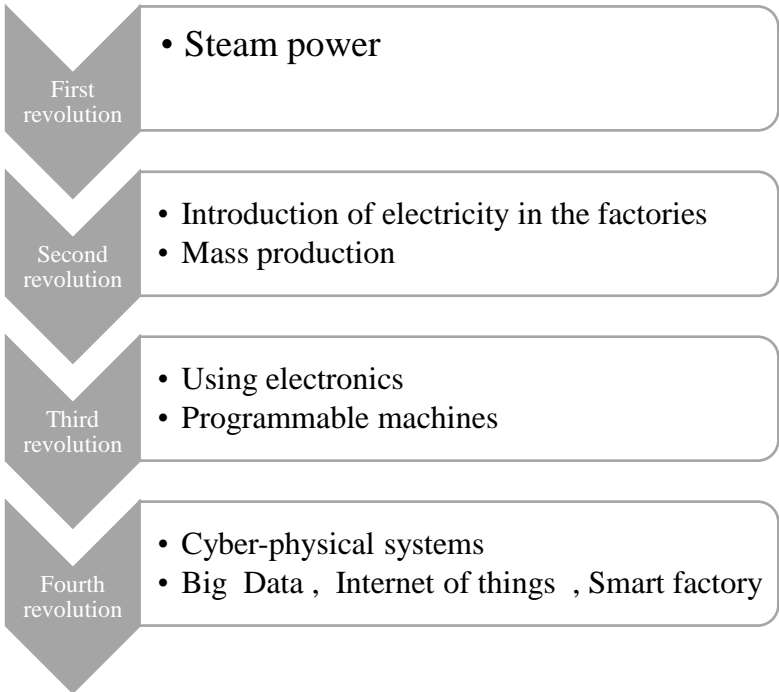


Figure 1: (R)evolution of industry

Section 2: The components of industry 4.0

1. The vision of industry 4.0:

There is a basic consensus among many researchers that the industrial revisions require a long-time period of development and cover the following four aspects, considered as the future manufacturing visions in the following table(Qin, Liu, & Grosvenor, 2016) :

Factory	As one of the main components of Industry 4.0, the future factory is going to involve a new integrative, where not only all manufacturing resources (sensors, actuators, machines, robots, conveyors, etc.) are connected and exchange information automatically, but also the factory will become conscious and intelligent enough to predict and maintain the machines; to control the production process, and to manage the factory system.
Business	Industry 4.0 implies a complete communication network will exist between various companies, factories, supplier, logistics, resources, customers, etc. Every section optimizes their configuration in real-time depending on the demands and status of associated sections in the network, which makes the maximum profit for all cooperatives with the limited sharing resources.
Products	Benefitting from Industry 4.0, will be a new type of product generated in manufacturing, that of smart products. These products are embedded with sensors, identifiable components, and processors, which carry information and knowledge to convey the functional guidance the customers, and transmits the uses feedback to the manufacturing system.
Customers	Customers will also have many advantages under Industry 4.0. A new purchasing method is going to be provided to customers. It allows customers to order whatever function of products, with any number even if only one is. In addition, customers could change their order and ideas at any time during production even at the last minute with no charge. On the other hand, the benefit from the smart products enables the customer not only to know the production information of the product but also to receive the advice of utilization depending on their own behaviors.

2. The core component:

In the first section of this series, we discussed the many changes in the industry, the development of Industry 4.0. T and the transformation from Industry 1.0 to now. Now that we have a better understanding of what Industry 4.0 is, let's take a look at what it entails. The components that underpin Industry 4.0:

- Cyber-physical system:

An important component of Industry 4.0 is a combination of physical and virtual world. This connection is made possible by the creation of the so-called cyber-physical system (CPS).

Cyber-Physical Systems (CPS) is defined as transformative technologies for managing interconnected systems between its physical assets and computational capabilities. With recent developments that have resulted in higher availability and affordability of sensors, data acquisition systems and computer networks, the competitive nature of today's industry forces more factories to move toward implementing high-tech methodologies(Lee, Bagheri, & Kao, 2015).

- Internet of Things:

The Internet of Things (IoT) is a new paradigm that is rapidly gaining ground in the modern wireless telecommunications landscape, the concept is the widespread presence around us of a variety of things or objects - such as radio frequency identification (RFID) tags, Sensors, actuators, cell phones, etc. that through unique addressing schemes can interact with each other and cooperate with their neighbors to achieve common goals. The main strength of the IOT idea is the high impact it will have on various aspects of everyday life and the behavior of potential users(Okano, 2017).

- Smart Factory:

Smart factory is also referred to as key advantages Industry 4.0. It's an optimized manufacturing facility which can facilitate launching new products depending on market dynamics, is scalable enough to meet demand variation for existing products, is able to produce finished goods at least cost, has smart machines, sensors and robots which are seamlessly integrated with information system architecture to enable high level of automation

in transaction processing and has real time analytics that helps in minimizing downtime and improving efficiency(Barber, 2018).

3. The way forward for implementation of industry 4.0:

The Industries and countries will embrace Industry 4.0 at different rates and in different ways. Industries with a high level of product variants, such as the automotive and food-and-beverage industries, will benefit from a greater degree of flexibility that can generate productivity gains, for example, and industries that demand high quality, such as semiconductors and pharmaceuticals, will benefit from data-analytics-driven improvements that reduce error rates. Industry 4.0 allows an individualized reacting on customer requests with a high degree of self-organization that can provide satisfaction of clients (Schmidt, Möhring, Härting, & Reichstein, 2015).

To actively shape the transformation, producers and system suppliers must take decisive action to embrace the nine pillars of technological advancement. They must also address the need to adapt the appropriate infrastructure and education (Russman et al., 2015) .

