A Conceptual Model on People Approach and Smart Manufacturing

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***Abstract*— The purpose of this study is to emphasize the important role of people approach in the revolution of smart manufacturing and industry 4.0. Two hundred years ago, industrial revolution in the West transformed or evolved from water-driven or water-driven mechanical production, and to date, we are in an era characterized by cyber-physical systems. This transformation or industrial revolution was driven by people who used creative minds to solve problems. Rapid development of technology has brought about many disruptive technologies such as big data, artificial intelligence and cloud computing. These technologies are penetrating almost in all industries include manufacturing industry. The fusion of these state-of-the-art technologies and manufacturing brings together the physical and virtual worlds through Cyber-Physical System (CPS), which marks the advent of the fourth stage of industrial production – Industry 4.0.**

Keywords- *Cyber Physical System, Industry 4.0, Human Factor, Smart Manufacturing, Cloud Computing*

1. Introduction

The chapter is structured as follows: first, an overview of the smart manufacturing and industry 4.0 revolution, followed by the future skills required by human capital, the conceptual model for the smart manufacturing and industry 4.0 revolution, and the conclusion of the smart manufacturing and industry 4.0 revolution.

1.1. A Summary of Smart Manufacturing and Industry 4.0 Revolution

The industry have to admit that, to move in line with industrial revolution 4.0, we have to aware, ready and implement the change management in the organization. Also, to make the industrial revolution move forward, we have to know the key component in the industrial revolution 4.0 which lead to the successful of the phenomenon. One of the key component in the IR4.0 is a smart manufacturing (SM). Smart manufacturing is the integration of the technology that can increase the production and decrease the cost of production using very innovative machine. It is connected with the aid of sensors and RFID chips that make the technology more sophisticated. For instance, in smart manufacturing, all the product, transport option and tools interact with each other and will organized with the goal of improving the overall production. So that, it can reduce the cost of production and also workforce.

Besides that, intensified market competition and rapid demand changes have forced companies to adapt advanced technologies to improve smart manufacturing. Industry 4.0 is the current trend in automation and data exchange in production technology. Advanced technologies have obviously led to a competitive advantage in the performance of the individual company.

The revolution of Smart Manufacturing and Industry 4.0 is characterized by Mobile, Cloud, Big Data Analytics, Machine-to-Machine (M2M), Man to Machine Interactions (M2MI), 3D Printing, Robotics and much more, requiring organizations with special expertise. It is also said that the Industry 4.0 revolution goes much further than these. Cyber-Physical Systems (CPS) digital networks are simple physical objects with embedded software and computer power. In the Smart Manufacturing and Industry 4.0 revolution, smart products and cyber-physical systems (CPS) are expected to be more manufactured products. This is based on connectivity and computational power, which leads to self - management. Today, most production equipment is transformed into Cyber-Physical Production Systems (CPPS), which is enhanced software machinery. This equipment has its own computer power, which capitalizes on a wide range of integrated sensors and actuators beyond connectivity and processing power. The CPPS acts and knows its status, capabilities and various configuration options and can take decisions

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independently, just like people. This gives way to a mass production, which at the end of the supply chain gives mass customization to each product. The mass customization guarantees unique features as defined by the end customer. The feature of the Smart Manufacturing and Industry 4.0 supply chain is highly visible, fully integrated and the physical flows are continuously charted on digital platforms. This makes individual CPPS services available to carry out the activities required to make each customized product [1].

According to ref. [1], in Smart Manufacturing and Industry 4.0, learning organizations are an indispensable way to educate students and professionals about the practical application of the principles and concepts of production management. In recent decades, lean management as a learning topic has clearly dominated the scene. However, the current and future production situations in the sense of the Smart Manufacturing and Industry 4.0 revolution also need to address other skills in order to enable managers and employees of organizations today to deal with the challenges of an increasingly digitized production system. In the other hand, human skills also give a big impact to the smart manufacturing and Industry 4.0 because the industry won't depend on the machines hundred percent to runs the business, they still need the high skill workforce to handle and control all the machines.

1.2. Current challenges

In current manufacturing system still using traditional machinery instead of advanced technology to accomplish the various of processes according to planned production logics. Therefore, the business cannot cater the demand from the clients. Several challenges rise under this mechanism. One of the challenges is an inefficient production due to working efficiency is low because all the operation line and execution on shop floors are time-consuming when they are using large amount of workforce. For example, all these ground workforce are usually make a meeting to get solution for any problem happened in their production and this thing will take long time to share the idea and information to fix all the thing. Besides that, at present, manufacturing companies face challenges in visualizing and displaying different production services. In Industry 4.0, the visibility of information plays an important role in the precise decision making. At the moment, the implementation of manufacturing virtualization and visualization has several challenges. First of all, manufacturing objects should be viewed in real time to guarantee the quality and safety of production. Unfortunately, the CCTV system is only the options that cannot reflect a work machine's status. In addition, the production of resources should be virtualized into different services so that they can be shared as a service. Virtualized approaches and models of sharing are rarely reported and investigated. Finally, the visibility of various manufacturing objects requires a new modelling approach for data that can combine heterogeneous data in a standardized format. Such data can then be displayed to various end users concerned about the different visibility of different equipment. Due to this challenges, the researcher proposed the new model for this study.

