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Role of Industry 4.0 in Process Strategy

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ABSTRACT: As know Germany is one of the country who introducing the industry 4.0. from this paper, it discussing the relation of process strategy in Industry 4.0. In design process, nine technology introduce by 4.0 helping in increase product of manufacture, economy of shift, industrial growth of foster, and increase the company production. This article created in hope the worker in industrial also student can know more about new technologies existing in industrial world and make improvement in future.

Keywords: Industry 4.0, Process, Technology advancement;

INTRODUCTION

In 1760, our present progress began gargantuan change in manufacturing which highlight the change of handcrafted products to utilizing machines. This change which remains for the most part known as the first Industrial Revolution, will in the long run bring around humankind towards the age modernization. From that point forward, we have touched base at what is considered as the fourth Industrial Revolution or most commonly recognized as Industry 4.0. The third Industrial Revolution introduce the dawn of computers and the inaugurations of automation, when robots and instruments started to supplant human workforces on those mechanical production systems. While the Industry 4.0 buildup absorptions of computers and automation completely, with mechanical technology connected remotely to computers sustained with machine learning algorithms that can learn and govern robotics with almost no contribution from human operators. Presumably, one of the key stakeholder in an organization that is influenced the most by Industry 4.0 are operation managers.

Operations managers are secondary stakeholders in an organization that focuses on overseeing multiple business affairs that will ultimately leads to productions of good or services in an optimum fashion and according to Heizer, Render and Munson, one of the key areas that is thoroughly looked at by operation managers are process strategies. Process strategies are approaches by an organization to transform resources into goods and services. The aim is to establish process that can deliver outcomes that meet clients' prerequisites within cost and other administrative limitations. Generally, organizations have will select variation of the respective process strategies which range from process focus, repetitive focus, product focus or mass customization and these decisions will have a long haul impact on proficiency and flexibility of production. [1]

1. INDUSTRY 4.0

As known, the industry 4.0 is about the use of digital technology in make the manufacturing more agile, flexible and responsive to customer. Now the creating of a smart factory in order have

internet, wireless sensors, software and other advance technology working together to reduce the complication in production process and improve the customer satisfactions [18].

2. THE REVOLUTION OF INDUSTRIAL

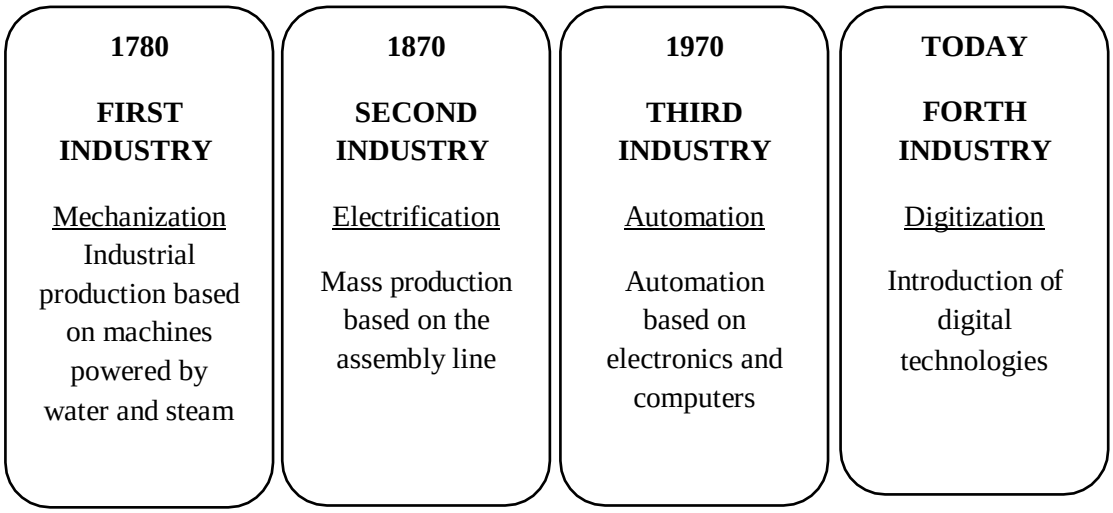

Figure 1: the revolution of industrial [18]

In Figure 1 showed the revolution of industrial from the manual work to right now which using all digitalized technology in industry 4.0. The first industrial, starting with mechanization and mechanical power generation. The changes from manual work to the manufacturing process at textile enterprise. An advanced first-rate of existence changed into a major motive force of the trade.