- Producers Must Set Priorities and Upgrade the Workforce

Producers have to set priorities among their production processes and enhance their workforce's competencies, as follows:

- ✚ Identify key areas for improvement, such as flexibility, speed, productivity, and quality. Then, consider how the nine pillars of technological advancement can drive improvement in the designated areas. Avoid becoming stuck in incremental approaches; instead, consider more fundamental changes enabled by a combination of the nine technologies.
- ✚ Analyze the long-term impact on the workforce and conduct strategic workforce planning. Adapt roles, recruiting, and vocational training to prepare the workforce with the additional IT skills that will be required.

While these improvements already hold significant potential for existing industries, emerging fields could use Industry 4.0 technology to disrupt existing standards using innovative factory layouts and production processes (Russman et al., 2015) .

- Suppliers Must Leverage Technologies

Manufacturing-system suppliers need to understand how they can employ technologies in new use cases to offer the greatest benefits to their customers. These technologies can be leveraged for different offerings, such as the enhancement of networked embedded systems and automation, the development of new software products, and the delivery of new services, such as analytics-driven services. To build these offers, they must put the right foundations in place:

- ✚ Define which business model to leverage for their enhanced or new offers.
- ✚ Build the technological foundation, such as the tool base for analytics.
- ✚ Build the right organization structure and capabilities.
- ✚ Develop partnerships that are essential in the digital world.
- ✚ Participate in and shape technological standardization. (Russman et al., 2015)

- Infrastructure and Education Must Be Adapted

Producers as well as suppliers must work to adapt infrastructure and education as they embrace the technologies of Industry 4.0. This is best addressed through a combined effort involving government, industry associations, and businesses to achieve the following:

- ✚ Upgrade technological infrastructure, such as fixed- and mobile-broadband services. Infrastructure must be rendered fast, secure, and reliable enough for companies to depend on it for near real-time data.
- ✚ Adapt school curricula, training, and university programs and strengthen entrepreneurial approaches to increase the IT-related skills and innovation abilities of the workforce(Russman et al., 2015) .

Section 3: Challenges, Benefits and examples of Industry 4.0

1. The challenges of industry 4.0:

Industry 4.0 comes with challenges. Today, manufacturers deal with huge quantities of information, both structured and unstructured, which reside in databases that are not always properly connected. To create business value, meet customer expectations in terms of innovation, personalization, and speed to market, it is necessary to connect these silos and enable a single, unbroken collection of data that is woven throughout the supply chain (CGI, 2017).

To do this, it is important not to neglect the following elements:

Awareness: Many manufacturers are still unaware of the possibilities that Industry 4.0 technologies can offer¹⁴ and company-specific business cases do not demonstrate this suitably.

People: Introducing new business models, business processes, and connected products and services will transform the way employees perform everyday tasks. In order to deploy Industry 4.0 solutions, companies need new people and skills. Certain jobs like those of industrial workers will change or might even become redundant. Warehouse workers, for instance, are expected to be replaced by autonomous robots. New roles, such as “robot coordinator” and “data scientist”, have been created, while routine and physically demanding jobs will disappear.

Cybersecurity: With digital factories and a digitally connected value chain, traditional IT security is not enough to protect the business. To overlook this reality is to compromise the stability and security of the company. As companies innovate, the “attack surface area” or the enterprise area that is vulnerable gets bigger. The challenge lies in understanding the potential cyber risk that innovation brings. A single plant shut down can cause production losses of millions of dollars each day.

Investments: In order to implement Industry 4.0 solutions, considerable investments are required to create a robust and secure network infrastructure and upgrade or replace legacy systems. To justify these investments, benefits have to be unequivocally and reliably quantified.

Collaboration: Today, no single vendor can deliver all the capabilities needed to implement Industry 4.0 solutions, as they are based on multiple technologies and devices that run on different networks. The delivery of Industry 4.0 solutions will be facilitated by an ecosystem of IT vendors, OT vendors, system integrators and emerging IoT startups. The critical success factor is close collaboration between the business, IT and OT.

Standardization: Existing manufacturing standards are insufficient to fully enable Industry 4.0 and new technical, architectural and business standards are needed. As an increasing number of devices and systems that use proprietary communication protocols enter the market, data silos are formed, creating a complex network of connections between isolated data sources.

2. Benefits of Adopting an Industry 4.0 Model

Industry 4.0 spans the entire product life cycle and supply chain design, sales, inventory, scheduling, quality, engineering, and customer and field service. Here is a quick, non-exhaustive list of some of the benefits of adopting an Industry 4.0 model for your business:

- The digital technologies helped boost their productivity: The main driver of productivity growth in a smart factory is the capacity to predict and prevent downtime, and to optimize equipment effectiveness and maintenance (Business & Bank, 2017) .
- Using resources and optimizing processes: The possibilities to improve processes and the consumption of materials when using the concepts of Industry 4.0 are versatile. It is possible to decrease material costs by less defective goods and optimize processes (in speed or yield) via the use of cyber-physical systems, which allow the observation of processes in real-time. Through the use of these technologies it will be possible to react to events in the physical world in an automatic and fast way (Werthmann, n.d.).
- Improving overall product quality: For instance, real-time quality controls allow you to reduce, or even eliminate, customer returns that occur when products do not meet specifications (Domingo, 2016) .
- Identified greater capacity to innovate as a benefit: New business models made possible by smart products and new advanced technologies, such as 3D printing, are only beginning to emerge. They promise to spark innovation on a monumental scale over the next five to 10 years. We are already seeing inspiring examples of how small businesses are using connected products and customization to reinvent themselves in the digital context (Business & Bank, 2017) .

3. Example of industry 4.0

The Fourth Industrial Revolution is not something of the distant future, indeed it is already here. Through the widespread adoption of Industry 4.0 practices, the world's most dynamic region, Southeast Asia, has the potential to leapfrog ahead of other developing regions, such as the Middle East and Africa, by not only embracing but also contributing to the new technologies that will transform how people work, live and communicate.

Singapore is for example already a landmark in the globe for its innovative technological hub status across the board from smart urban planning to desalination and high-end engineering practices. Malaysia on the other hand is taking over the shared economy in the transportation scene in South East Asia with its rapidly growing "Grab" platform.