1.3. People approach in smart manufacturing

In today business, people approach is considered crucial for the success of the organization. People who have education, experience and knowledge will give a big contribution to the smart manufacturing and Industry 4.0 implementation in the organization because it will determine the organization to achieve success in this competitive world. However, theory of human capital considers that knowledge brings greater cognitive skills to individuals and thus impels their productivity and efficiency to develop activities.

According to ref. [2], when we talk about smart manufacturing and Industry 4.0, we just think about implementation of technologies like internet of things (IoT), cloud computing, artificial intelligence, and 3D printing. Contrary to what we might think, however, Industry 4.0 is not intended to replace people, but to help them function more effectively. Without a good cooperation between people and machines, a successful digital transformation will not be possible. The role of people in the usage of technology very important to ensure everything are smooth because technology alone will not enable transformation. Besides that, it is very important for workforce to have the ability to understand the function of new technology in order to optimize the benefits. For

example, the database from a simple Excel file can be extract and upload to big data analytics server. This could provide new service and solutions for their customers. However, if they are implemented without the right knowledge, the technologies may only provide unusable amount of data. So that, to maximize the implementation of new technology, the manufacturing have to hired the right people who got the high of skill to handle this kind of situation. Here, we can say that, the ingredient for success are the right collaboration between humans and machines.

Besides, the employee participation is very important in the production processes because totally it will affect the business itself. So, the people approach in this activities can be considered as a compulsory to ensure the collaboration is in line with the organization's goal.it is good when all employees feel involved in the implementation of transformation projects and understand their place in the company's vision.

2. Review Related Literature

2.1. Capability to implement Smart Manufacturing

Smart manufacturing refers to a highly productive production environment for connected and intelligent machinery and materials with minimized waste, defects and downtime [3]. Process efficiency is optimized in this environment through machinery and equipment automation and self-optimization. In fact, Smart Factory is a dynamic integrated cyber-physical-human manufacturing system in which physical resources are used as intelligent communications and human resources through industrial internet of things (IIoT) and internet of people (IoP) and web of things (WoT) infrastructures [4]. Many manufacturing industry are researching about this topic, however the achievement criteria of IR4.0 are as yet uncertain [5]. So, this paper will examine the factors involve in implementation of smart manufacturing in food industry that can fulfill criteria of IR4.0 such as human skills, knowledge sharing and transformational leadership.

2.2. Human skills

Development of programs for upgrading skills and training for employees of service companies taking into account the characteristics of their work activities [6]. Human skill very important to ensure the implementation of smart manufacturing success. But, as highlighted in [7], workforce qualification strategies are required in handling manufacturing system grow and the gap analysis between previous studies shows that, there is still no specific study in food industry.

In manufacturing plants, the application of automation systems like industrial robots provides high levels of flexibility. Intelligent use and synergy of human skills, combined with robotic systems qualities (for example, flexibility, high speed and precision), lead to beneficial synergistic effects. The implementation of such synergy would therefore allow substantial improvements, especially in terms of increased productiveness and humanization of workplace production processes [8]. Human and robotic elements should therefore be considered complementary. Manufacturing robotics systems will support human work in carrying out various tasks not replacing them through intelligent interaction [9-11]. While sensor data permits robots to recognize unknown environments, speech, gestures, optics or other means provided by human instructions will ensure their proper functioning.

Proposition 1: Human skills would be positively related to smart manufacturing implementation.

2.3. Knowledge sharing

Knowledge sharing (KS) has been recognized as a most significant construct of knowledge management [12-14]. KS is increasingly viewed as an important feature of a successful organization [15]. As a highlighted in previous study, researcher have to develop case study to demonstrate the reuse of such knowledge construct and the usefulness of smart manufacturing knowledge base.

The forming, circulation, sharing, absorption and use of human and intellectual capital modality and the patterns are becoming ever more essential to enable intelligent, sustainable and integrated growth, drivers and builders. The process of sharing knowledge is to share knowledge, know-how and

information among employees, individuals, friends and communities or in associations [16], [17].

