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III. ENGINEERING SCIENCE



A REVIEW AND CLASSIFICATION OF WORLD CLASS MANUFACTURING LITERATURES

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Abstract

This paper focuses on the existing literatures of World Class Manufacturing (WCM) that classifies all available research papers. In this work is defined a review that covers most of the currently available literatures that describes WCM pillars, its implementation models, missions, main tools and key factors. A taxonomy is developed through reviews.

Key words: World Class Manufacturing, Literature review, Taxonomy, Lean Manufacturing.

1. Introduction.

Nowadays, a global competition has changed the traditional competitive environment of the manufacturing industries. Rapid changing of technologies and customer needs requires developing the strategic objectives for firms, in order to achieve a competitive advantage in the market. While, all manufacturing companies are trying to improve operational performance, increase an efficiency of production processes. Most of the companies are trying to find out a perfect strategy that can provide an excellent productivity improvement in managerial and production phase. They want to suffer themselves from poor and inconsistent methodologies of modern manufacturing. In particular, manufacturing world has faced with many changes in the last decade of 20th century. In order to stay in a global competition, the companies should make a continuous innovation in production facilities. Innovation is one key aspect of staying in global competition. The companies that are operating in this competitive environment should meet customer needs by offering high quality products. The companies must represent a tendency to make their operations efficient and flexible. However, the efficiency of any organization depends on the organizational level of production systems and the range of applications that can provide modern production management supporting tools.

Flexible organization is able to identify exact customer needs and expectations quickly, then respond immediately with high value products. At the same time, company should manage these actions properly. They need to focus on a con-

tinuous product improvement, continuous innovations, applied latest technologies, a wide range of products, research and development facilities, competitive prices and delivery time of the new product. In order to, better organize a new product development processes and manage them, the companies needs a new manufacturing and management model. World Class Manufacturing is an example of such model. World Class Manufacturing is a management concept introduced by organizations using the best production systems in the world.

World Class Manufacturing is an integrated model that assumes continuous improvement of activities within an organization. The aim is to achieve global competitive advantage by adhering the following principles: no waste, no stock, no defect, no failure, improvement of applied processes, increased productivity, improved security and cost reduction.

The aim of this work is to review the literatures that describes World Class Manufacturing model, its objectives, pillars, concepts, main implementation tools, implementation strategies, critical success factors and implementation processes. Then, based on the literature review, we need to make a classification of the selected research papers. The classification of literature will be done by choosing literatures that have the same focus, objective and covered aspects.

2. Theory of World Class Manufacturing and its pillars.

World class manufacturing (WCM) is one example of such systems. World Class Manufacturing is an integrated

management model, which considers continuous improvement of activities within the organizational framework system. The target is to achieve global competitiveness by adhering to the following principles: “no waste”, “no stock”, “no failure”, “no defects”, improvement in processes, increased productivity, improved security and cost reduction (Palucha, 2012). In addition, it is necessary to use teamwork and train employees to work in such systems in order to run world-class manufacturing processes.

The World Class Manufacturing Company is being able to face with new technological paradigm, being flexible in terms of production, being the leader in the global market to meet new customer requirement. However, it can be interpreted as gaining such level of performance that can provides an ability for the company to succeed and survive in the future (Fekete, 2013). Hayes and Wheelwright first introduced the term of World Class Manufacturing (WCM) in 1984 (Flynn & Schroeder, 1999). Hayes and Wheelwright were the professors of Harvard Business School. They described WCM as a set of practices that can lead superior performance for the company. They used WCM in order to describe organizations, which achieved a global competitive advantage by using their manufacturing capabilities in the global market. They defined a number of crucial practices, which include development of employees, developing a technical competence of the management group, competing on quality, promoting an employee participation and investing in state-of-the art equipment (Hayes & Wheelwright, 1985). Development of employees is to train workers and operators, continuously. Well-trained workers operate in efficient way and it may effect to the final outcome of production such as reduction on machine failure, breakdowns. The machine failures and breakdowns can be reduced by promoting employees participation in maintenance process. At the same time, company should also consider the development of technical competence of the management group. The management group should link all other practices efficiently. Richard Schonberger developed those concepts which are define by Hayes and Wheelwright. He focused on continuous improvement, development of supply chain, product design to the practices cited by Hayes and Wheelwright and JIT. In Figure 1, we can be familiar with Schonberger’s WCM model.