Indonesia is successfully powering luxury properties located in natural resorts at Bali by building High Temperature Gas Reactors (HTGR), utilizing advanced and clean technologies as a business model. The trend is not exclusive to these countries in the region and is apparent especially in infrastructural and agricultural areas.

Industry 4.0 has been hailed as the underpinning of the modern smart factory, promoting the rise of cyber-physical systems, increased machine-to-machine communication, and decentralized decision-making within production processes. The concepts that make up the Industry 4.0 framework have been suitably revolutionary, and they are rapidly changing the way that manufacturing businesses operate, but many organizations are realizing that this framework does not have to stop at the edge of the factory floor. Indeed, the very same principles that drive modern, digitized manufacturing are also bringing about the era of Logistics 4.0, so what logistics 4.0?

Chapter 2: Logistics 4.0

After the fourth revolution of industry, the use and evolution of Information and Communication Technologies have become unavoidable. The emergence of the Industry Internet of Things promoted new challenges in logistic domain, which might require technological changes such as high need for transparency, integrity control in the supply chains. Digital innovation enables logistics players to drive efficiency and lower costs, as well as pursue new business opportunities. This transformation is leading to a new paradigm called “Logistics 4.0”(Bamberger, Nansé, Schreiber, & Zintel, 2017)

In this second chapter we will study the definition of logistics 4.0 there components its challenges and finally some examples of companies that uses logistics.

SECTION 1: PRESENTATION OF LOGISTICS 4.0

1. Definition of logistics:

Logistics is the process of planning and executing the efficient transportation and storage of goods from the point of origin to the point of consumption. The goal of logistics is to meet customer requirements in a timely, cost-effective manner. Generally logistics is that part of the supply chain process that plans implements and controls the efficient , effective flow and storage of goods services and related information from point of origin to the point of consumption in order to meet costumers requirement (C. Rutner & Langley, 2006) .

Originally, logistics played the vital role of moving military personnel, equipment and goods. While logistics is as important as ever in the military,In the military literature, logisticsemerged as a specific term by the time of the American Civil War. Following Second World War, researchers began to characterize logistics into twosectors: business and military

went so far to specifically recognize the growing use of the term “business logistics.” the term today is more commonly used in the context of moving commercial goods within the supply chain (Rutner et al., 2012).

Now, many companies specialize in logistics, providing the service to manufacturers, retailers and other industries with a large need to transport goods. Some own the full gamut of infrastructure, from jet planes to trucks, warehouses and software, while others specialize in one or two parts. FedEx, UPS and DHL are well-known logistics providers.

2. Evolution of Logistics 4.0:

The industrial production has experienced an evolution over the time. We can divide these changes of the industry in three main periods. Sometimes has been an abrupt change and sometimes just an improvement of the way of work. It is not an accepted way of design these periods of advances, but in order to simplify it versions of the industry and its logistics (1.0, 2.0, 3.0 and the coming 4.0) will be designed.

a. Logistics 1.0

The first change that we can perceived in the industry was such an abrupt change that can be understood as revolution. It was the change from the manual work to the machine production. From the 17th century, the rural life turned into an industrialization life, from working with manual tools and animal force to work with machinery of industrial manufacturing and transportation of goods and people (Domingo, 2016). Therefore, this period meant for logistics the “mechanization of transport”. The first innovation is the mechanization of transportation from the late 19th century and early 20th century. Ships and trains equipped with steam engines had been used as a main transportation tools instead of humans and animal power for transporting goods and containers in large quantities and long distance. Transportation capacity has been enhanced significantly. Logistics in 20 century can be said that it was the beginning of the mass transportation (Wang, 2016).

b. Logistics 2.0

The invention of electric power and mass production in manufacturing lead to the second innovation of logistics. This second period of changes is considered more as an evolution than a revolution from technology point of view. There were findings about new materials as steel,

copper or aluminum, which gained much importance in order to develop the machinery. From the 1960s, we can find the “automation of cargo handling”, the transportation by railways and aircraft ships with the electric power, the mass production (with the electric power) therefore was the beginning of use of logistics equipment such as automatic sorting and automatic warehouses (Domingo, 2016).

c. Logistics 3.0

This industrial evolution took place with the introduction of computers in manufacturing. Regarding the logistics, it was developed the “system of logistics management”. It was the beginning of important software that nowadays are very spread in logistics, WMS (Warehouse Management System) and TMS (Transport Management System), automation and efficiency of logistics management, inventory and dispatch has been significantly progressed and improved (Domingo, 2016; Wang, 2016)..

3. The fourth revolution of Logistics

The demand for high-individualized products and services is continually increasing. Thus, inbound and outbound logistics have to adapt to this changing environment. Due to its increasing complexity, it cannot be handled with ordinary planning and control practices so the logistics 4.0 has been implemented (Barreto, Amaral, & Pereira, 2017).

Logistics 4.0 is the use of bar codes, radio frequency identification technology, sensors, global positioning systems and other advanced networking technologies through information processing and network communication technology platform. These technologies are widely used in logistics transportation, warehousing, distribution, packaging, handling, and other aspects of basic activities (Wang, 2016).

The Logistics 4.0 definition combines two aspects: processual (supply chain processes are a subject of the Logistics 4.0 actions) and technical (tools and technologies that support internal processes in the supply chains) (Oleskow-szlapka & Stachowiak, 2019).

The Logistics 4.0 technological solutions are based on using drones, self-steering vehicles, sensors, Big Data, GPS, RFID, and M2M. As part of the concept, the technologies dedicated to modern enterprises use i.e. virtual reality glasses, intelligent transporters, gates, forklifts and automatic vehicles.

SECTION 2: Challenges, benefits and technologies of logistics 4.0 :

The developments of Industry 4.0 affect logistics heavily, leading to Logistics 4.0. This not only facilitates improvement in different aspects of logistics, such as sustainability, efficiency, responsiveness to customers, and better traceability, but also affects the fundamental elements of businesses.