KS can help employees to learn from one another, use the latest technology, improve performance, develop new ideas and demonstrate positive attitudes towards organizational change (OC). An earlier study also shows that KS can improve skills, allow staff to respond positively to OC [18], [19]. Based on previous literature, KS can achieve positive results, namely creativity, technological innovation, managerial success, organizational success, organizational learning, trouble-solving and OCs [20-22], [17].

Proposition 2: Knowledge sharing would be positively related to smart manufacturing implementation.

2.4. Transformational Leadership

Transformation leadership is portrayed by the following: idealized influence/charisma, inspiring motivation, intellectual stimulation and individual consideration [23]. Transformation leadership enjoys the reputation of being an effective leadership strategy in particular, if not the most, and has received the greatest empirical research attention [24] [25]. But, as ref. [26] highlighted in their study, transformational leadership is most common discussed and IR4.0 need something more than this which should be more specific in learning and innovation.

The relation between transformation leadership and changes have been empirically examined by various studies. [27], for example, found that transformational leadership is especially important to maintain a positive organizational atmosphere in organizations undergoing a major system change. Carter [28 also found, as part of the implementation of the organizational change, that the transformational leadership was associated with improving quality of relations with subordinates which was then associated with improving subordinate task performance and citizenship.

Proposition 3: Transformational leadership would be positively related to smart manufacturing implementation.

3. Methodology

3.1. The model

The model to be tested (Figure 1) below illustrate the main antecedents of human skills, transformational leadership, knowledge sharing and smart manufacturing as variable value. This influences can be direct or indirect through other variable, as can observe in the model.

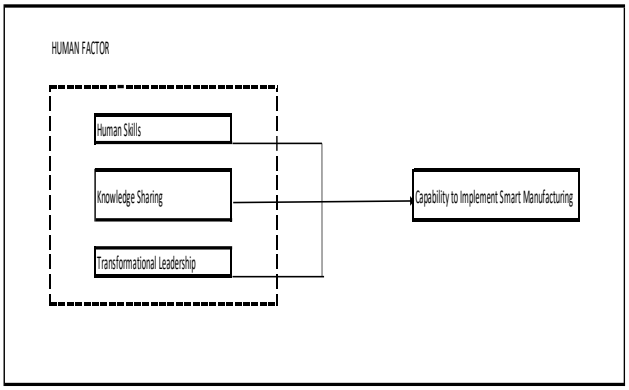

Figure 1. Conceptual Model to be tested

3.2. Sample's Definition

Having defined the expertise (i.e.: manager) of the organization as the most suitable sample for implementation of smart manufacturing in order to test the proposed model as above. Due to the technical impossibility of embodying all of manufacturer in Malaysia, so we choose to limit the study to food industry. Thus, the considered target population was all the employee in selected department of that manufacturer.

3.3. Source of Data

The researcher can generally collect data from both sources, which are a primary (essential) and a secondary (optional) source. The data source can be classified as two, qualitative data and quantitative data, according to ref. [29]. Information is truly believed to be the lowest data unit from which other measurements and analyses can be carried out. In addition, the data can be a number, design, word, idea, image or fact. . Data cannot be damaged in itself and it

must be transformed into meaningful data to capture evidence of this.

The researcher employed a quantitative design in this study. According to [30] a quantitative method allows statistical analysis to ensure that the collected information is true and valid. For instance, a survey uses a means for data collection since it can help to determine the relationship between human skills, transformational leadership, knowledge sharing and smart manufacturing implementation. A cross-sectional collection of data defined by [31] for the collection of data from the intended sample group. This type of design is uncomplicated, inexpensive and allows for a relatively short stop to the data collection.

3.4. Unit of Analysis

Since the opinion of the respondent on human skills, transformational leadership and knowledge sharing are important in capturing its influence on smart manufacturing implementation, the employee in selected department will be asked to be the unit of analysis in this field. Individual are more suitable for this sketch as an analysis unit because it is easy to test all the variables that are identified in the research model.

4. Conclusion

Smart manufacturing and Industry 4.0 could higher output and productivity of the organization compared to traditional factory which just produce lower output and productivity. As per mentioned previously, the demand of the product expected to be increased till 2020, so the industries have to adopt the new technology that we called as a "New Smart Manufacturing" to ensure their industries are not lag behind compared to others developed countries such as USA,UK, South Korea and China. The implementation of smart manufacturing also can higher quality products, higher paying skilled jobs, safer working environment, lower production costs and IT optimized. Besides that, the people approach in this trend make all the activities easy and smooth. While, old traditional factory make lower output and productivity, lower quality products, lower paying unskilled jobs, higher risk working conditions, higher environmental impact, higher production costs and also longer time to market.

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