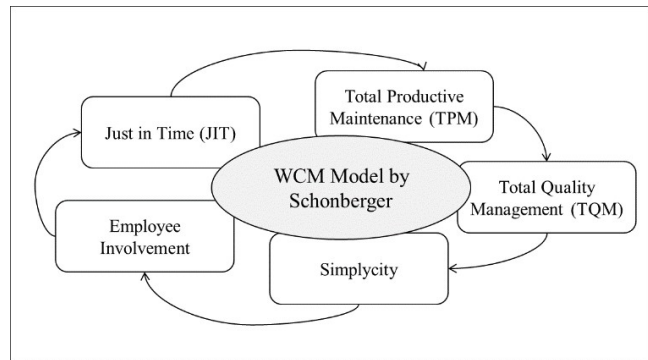


Figure 1. Schonberger’s model of WCM (Schoenberger, 1986).

The core philosophy of JIT is to provide an organizational framework continuously release an opportunities for elimination of non-value added activities (Mahadevan, 2010). JIT systems have brought to limelight the distinction between value added and non-value added activities.

There is another effective organizational framework for continuously eliminating them should complement it. It is Total Quality Management (TQM), which addresses the quality of management as well as the management of quality. It involves everyone in an organization in a systematic long-term endeavor to develop processes that are customer oriented, flexible and responsive, and constantly improving in quality.

The third distinctive parameter of WCM is the idea of Total Productive Maintenance (TPM). Contrary to the traditional thinking that maintenance has to be done by “qualified” maintenance crews, while WCM organizations have realized that transferring some of routine maintenance tasks to the direct workers themselves would offer numerous benefits.

Implementing above three systems in one company, it is necessary break away rigid classification of the labour that is characteristic of traditional manufacturer (Mahadevan, 2010). The small improvement group (focused group) may perform some maintenance tasks and they have to be allowed to perform their own quality inspections. WCM suggested fourth concept, which is defined as Employee Involvement (Mahadevan, 2010). Employee involvement means that every employee is regarded as a unique human being, not just a cog in a machine, and each employee is involved in helping the organization meet its goals.

The last concept that is seen to be common among WCM organizations is simplicity in terms of functioning (Ma-

hadevan, 2010). The best examples could be seen in the Toyota Production system (Ohno, 1992). The introduction of JIT, TQM, TPM, KANBAN system, fail proofing systems and employee involvement have all contributed to the ideal of simplicity. As business grows and as more varieties of the products are built, the manufacturing, management and control systems will remain more or less with the same complexity. This helps WCM organization to overcome trade-off obstacles. Moreover, this feature also indicates how well systems and planning methodologies have been established that are robust enough to assist the increase in the scale and complexity of activities in the organization.

WCM has its own methods and tools as a management model that can give an opportunity to achieve a competitive advantage, based on the principle “to manufacture highest quality product at lower prices” (Palucha, 2012). The model is constructed on the basis of ten interrelated pillars: Safety, cost deployment, Focused Improvement, Autonomous Activities [Autonomous Maintenance (AM) & Workplace Organization (WO)], Professional Maintenance, Quality Control, Logistic & Customer Service, Early Equipment & Product Management, People development, Environment which can lead to above-mentioned objectives. High operational level of production and logistics processes referring to both methodology used and results obtained by the world’s best companies lay a foundation of the WCM (Palucha, 2012). Figure 2 illustrates the ten pillars of WCM.

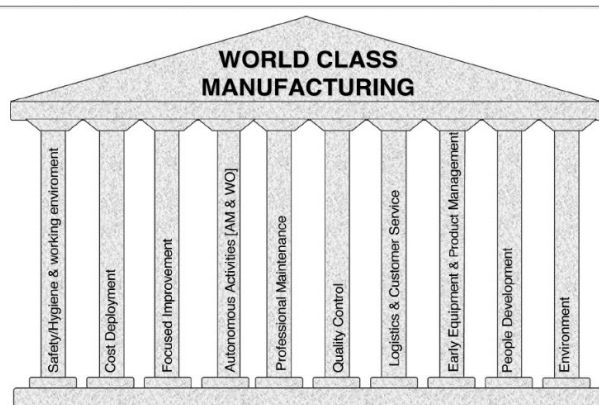


Figure 2. WCM pillars (K.Palucha, 2012)

3. Methodology of taxonomy.

Taxonomy is the process or system of describing the way in which different living things are related by putting them in groups. In other words making a scientific classification.

In this chapter, we are dealing with a taxonomy of literature reviews on World Class Manufacturing. Literature reviews play an important role in the advancement of a discipline, because they accumulate past research efforts, summarize major issues and are important way of disseminate the information generated by individual studies. There are many different types of literature reviews. Some present a simple discussion of topic while others provide a comprehensive and systematic summary of past research. Regardless of their scope, reviews differ from other research endeavors in that they are based on a body of completed works, rather than new research. In this section, we will describe the certain amount of past researches that are related to the World Class Manufacturing model. The main purpose of the taxonomy is to divide the existing literatures into classes. By this classification, we will be able to define the limitations, weaker points of the literatures on WCM and then, we can suggest to new researcher in order to further improvement. This chapter consist of the five sections: classification of the literatures and description of the four class that are defined based on the literature review.