1. The challenges of logistics 4.0:

- ✚ **Manage the traceability of your products throughout the supply chain:** Achieving efficiencies means there is mastery of product traceability throughout your 4.0 supply chain. For example, it is important that you label your goods with barcodes to monitor their location remotely, and that you use logistics software built into your supply chain.
- ✚ **Anticipate the needs of your client:** In logistics, Big Data helps us anticipate customer needs, anticipate them and manage supplies based on reliable demand forecasts. The new analytics tools developed for Logistics 4.0 share their sales history, weather forecasts, local news, and even user conversations on social networks to better understand their expectations.
- ✚ **Adopt smart logistics:** Integrating logistics 4.0 into the day-to-day operation of the industry means taking advantage of all the technologies available on the market. For example, if we take our Easy WMS Warehouse Management Software, this IT tool makes it easy to automate your warehouse process (Domingo, 2016; Wang, 2016).

We can add also:

- ✚ Insufficient qualifications of employees.
- ✚ Lack of standards, regulations and forms of certification.
- ✚ Unclear legal situation concerning the use of external data.
- ✚ Low maturity level of required technologies.
- ✚ Too slow expansion of basic technologies.
- ✚ Insufficient network stability (Domingo, 2016) .

2. The key benefits of digitization for the logistics sector

Most companies associate digitization with the goal of greater delivery reliability. Digitization provides various levers for this purpose, such as more transparency, better predictability and planning, risk reduction or customer-specific products. At the same time, modern IT enables companies to integrate greater flexibility and agility in their processes and therefore to react more promptly to customers and market requirements (Oleskow-szlapka & Stachowiak, 2019). A further advantage of digitization is that it paves the way for better management of as well as reduction of— the increasing complexity in the process landscape. Other benefits like greater efficiency, risk minimization, automation, error avoidance and improved decision-making based on more valid and more complete information help to ensure that costs are reduced. At the same time, new services in areas like the analysis and interpretation of data result in increased customer satisfaction. This can lay the foundation for new business areas and sales potential (Werthmann, n.d.).

3. The technologies of logistics 4.0

Even today, a digitalized supply chain offers significant advantages in terms of customer service and increased efficiency, allowing shippers to create competitive advantages for themselves, their supply chain partners and their transportation providers. These are the technologies used to identify, locate, smell, treat and act:

a. Identification:

RFID is an acronym for “radio-frequency identification”, RFID is a concept similar to barcode technology, but without requiring a direct visibility of the monitored entities. Just as barcode systems require a proper optical reader and special tags applied on products, RFID needs a reader equipment and special tags or cards attached to the products in order for the products to be tracked (Domingo, 2016; Wang, 2016).

Many types of RFID exist, but at the highest level, we can divide RFID devices into two classes: active and passive. Active tags require a power source—they’re either connected to a powered infrastructure or use energy stored in an integrated battery. In the latter case, a tag’s lifetime is limited by the stored energy, balanced against the number of read operations the device must undergo (Roy Want, 2006).

The aim of RFID systems is to identify any objects in logistics process chains and to link information with these objects to speed up and improve logistics processes. Automatic identification is an integral part of the Internet of Things RFID technology is employed in many industries to perform such tasks as: Inventory management, asset tracking, personnel tracking, controlling access to restricted areas, ID Badging, supply chain management, counterfeit prevention.

Benefits of using RFID technology include the reduction of labor costs, the simplification of business processes and the reduction of inventory inaccuracies, as well as more transparency in logistics processes (Domingo, 2016; Wang, 2016).

b. Locating

Location systems serve to find the physical location of objects, the most used system is the: RTLS: Abbreviation for Real-time locating systems, it is essential for anyone whose business requires transportation and logistics. RTLS allows enterprises to have end-to-end visibility and traceability of all containers, packages and pallets. For manufacturers, RTLS offers intelligent management and flow; for security and safety, it offers the control of employee access and management of hazardous areas. But we can say that they frequently fail to deliver the precision promised (Fisher & Monahan, 2012).

Real-time locating systems (RTLS) are applied to automatically identify and track the location of objects or people in real time (Wang, 2016). In addition, it gives unique insights into logistics and warehousing business. With the help of logistics RTLS, companies can:

- Create the most optimal work routes and processes for people and machinery.
- Calculate the time lost on non-productive tasks.
- Build anti-collision systems to prevent workplace accidents.
- Build no-go zones or ensure that autonomous devices and people can work safely together.
- Build efficient evacuation systems for hazardous environments.

The benefits of RTLS, it helps drivers reduce the amount of time they waste searching for pallets and locations, as real time location information is instantly available to them (Domingo, 2016).

c. Sensing:

The remaining basic requirement of logistics is to provide logistic goods in the “right condition”. Smart sensors are used to detect the condition of goods or changes in its environment, and then provide a corresponding output for the purpose of decision-making..

Typical sensors used in Logistics are:

- Temperature sensor
- Humidity sensor
- Ethylene sensor
- Active RFID transponders

CPS abbreviation for Cyber physical systems form the basis for the fourth industrial revolution: informational components (cyber) and mechanical or electronic and sensory components (physical) merge with each other to form an intelligent system .

The term cyber-physical systems (CPS) refers to a new generation of systems with integrated computational and physical capabilities that can interact with humans through many new modalities(Baheti& Gill, 2011).

CPSs are integrations of computation, networking, and physical processes: the combination of several systems of different nature whose main purpose is to control a physical process and, through feedback, andCPSs are transforming the way humans interact with engineered systems, just as the internet has transformed the way people interact with information.

The benefits of CPS is that it can perform countless calculations instantaneously, potential to bring a positive revolution to the world,fast way to ensure safety in various real world processes and improvement in life quality for countless people(Domingo, 2016; Wang, 2016).

d. Networking

The Internet of Things (IoT) is a network of physical systems that are uniquely identified and can interact to reach common goals.we can also say that IoT refers to intelligent objects having the ability to seamlessly connect together, share data, information and be able to react . to changes in the environment(Labib et al., 2018) . The “things” in IoT are sensors,actuators, communication modules, devices that can cooperate together with neighboringsmart components to reach goals that could not be achieved without this cooperation.