Then, in second industry the electrification has been introduced in industrial and mass production. The Henry said, 'you can have any color as long as it is black' which tell about mass product introduction without the possibility of quality product.

Meanwhile, third industrial revolution is introduction of microelectronics and automation. The flexible production facilitated in manufacturing, where machine make manufacturing product is variety and flexible in production line but in aspect of production quality still not flexible.

Now our industry was showed with revolution of forth industry which about the Information and Communications Technologies (ICT). This industry is introducing the used of smart automation of cyber-physical technology in basic technology in focused at control and advance connectivity. This new technology change the industrial production system from classical system to self-organizing system which helping in flexible mass, customization of production and quality of product in flexible [19].

3. RELATION TO PROCESS STRATEGY

In industry, the process strategies is important in helping managers during decision making to find the best way to produce the product so the planet's resources will not easy waste. The design process is a approach of organization to change the resources into good and services. The reasons to assemble the good and services friendly to environment that could be delivered in right manner. The objective is to create a process which can produce product or services which meets with customers' requirement within cost and managerial constraint. Forth industry, by introduced digital industrial technology, it lead the increasing of industry production. The nine technology advancement by forth

industry making the production in industry increase, economies changes, rise the growth of industrial, and change the labor force in order to change the competition of company.

3.1 Nine Technology Advancement by Industry 4.0.

The introducing the technology advancement in industrial production, change the production by gather the cells as a integrated, optimized and automated the flow of production and focus in greater changing old production between the supplier, producer and customer in order of human and machine .

3.1.1 Big data and analytics

Big data and analytics allow in access of data from different sources and customer to support during decision making, rearrange the quality of product energy saving, and making improvement in aspect of equipment services (Kamarul B., Othman, Nor A. and Talib 2016). Under Industry 4.0, big data analytics is useful in for industrial technology development. By developed a big data analytics solution with able the learning capability which help in assist the manufacturer in maintaining the control of operation management also product efficiency. An advanced machine learning algorithm analyzes accumulate the data collected to order the warning for oddity and failure at system for maintain the quality of product.

Example in smart manufacturing system are produced many data and combined the data from the interconnected system which located in several layer and domain. By used the big data analytic, showing the information of changing big amount of data in decision support. Other that, let the observation to saw the pattern changes for simple monitoring anomalies. Then, increase the system visibility and it very useful during prediction of problem. [20].

3.1.2 Autonomous Robots

The manufacturers already use robot long time ago to handle difficult works and by robots make it easier to handle. Besides, the used of robots becomes more flexible cooperative and more autonomous. Then, they connection each other and work safely along together with humans as well learn from them. The used of robots will helps in cut the cost and increasing the capabilities of production of product in industrial [21].

An industry 4.0 produced the autonomous product method which helps to complete the task by robots which focused on safety, flexibility, versatility and collaboration. The integration into human workplaces becomes more economic and productive without need to isolate the working area, and more application opened in industry. The more industrial robot involve, the easier the industrial revolution. So in industry 4.0, robots and human will work together by link task and using smart sensor human-machine interfaces. From what can see, the used of robots was widely used in various function such as production, logistics, and office management to distribute the document and the can control it from far. If anything happened they human can receive message from his hand phone which connected with webcam so he can see and detect the problem and give the instruction to ensure the work is proceed till he comes back on tomorrow. So, the plant and machine will continues operate 24 hours and used worker only in a day. For example in European they offer an autonomous robots which can interact in one another. The robots interconnected for ensure they can work together and automatically in order to similar their action to fit with unfinished product in line. The collaboration with human by high sensor and control units. Same goes to industrial robot supplier ABB, by producing robots called Yumi which designed to help assemble the product along with human for the safety recognition.

