4.5 RESEARCH PAPER - INDUSTRY 4.0

Final Research Paper - Industry 4.0

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INTRODUCTION

Industry 4.0 represents a transformative manufacturing and production shift driven by automation, data exchange, and smart technologies. Industry 4.0 is about collecting data and transforming the data into informative statistics for the user. The data can be gathered from the environment, people, processes, services, machines, systems, etc. Then, analyze, interpret, optimize, leverage, and compute the collected data to provide business development, future prediction, problem diagnosis, monitoring process, expansion planning, innovating, and prototyping the solutions that can boost productivity immediately, solving the problem promptly and quick planning for the next day. Industry 4.0 is collecting the data, understanding the data, and telling you what you need to do next. Industry 4.0 is about big data, emphasizing digital technology with the help of interconnectivity between each device through IoT. So that the user is allowed to access real-time data and do analysis for the next plan.

WHAT IS INDUSTRY 4.0?

Industry 4.0 is called a new revolution combining advanced production and operations techniques that with smart technologies will be integrated into organizations, people, and assets.

This revolution is marked by the emergence of new technologies such as robotics, analytics, artificial intelligence, cognitive technologies, nanotechnology, and the Internet of Things (IoT), among others. Organizations must identify the technologies that best meet their needs to invest in them. Some companies still do not understand the changes and opportunities that Industry 4.0 could bring, and they don’t risk losing market share.

For traditional leaders, accustomed to linear data and communications, the change that this new industrial revolution represents - providing real-time access to data and business intelligence - will transform the way they conduct business. The digital integration of information from different sources and locations allows business to be conducted in a continuous cycle. Throughout this cycle, real-time access to

information is driven by the continuous, cyclical flow of information and actions between the physical and digital worlds. This flow takes place through a series of iterative steps known as PDP – physical-to-digital-to-physical:

Physical to digital. Information is captured from the physical world and a digital record of it is created.

Digital to digital. In this step, information is shared and interpreted using advanced analytics, scenario analysis, and artificial intelligence to uncover relevant insights.

Digital to physical. Algorithms are applied to translate decisions from the digital world into effective data, spurring action and change in the physical world.

It's History?

The history comes through the Industrial Revolution that occurred in Great Britain in the 8th century, and the invention of new machines that did tasks previously done by people, it has achieved the growth of loans and expansion of banking, large-scale industrial production, concentration of capital, division of labor, increased productivity, use of new technologies, etc. The biggest significant change in the industry is the transformations it has undergone, from Industry 1.0 to Industry 4.0. They have the notion that we are in Industry 4.0, but they still do not know how they reached this stage or everything that had to be carried out. Throughout history, there have been several industrial revolutions that have brought about not only changes in industrial processes but also social, economic, and technological ones.

The first Industrial Revolution, which began in the second half of the 18th century in the United Kingdom with the appearance of the steam engine, was the greatest economic, social, and technological transformation since the Neolithic. The incorporation of machines into

production processes allowed for more and faster production, multiplying per capita income and GDP.

New sources of energy such as gas, oil, and mainly electricity gave rise to what was called the Second Industrial Revolution in the mid-19th century. This was the era of mass production, new materials, new transport systems the plane and the car, and new communication systems, with the appearance of the telephone and the radio. These advances caused a profound change in the economy, which was increasingly internationalized and globalized.

The third industrial revolution is a more recent concept, coined in 2006 and focused on changes resulting from the use of renewable energy, the automation of processes, and the use of the Internet.

There are many names given to the Fourth Industrial Revolution that we are currently experiencing: Industry 4.0, Connected Industry 4.0, smart industry, cyber-industry of the future, Industrial Internet of Things, etc. As in the three previous revolutions, this new revolution is based on the application of new technologies to industrial processes, both at the machinery and production level and throughout the entire value chain of the industrial process.

WHAT KEY TECHNOLOGIES ARE TRANSFORMING PRODUCTION?

These are some key technologies that are transforming production. They are the principal ones transforming the 4.0 Industry.

Artificial Intelligence, Which AI is used to analyze large amounts of data and make intelligent decisions in real-time. AI helps to improve production efficiency, product quality, and predictive maintenance.

Internet of Things, IoT allows sensors and devices to be connected to the Internet, allowing real-time data to be collected on the status of equipment and production processes.

Cloud Computing, Cloud computing provides a platform for storing and processing large amounts of data. This data can be used to train AI models, run simulations, and analyze historical data.

Robotics, Robots are used to automate repetitive and dangerous tasks, which can improve safety and productivity.

3D Printing, 3D printing will allow complex and customized parts to be manufactured quickly and efficiently.

WHAT ARE CYBER-PHYSICAL SYSTEMS (CPS)?

CPS security uses the term of combination in computer-based algorithms in the cyber part and physical processes or components in the physical part this is to perform a task or solve a problem in the real world or time.

CPS security enables computer-based intelligence with the physical world to monitor, control, and optimize processes. Common across various industries and applications, cyber-physical systems play a crucial role in improving efficiency, automation, and connectivity in daily lives and industries.

CLOUD TECHNOLOGY IS AN ENABLER OF INDUSTRY 4.0. WHY AND HOW?

Cloud computing is not a final solution, but an enabler to implement other solutions that would previously require a large computing capacity. Nowadays, cloud services are presented as infrastructure, platforms, and services. The manufacturing sector can then opt for a specific solution and plan the migration in stages. This allows cloud services to be a flexible, convenient, and even customized option.

The cloud allows the synchronization and centralization of data with multiple sources, allowing decision-makers to be freed from the tedious work of manually transferring data from one system to another. Since industries, especially manufacturing 4.0, are moving towards automation in monitoring and controlling plant processes, it is

essential to ensure that data is the same from all sources. Cloud computing helps synchronize this information, defining a single point as the source of information and allowing access through the Internet.

WHAT INDUSTRIES ARE USING INDUSTRY 4.0 CONCEPTS TODAY?

Industries are adopting Industry 4.0 concepts for better productivity and efficiency every day more. These will make companies have a new modern innovation. Some of the new sectors include manufacturing, Healthcare, utility companies, Automotive, Pharmaceuticals, agriculture, Construction, Supply Chain, and many more. These companies adopting Industry 4.0 have seen an increase in their production and operations with better performance. They also mention that with 4.0, they have been able to meet deadlines on time, and they have seen a growth in demand, increasing their popularity. These make them stay competitive way in the global market.

CONCLUSION

Thanks to the innovations that Industry 4.0 offers, it is possible to adapt and learn from data in real time. Thanks to this, companies are more likely to be proactive, responsive, and, above all, predictive. Likewise, it also allows organizations to reduce risks within their operations. From each person's perspective, Industry 4.0 can represent different things. For a company's staff, it can mean a series of operational changes that they will carry out in their jobs. However, for customers, it could mean more personalized attention to the products and services they will receive from the company. Also called smart industry, this new concept predicts a future in which companies integrate the physical and virtual world until they unify into one. In this system, machines will constantly exchange information with the supply chain and processes can be automatically optimized.

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