In other words, the IoT can be described as a network where CPS cooperate with each other through unique addressing schemas(Obitko& Jirkovský, 2015).

With IoT enterprises can supervise their every product in real time, and manage their logistics architecture. They not only supervise the circulation in supply chain and share information, but also analyse the data generated from every procedure and forecast. By forecasting the information from the current procedure of their products, the future trend or the probability that accident happens is estimated, remedy measures can be adopted or the warning can be given ahead.

The benefits of IoT is that it optimizes the supply chain management, it makes sources to be used effectively, it makes the whole supply chain to be visible so that it can improve the information of supply chain transparency and the supply chain is managed in real time; the lastly it makes the supply chain high agility and complete integration. It can also be used to improve production quality and uptime, as the data gathered from devices and sensors on the network enables real-time and predictive maintenance across the estate(Domingo, 2016).

The implementation of Internet of Things technology is becoming increasingly popular in the logistics industry due to its promise of valuable payoffs. The benefits will span across the entire logistics value chain, and benefits from IoT implementation will also impact areas such as operational efficiency, safety, security, and customer experience, while redesigning traditional business models.(Conner, 2018)

e. Data collection and analysis

Logistics 4.0 implies a huge increase of variety, volume and velocity of data creation. The type and amount of collected data has been increased because of the advances in sensor technology and the products contained computed capacities.

Before, only simple types of data as temperature measurement were collected, nowadays large data as images or real time videos are use(Abramowicz, 2015).

Big data is a term that describes the large volume of data – both structured and unstructured – that inundates a business on a day-to-day basis. Big data can be analyzed for insights that lead to better decisions and strategic business moves.

- regarding the volume, the systems are moving to processing petabytes and larger amount of data, due to the new opportunities to collect data from many sources together and also the IoT is bringing the necessity to gather and process larger amount of data .

- Regarding the velocity, due to the need of the real time processing data by the use of internet. For example, the need of immediate reaction for proper serving web page or the need of the fraud credit card detection that has to be processed immediately as well.
- Regarding the variety, is not surprising since computers process almost anything. Well-structured data in relational database are accompanied by images, texts, audios or videos. The challenges come when trying to integrate even well-structured data, and the data integration in general is a big research field. Several studies say that the main problem with the Big Data is not the “Big”, if not the heterogeneity of the data(Domingo, 2016).

f. Blockchain technology

Blockchain explores more and more industries every day. Blockchain is the technology protocol that Bitcoin is built on top of. Just as the internet that was introduced in the 1960s and late 1970s, is a communications protocol that governs the rules and regulations for information exchange over the network of networks, Blockchain is a protocol that governs the rules and regulations for value exchange. One is the internet of information, while the other is the internet of value. Internet is a communications protocol and Blockchain is value exchange protocol(Twesige, 2015).

The logistics industry involves many parties: manufacturers, customers, suppliers, auditors, etc. The blockchain technology offers benefits for everyone in this chain. It allows customers to track the product and trace the whole chain of product manufacturing. Auditors can easily verify and check any transactions. Information stored in blockchain is unalterable; any third party, which makes this technology more secure than any existing solution, cannot change it.

Section 3: Examples of logistics 4.0

1. First example: Toll Group

Toll Global Logistics needed to track goods and shipments more efficiently at its Singapore plant. With goals including reduced person-hours by reducing manual dependency and increased visibility for the company and its customers, the organization deployed a system that labeled each of the site's 150,000 pallets with RFID tags. Passive UHF. When shipments arrive, staff members scan barcodes on boxes and then use a portal to read RFID tags on the pallets in which these boxes are loaded (or removed).

The pallet identification data is then linked and sent via Wi-Fi to software that stores the data and makes it available to internal users and customers. Toll Global Logistics estimates that the system will save about six minutes of pallet work time, resulting in over 600 person-days per year (Domingo, 2016).

2. Second example: ALIBABA BlockChain

The Chinese giant Alibaba has always been among the pioneers to adopt blockchain solutions. For example, it has turned to blockchain to fight food fraud, secure medical data and track cross-border shipments.

Through its subsidiary Lynx International, Alibaba integrated blockchain technology to track information in its cross-border logistics operations. Their system has now an immutable record of shipment information such as details about the production, transportation, customs, inspection and any third party verification.

For a shipping and logistics, company like Lynx, security and transparency cannot be overemphasized. Blockchain proved to be, therefore, the ideal solution for them.

3. Third example: B &R :

B & R is one of the most innovative automation companies in the world, leading in the field of industrial automation and process control. The company continues to invest in its employees and services and believes that the distribution of automation logic in production

systems - Industry 4.0 - has created an urgent need for communication networks that offer transparency and efficiency without compromising reliability.

The latest B & R project optimized its production of industrial PCs. It consists for B & R customers to configure PCs according to their specifications using an online tool that after checking the feasibility of the order, the ERP system generates an invoice with a unique serial number.

"The ERP system provides an optimized order-processing schedule and ensures the smooth running of the logistics. Some parts from the warehouse are delivered just in time. The EGGELSBURG plant (Austria) is fully networked horizontally and vertically. "We have a single, seamless network that integrates all building automation machines and components as well as the ERP system," explains Haas. This allows the ERP system to control automated storage and retrieval vehicles in the bay warehouse. Communication throughout the network factory works in all directions. When a module reaches the fully automated station for assembly, testing, and labelling,

A real-time SAP query determines the required tests. This is possible because each product has a unique serial number read by the RFID system. B & R collects and evaluates all of its production data using its own process control system software. "For B & R, smart factory networking has been a reality since 2006," says Haas. "What has been for us as usual, has now received a name: Industry 4.0"

Logistics 4.0 is a wide term that can be summarized as logistics and supply chain processes which are supported by intelligent sensors (RFID systems), embedded software and databases from which relevant product information is provided and shared over internet (IoT), so that a major automation degree can be achieved and logistics can be seen as a network where all the machinery can communicate each other and with humans.

in this chapter we have sought to clarify the logistics concept 4.0 by presenting its general components and principles and benefits for the entire company .