3.1.3 Stimulation

As stated in article [21], the 3-d stimulation of product, material and production process used already in engineering phase but in future the stimulation more widen their function in plant operation. The stimulation will use data to show the physical world in virtual model which consist of machine, product and human. The operator is allow in making test to rearrange the setting of machine for next of product line in before physical changer which let down setup times of machine and increasing of quality.

3.1.4 Internet of things (IoT)

In article [22] stated, IoT may even enhance more devices with driven in computing and may be interconnected using trendy technology. This lets in area tools to talk and have each other and with an extra centralized controller, as required. It additionally decentralizes analytics and decision making, permitting actual-time responses.

Today, some driven the computing in sensor and machine. They're generally prepared in a vertical automation pyramid in which sensors and equipment with restricted intelligence and automation controllers feed into an main production-procedure manipulate system. By the commercial IoT, more gadgets from time to time consisting of even unfinished merchandise can be enriched with driven in computing and related the use of standard technology. This permits subject devices to talk and engage each with each other and with centralized controllers, as essential. It also decentralizes analytics and decision of making, allowing real-time of responses.

The Bosch Rexroth, control device dealer, equipped a manufacturing facility for valves with a decentralized production process. The products are diagnosed by radio frequency identity codes, and computers "recognize" which production steps need to be carried out for each product and can adjust to show the particular operation [21].

3.1.5 Cloud Computing

As all advancements, cloud computing technology has a few highlights which decide its function. These features are fundamentally, storage over internet, service over Internet, applications over internet and energy efficiency [3].

Storage over internet is employed through storage over Internet Protocol (SoIP) technology. With the mix of preeminent storage and networking industry best practices, SoIP gives efficient and flexible IP storage solutions. While the principle target of Service over Internet is to be resolved to help clients everywhere throughout the world keeping in mind the end goal to change desirables into accomplishments by outfitting the internet's proficiency, speed and omnipresence. Additionally, Application over internet are applications composed to carry out the activity of a present manual errand, or basically anything, and which play out their activity over the cloud by means of a web association instead of the traditional model of an application that must be introduced and keep running on a local computer are the Cloud Applications and finally cloud computing manages energy more efficiently because of the fact that it can convey more services for a similar energy input than a traditional local server [3].

Cloud-based solutions offer manufacturers an extensive variety of advantages, among the most noteworthy of which are adaptability, operational efficiency, application and partner integration, information storage, analytics and improved security. Specifically, cloud computing encourages research, design, and advancement of new products, which powers innovation, decreases product development cost, and agility to market [4]. Additionally, cloud-based systems can be scaled up or down to oversee fickle workloads, a particularly vital advantage for manufacturing firms [5].

3.1.6 Cyber-Physical Systems

Cyber-Physical Systems (CPS) is defined as transformative advancements for overseeing interconnected systems between its physical resources and computers. It has the ability to perform straightforward decisions on its own. Technology such as IoT, Smart Factory and Cyber-Physical Systems have the capability to perform decentralize decision-making [6].

Executing cyber-physical systems in the present industrial facilities offers a few points of interest that can be ordered in three phases of segment. Given that a production line comprises of a various measure of machines, the upsides of a cyber-physical systems empowered organization. At the component stage, once the data from essential components has been transformed into information, a digital twin of every components will be in charge of capturing time machine records and integrating future steps to give self-awareness and self-prediction. At the following stage, further developed machine information, would be gathered to observe the status and produce digital twin of every specific machine. These digital twins in cyber-physical systems give the extra self- comparison ability. Advanced to the stage three (production system), accumulated knowledge gives self-configurability and self-maintainability to the plant. The level of information not just ensures straightforward and close to zero downtime generation, yet additionally gives improved creation arranging and stock administration gets ready for industrial facility administration [7].

3.1.7 Augmented Reality

Augmented reality is the way or a technology to provide a composite view to user's view of physical and real-world environment. The composite view contains various computer-generated data or information that superimposed to user's physical and real-world view. The computer-generated data or information can be constructive where the data is additive in nature to the physical and real-world or destructive in nature where the data is masking the physical and real-world environment. The data is recorded with the physical and real-world environment multi-dimensionally to such an extent that it is observed as an immersive aspect of the real environment [8].