So what is the impact of logistics 4.0 on supply chain performance in practical way?

The introduction of the new logistic concept into manufacturing has many impacts on the whole supply chain. Collaboration between suppliers, manufacturers and customers is crucial to increase the transparency of all the steps from when the order is dispatched until the end-of-life of the product. Furthermore, due to the introduction of digitalization and automation of processes of supply chain management (SCM) structure has become more advanced and optimized(Tjahjono, 2017).

The definition of Logistics 4.0 combines two aspects: processual (supply chain processes are a subject of the Logistics 4.0 actions) and technical (tools and technologies that support internal processes in the supply chains). The tools and technologies are mostly within IT range as digitization creates plenty of advantages for the supply chain. They comprise among other things following issues:

- reduced complexity,
- increased reliability,
- predictability and thus minimized risks, reduced errors,
- reduced transport cost,
- creating new business areas and thus turnover potential,
- increased innovation capability,
- increased agility and flexibility,

in case of new market requirements . As a result Logistics 4.0 plays the same role in managing supply chains as Industry 4.0 for modern manufacturing factories(Oleskowszlapka& Stachowiak, 2019).

According to the previous chapters, it can be seen that the implementation of certain technologies of logistics 4.0, such as virtual and augmented realities, 3D-Printing and simulation, results will all result in opportunities. On the other hand, big dataanalytics, cloud technology, cybersecurity, the IoT, miniaturization of electronics, AIDC, RFID, robotics, drones and nanotechnology, M2M are opportunities for the organizations(Tjahjono, 2017).

With their implementation, the whole supply chain will be affected from a structural and technological perspective, as all supply chain activities undergo a digitalization process. For example, Smart Factories will include intra-logistic processes which support the manufacturing systems with sophisticated applications, such as cyber-physical systems and driverless-transporting-systems execute intra-logistics processes within the manufacturing factory of companies(Pfohl& Yahsi, 2015). At last, we can conclude the importance of the concept logistics 4.0 on the supply chain, the benefits and gains it adds to the entire chain.

Chapter 3:Case Studies of logistics 4.0

For optimizing cost and time, Logistics 4.0 has emerged to improve the performance of all SCM links and ensure that it is always robust and resistant to environmental change. the global supply chain will mature as a vast network of interconnected companies, processes, and data flows that will support new business designs and models (Oleskow-szlapka & Stachowiak, 2019) . Some companies have realized the significant value of this technological revolution and have already begun developing and using it.

In this chapter we will try to show real cases of companies that are struggling in critical cases and complications, they have taken refuge in logistics 4.0 to solve their problems and other ones who have conceived innovation in logistics and are conscious that it is a competitive advantage to improve their performance .

Section 1:Benefits of RFID on supply chain management ;Case (UPMC and Boeing)

1. Overview of UPMC Central Distribution supply Center

The University of Pittsburgh Medical Center (UPMC) is a \$17-billion-dollar healthcare provider and insurer based in Pittsburgh, PA.

UPMC currently operates over 30 hospitals, more than 600 doctors' offices and outpatient centers, has over 4,000 physicians employed, along with a variety of rehabilitation centers, retirement communities, and long-term care facilities. To operate and run all of these locations UPMC needs many supplies and to maintain their operating margins, they need the supplies in the most efficient means.

The goal of UPMC's supply chain is simple: establish the most cost effective and efficient means of supporting UPMC facilities and their patients. Part of this goal includes the utilization of a Centralized Distribution Center. Having a centralized warehouse allows supply chain to purchase products at lower prices by eliminating traditional healthcare distributors.

The distribution center also utilizes Voice Directed Picking which helped them reduce their picking errors by 25%, leaves the pickers hands free for picking and labeling, and is environmentally friendly with the reduction of paper . All of these numbers are for UPMC at its current size but UPMC just bought an additional 18 hospitals from Jamestown, New York to Harrisburg, PA. The addition of these new facilities will mean an increased need to be even more efficient and effective. Part of this would be to explore the option of using RFID technology.

2. Overview of Boeing Factory in Everett, WA

The Boeing Company Factory based in Everett, WA is highly coordinated logistics and manufacturing operation that helps produce commercial and military aircraft for the worldwide aviation market. Boeing products and tailored services include commercial and military aircraft, satellites, weapons, electronic and defense systems, launch systems, advanced information and communication systems, and performance-based logistics and training. Boeing is noted as having the largest manufacturing building in the world .Their manufacturing product facilities employs thousands in aircraft fabrication and production, product development, aviation safety and security and airplane certifications.

There are numerous logistical and transportation needs to build the aircraft. The 747 and 767, the older and original aircraft of this factory, follow a traditional assembly process that combines components such as wings, elevators, rudders, and other parts at one of four stage of assembly. The parts of this aircraft are assembled in a nearby bay which arrives via rail and truck from various U.S. suppliers from across the world.

The 777 and 787 process, mostly in part due to the aircraft being new and one of the first in the world to be designed completely using a computer rather than an actual model, implement just-in-time (JIT) practices for the delivery of the various components and assemble the aircraft on a slow moving assembly line. This process is successful due to a very close and transparent partnership with suppliers from across the world which are engaged to ensure the parts - as large as an aircraft fuselage - arrive exactly when they are required. From this point, each task and step of assembly is precisely timed out for workers to complete in order to maximize productivity. The parts for the workers assembling the various aspects of the aircraft are delivered through mobile robotic carts in the factory which are delivered to the

exact location of the workers as the aircraft assembly line ever so slowly moves. This orchestra of various parts and workers ensure the products are assembled on time as well as uses barcode and RFID technology to ensure products are able to be Tracked and easily moved throughout the factory.



Figure 2: Boeing factory

3. Implications of RFID :

a. Managerial Implications :

For companies such as UPMC and Boeing, which have been reviewed in this section, these two companies operate in two separate industries though hold various applicability of how RFID technology can affect managerial decisions. RFID technology, through its evolution since WWII technology to benefit managers in various types of industries who are looking to quickly, efficiently, and accurately Track the inventory of their product. In particular, companies with large amounts of individual components to complete a service or products, such as UPMC and Boeing respectively, have numerous benefits for managers.

First, the reduction of human errors and implementation of consistency that RFID technology can provide is impactful for managers. RFID allows the constant and consistent flow of information through an established system of transmitters and receivers that is not dependent on humans who may collect information differently. This also ensures that human errors, even by the best of employees, can be reduced and even eliminated.

Secondly, RFID technology allows for the delivery of information and components exactly when it is needed. At the Boeing factory, the right amount and type of components is delivered precisely when workers require the components which reduces errors and ensures maximum efficiency. For a company such as UPMC which is growing the number of

hospitals in their network, RFID can provide the company a consistent source of data collection across a wide range of employees and staff.

Overall implications of RFID technology to manager in supply chain management and to leaders in companies such as UPMC and Boeing is noticeable with the ability to be quantified in time, costs, and efficiency savings. The efficiency of RFID technology to collect this information with reduced errors translates into more accurate information for managers to make decisions at often a much lower potential cost.

A study Wu and Ku (2013) investigated what happens in upstream and downstream firms when RFID technology is brought into the supply chain. They researched a different ways RFID could prove difficult for firms including its effect on operation structure, group cooperation, and influence on issues derived from RFID technology. Although almost all of their findings confirmed that RFID technology has a positive influence on supply chains, there were a couple of negative outcomes. These were mostly around the changes that would take place with the introduction of RFID technology to a firm and the extent of this change is largely unknown.

RFID technology applicability can be applied to an even greater sense at both companies. UPMC for example has a large hospital system with multiple staff members covering a wide variety of shifts at the hospital. This dynamic in the healthcare industry is also more complex with all the various supplies and tools needed to treat patients in a hospital. While much of the supplies are Tracked with bar codes today, RFID tags can help to collect data and perform an inventory in real time. This inventory can be more easily known as needed as well as Tracked through its usage throughout a time period to better predict when supplies or tools may be needed for predictable procedures or treatments.

UPMC as a result can better predict when a supply may be needed and can also reduce storage space in a hospital. In turn, Boeing Company is moving more towards RFID technology from the bar coded technology that was historically used at the factory. Boeing today uses the RFID chips to Track and guide the movement of robots with the components for their aircraft.

However, for Boeing their use can also be far greater by being able to integrate RFID technology not only in the logistical process to assemble the aircraft but also in the actual maintenance of an aircraft. For example, safety checks for inspections of aircraft can be more efficient and accurate if RFID technology could be implemented to monitoring the existing systems of their aircraft. Mechanics could then know precisely where to look onboard an

aircraft with this more accurate information to better maintain their fleet. While RFID technology at Boeing cannot fully take the place of a human inspection, it can help to ensure the accuracy and speed at to which inspections could occur. For companies such as UPMC and Boeing, surveying the work force that interacts with these components and the management can be an important step to understand the potential impact and scope of RFID technology at both these companies.

b. General Conclusions and Implications :

RFID technology has demonstrated its ability to evolve into a logistics solution since its inception in the 1900's. As technology has improved by becoming less expensive on a per chip basis and through a much smaller size, RFID technology is a competitive advantage for managers involved in supply chain management. Various aspects of the supply chain process are now able to be more accurately and easily Tracked based upon their location and the data associated with the chip rather than through line of sight technology that exists through bar code technology. Managers can now be empowered with time and a constant flow of data that allows them to make fact based decisions and projections which have helped to save time and money through efficiency for their companies. Companies such as Boeing are demonstrating the existing potential of RFID technology while companies such as UPMC can take RFID technology the next level by Tracking thousands of supplies that exist in a hospital.

As with any technology, there is an investment that is required to implement RFID technology. While this group recognizes the benefit of RFID technology, performing a case study on individual companies to understand the cost-benefit of this technology is important. Additionally, completing a detailed survey of UPMC and Boeing is a key aspect of future work that would allow for a strong understanding of RFID at each of the companies. Overall, the benefits of RFID technology are likely to improve as the technology for transmitting and receiving devices continues to be more cost efficient and widely implemented in the supply chain management system.

Section2:Kiva Robots : Amazon

1. Overview of ROBOT KIVA:

Automating warehouses and picking with the use of robots is not that easy. It is not easy as such and has not been easy from the perspective of organizations that looked for a solution to do it. Regarding the latter, we must mention Amazon. When the company looked at ways to further enhance the operational efficiency of its distribution centers, Amazon found a solution with Kiva Systems, a provider of mobile robotic fulfilment systems.

Those are Kiva robots, once the marvel of warehouses everywhere. Amazon whipped out its wallet and threw down \$775 million to purchase these robot legions in 2012. The acquisition effectively gave Jeff Bezos, its 52-year-old chief executive, command of an entire industry. He decided to use the robots for Amazon and Amazon alone, ending the sale of Kiva's products to warehouse operators and retailers that had come to rely on them. As contracts expired, they had to find other options to keep up with an ever-increasing consumer need for speed. The only problem was that there were no other options. Kiva was pretty much it (*AIW Lecture 3 handouts (combined).pdf*, n.d.)

2. Design of Amazon Robotics

Amazon Robotics is designed for the sake of meeting growing consumer demands in e-commerce by using a better system to provide order fulfillment solutions. Most advanced robotic technology is used to achieve highly automated distribution center operations. These methods includes autonomous mobile robots, sophisticated control software, language perception, power management, computer vision, depth sensing, machine learning, object recognition, and semantic understanding of commands. (Li, 2016).