An augmented reality is not to be confused with virtual reality where augmented reality alters user's view of the physical and real-world environment while virtual reality replaces user's view of physical and real-world environment with a simulated world [9].

With regard to Industry 4.0, [10] stated that the augmented reality technology can be applied to remotely connect between a skilled human operator in a control room with a human operator which located where the maintenance task has to be performed and requires expert assistance. Some failures cannot be predicted and need some in-depth analysis which only an expert maintenance operator can perform the repair. The problem intervention can be expensive where the expert maintenance need to travel to the location where the repair need to be done. Local maintenance human operator may attempt to resolve the problem by communicating with maintenance expert human operator using multimedia support such as video call, voice call, text messages and picture sending. With the application of augmented reality technology, an specialist operator may instruct local human operator by instructing maintenance recommendations through symbols and text projected to the real environment.

According to article [11] suggested that augmented reality technology allows an efficient training for maintenance and assembly personnel where the application of AR technology would accelerate the technicians' skills acquisition regarding maintenance procedures. The technology would also enable the novice technician be familiar with the real working environment for both job task training and guidance [1].

3.1.8 Additive Manufacturing

Additive manufacturing is a technology of manufacturing methods where the end product is made by the addition of materials, layer by layer. The process is much like 3D-printing where a three-dimensional object from computer-aided design (CAD) model or additive manufacturing file (AMF) which normally associated with polymer technologies and machines low-end in price and capabilities. Additive manufacturing can be described as the industrial version of 3D-printing where more complex parts or design with metal alloys as the materials can be produced.

The additive manufacturing approach have taken the manufacturing process to the next level since it offers the possibility of manufacturing any difficult geometric parts without using additional tools or machines [12]. Additive manufacturing is one of the fundamental parts of Industry 4.0 because of the need for mass customization where the physical part of the smart factory is restricted by the capacity of the current manufacturing processes [13]. This manufacturing capability enable individualization of mass-produced products and the production of small batches without impairing productivity or availability which has been a genuine challenge before [14].

3.1.8 Horizontal and Vertical Integration

Horizontal and vertical integration share the same purpose despite the fact that there are different aspects to look into between the two. The common purpose of horizontal and vertical integration refers to automated supply and value chain through ecosystem-wide data information between various systems and processes.

Horizontal integration refers to the digitization or integration of information technology systems of the various production and business planning processes. The integration is integrated via a network of global value chain networks which include business partners, supplier and vendors, customers and other external stakeholders. The integration enables processes to be transparent and flexible and allows dynamic process chains like quality or risk in real time. Organization should both contend and participate with numerous other related organization to form an efficient ecosystem through the flow of for example material and finance information among these corporations [15].

Vertical integration refers to the digitization or integration of information technology systems at various hierarchical production and manufacturing levels into one extensive solution. These progressive level are respectively the field level which interface the production procedure via sensors and actuators, the control level that regulates both machines and computers, the actual production line level which requires monitoring and regulation, the operations level which involves production planning and quality management and the enterprise planning level comprise of order management and order processing [15]. In simple words, vertical integration is the integration of information technology systems between shop floor and top floor.

4. CONCLUSION

The traditional role of operation management have been always about cost factor and how to manage them but the role now have been evolved to value management [16]. Companies will always try to keep the cost to the minimum level or sell goods with differentiated features. In Industry 4.0, the challenge faced by operation managers with regard to process strategies has been taken to the next level of complexity and revolutionary approach of manufacturing techniques. Adaptation of the 9 pillars of technology advancement requires thorough assessment and decision making by operation managers to guarantee smooth transition of the process strategies. Lastly both strategic and technological perspectives, the Industry 4.0 roadmap show every further step on the route towards an entirely digital enterprise. So. For achieve success in the digital transformation process, it is necessary to prepare the technology roadmap in the most accurate way [17]).

5. Contribution Note

This work was a MBA class project. The first 3 authors wrote this work; Dr Shahryar was lecturer of the course who taught and advice the topic.

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