In particular, a complete robotic picking system consists of three parts:

- a) The Back End Workstation System: the best route of picking is automatically planned when the order information arrives to autonomous mobile robots and then the most appropriate picking station is automatically searched, in the same time, the order processing sequence is also calculated automatically; afterwards, adequately scheduling and dispatching robot resource becomes a notable feature to make a plurality of robots running at the same time work in an orderly space and try to avoid the queues, cross-collision and other conditions, while the charging time is scheduled according to assignments of each robot

- b) The High-Speed Mobile Communication System: The high-speed mobile communication system is used to guarantee stable wireless network in the warehouse and to avoid the “offline hour” during the picking work.
- c) Autonomous Mobile Robots It is generally believed that the height form factor is an important factor to consider in the design of robots. Robots is considered that it would run more stable if it was designed shortly, as a result, Kiva robots are 40cm high.

1. The solution of Robot Kiva

In the Kiva Systems robotic warehousing solution, a central computer system controls an army of robots that do all the heavy lifting of retrieving and bringing the stock to the workstation where a “pick worker” can put the correct item into a box. Through the technology, robotic equipment can sense and adapt to location as well as position information. In particular, QR-code stickers allow them to “see” where they are and where is space to travel so as not to ram into other robots or pods, which are constantly changing position—thereby interacting autonomously with the warehouse environment. Moreover, robots travel in the most efficient way possible, whether it is underneath a row of untouched pods or detouring slightly to allow another pod to pass. They keep each operator operating at a sustained rate of one new pick face location every 6 seconds, which means no one operator is over burdened nor the other experiencing intervals of down time. They know not to line up too-many-at-atime at a station and also understand when to allocate more work to faster

workers.



Figure 3:Kiva in warehouse

Figure 5:Surface image of Kiva

Figure 4 : Kiva Robot

Section 3:KUKARobots :

1. Overview of KUKA Robotic:

KUKA Robotics, one of the providers of automation technology has been able to incorporate several Industry 4.0 technologies in their own production. One firm, which has come a long way in terms of data management in the industry, is KUKA. They do not only see its production as Industry 4.0-ready, as they are already building the applications within Industry 4.0. The next step in technological advancement for the firm is collecting the data to a local cloud and managing it in order to create value. Another future challenge for KUKA is building an infrastructure, which has the ability to manage robots to a greater extent; building a digital HR-department where robots are programmed, trained and assigned. However, they believe that no firm has come to this point yet.

Within The Tool Company examples of machine-to-machine communication have been identified to some extent, for example among advanced industrial robot manufacturers in Europe, as can be seen in the case where KUKA Robotics solutions for the connected plant are described. There is a trend towards more wireless tools, and in the future, there will probably be fewer or even no controllers, each tool will have its own display instead.

2. Functioning of KUKA robots :

A machine-to-machine interface within KUKA is used to replenish parts to the assembly of the robots; A mobile IIWA-robot (Intelligent Industrial Work Assistant) is connected to the business system as well as the material handling system, this robot can be seen in figure . Using information from this system, the IIWA-robot can collect and deliver parts to the right workstation. The technological challenges in implementing these systems are close to none since possibilities with subnets and multiple IP-addresses reduces the technical limitations. On the software side, KUKA is planning to deploy its own software for robotics and process management called Sunrise. The platform enables internal communication between the robots within the same cluster of processors in the software. This software can be considered a kinematic solution for connecting several types of robots, not just collaborative ones.

Human-machine-interface solutions are developed and used in the automation industry, especially by KUKA Robotics, as they are providers of such solutions. As for their production, KUKA has the opportunity to test their products in their own assembly. They use the IIWAtechnology in combination with operators internally in order to build new robots.

IIWA is a lightweight collaborative robot that assists operators in various production contexts. The robot requires no safety fences when working alongside humans and has the ability to learn and take notice from the operator using sensitive technology (KUKA Robotics, 2015). In addition, the IIWA is able to document and check its result continuously. The robot can be customized with one to five individual arms depending on which operation in the production is being performed.

3. Benefits of using KUKA Robotic

To summarize the automotive industry has relied upon robotics and automation for over 30 years, and today, 75% of a car is manufactured by the components industry. As the industry grows, develops, and advances, so does the profitability and usage of robotics. KUKA robots are some of the most innovative, powerful, and precise machines available and have the capacity for a wide range of task performances like welding, foundry operations, laser applications, and palletizing.

Advantages of KUKA Robotics in Automotive Supply and Manufacturing:

- Reduced Need for Reworking
- Multi-Task Performance
- User-Friendly Control Technology
- Executes Dangerous Tasks Easily
- High Processing Flexibility

The case studies above showed the importance of logistics 4.0 and its innovations in the supply chain, the benefits of RFID on Beoing and UPMC and the change it has brought, and also the added value of Amazon's Kiva robots

In conclusion of this chapter we can say that logistics 4.0 brings a huge gain for the whole supply chain in real terms thanks to its minimization of risks, optimization of time and costs and improvement of flexibility.

Conclusion

In this project, we tried to give a global presentation of Industry and Logistics 4.0 encompasses a range of technical components such as Cyber-physical systems, which include RFID systems, software and the database. During these Cyber-physical systems can be collected, analysed and shared essential information about the product with the Internet as a means of communication.

We can conclude that Logistics 4.0 is a broad term that can be summarized as logistics and supply chain processes supported by intelligent sensors (RFID systems), embedded software and databases from which relevant information is provided and shared.

Today's technology like big data, cloud computing, and the Internet of Things (IoT) is driving this new industry. It promises to make production faster, create better profit margins, and give companies a competitive advantage in an increasingly competitive environment.

It is going to take the manufacturing automation to the next level. Business models will be impacted, redefined, and new ones will be created. Machine safety will increase and risks to worker will decrease. It will touch the world. With regard to intralogistics, the integration of autonomous technologies such as automatic driving or drones and intelligent systems that RFID systems will mean a way of optimize logistics processes and facilitate human work.

These technologies are not intended to replace humans in their work with machines or result in job losses; they aim to serve the human, improve the quality of work and provide safer jobs.

The concept of logistics 4.0 has been described in this rapport. This involves software applications, Internet platforms and sensors installed in the plant's facilities. All that means a high investment, so future work would be the feasibility study in a real environment for the implementation of integrated RFID intelligent systems to manage logistics processes.

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