4. Taxonomy and classification of topics

Our mission is to define a set of topics, researches, investigations and give a summary for them. By summarizing, all of literatures, we are able to determine weaker parts of WCM. Our work is to make a list of several topics, to study their targets, improvements, implementations. Based on that analysis we will suggest new class of topics to be discussed. WCM introduced in 1990s. Since 1990s, there have been discovered several researches and improvement on this model. Many scientists, managers found various applications of WCM while working their research paper/work. It is better way to make some classification of all literatures in order to understand clearly the main target of each research paper.

Therefore, a list of literatures will be provided the definition of classes and description of each research paper. In addition, some case study will be discussed. The methodology of the classification is based on the reviewing of the current literatures on WCM. The WCM is becoming more popular in the world. However, there are not huge researches had been done to describe the WCM implementation, concept and objectives. Therefore, the literatures are selected from the most popular and well-known scientific journals. We have been considered set of literatures on WCM, then we selected the most significant articles and researches. These literatures are

the most representative and complete than others. For that reason, we are able to figure out the some classes of these literatures. After the collecting the set of literatures, we reviewed all these papers. In order to make class, we have considered the issues that are covered and addressed by those selected research papers.

We have to classify these literatures based on their focus, goal and coverage. We defined the following classes for these research papers.

1) Critical success factors and strategies of the implementation and operational performance of WCM – is chosen based on the main addresses of the literatures that are included into this class. As we reviewed, research papers of this class, they considered the issue of the critical success factors that can effect to the implementation of the WCM. The class is consist of five literatures; they have defined various success factors of the WCM implementation in different country origin. Some of them described the success factors in low developed country, while other showed in being developed countries. In the next section, we will discuss each of these literatures in detail.

2) Monitoring and controlling the progress of WCM implementation – we have selected this class based on the literature review that considered the monitoring issue of the implementation and to define the progressive stage or step of the WCM implementation. This class could be helpful for the companies that are implementing or that wants to implement WCM in their enterprise. This class include also one literature. Because, in this field, there is limited number of researches had been done.

3) Knowledge acquisition to get successful performance of WCM – is chosen based on the following reason, in order to successful implementation of WCM, the company should acquire enough knowledge. Every level of the organization should understand the meaning, concepts, and tools of WCM. This class describe the knowledge acquisition for the new company that wants to apply the WCM. It would be helpful for the companies to determine the level competence. Then, it will give an idea how to create an active organization among different level of the enterprise.

4) The impact of the WCM concepts and pillars in modern production management – this class is defined based on the more literatures that covered the following aspects:

- the conceptual framework of WCM;
- its main implementation tools;
- the difference between traditional and WCM organiza-

tion in terms of cost management;

- the main role of the concepts such as TPM, TQM and JIT during the implementation process.

Each of these classes are included the several literatures on basis of their address. In the next section, we will sort the eleven research papers and then put them into the classes.

5. Conclusion

Nowadays, World Class Manufacturing is becoming a popular and efficient management method. In order to reach the world class level in global market, companies should understand the meaning, goals, objectives and main focuses of WCM. This work is created for helping researchers and companies who are interested in World Class Manufacturing method. There are several advantages and limitations of such paper. At first, we need to talk about the benefits by addressing segments of auditions: researchers and practitioners. The main objective is to collect review existing literatures on WCM, then make a classification of these papers. Thesis is based on the classification of the research papers in order to find the weaker point of current literatures on WCM, and make a suggestion for new researchers' studies as a subject of the future researches. Moreover, providing a good reference for practitioners such as companies and firms that want apply a WCM methodology.

Advantages. The benefits for the researchers. This work gives an opportunity to clarify the weaker parts of the literatures that are written on the World Class Manufacturing. By classification of the topics, we can provide the undeveloped or less improved researches streams on the new methodology. Each class is a set of papers with the same focus, objective and scope. So that, researchers may use it as reference for their new topic that are related to World Class Manufacturing model.

The benefits for the practitioners: The paper provides the certain benefits for the practitioners too such as classification of the literatures gives more clear way of implementing WCM. In other words, the company who wants to implement the WCM, can find the different implementation methods in various countries, and also they are able to define critical success factors that can effect to the implementation of WCM. If they do not have any information about WCM, then our paper may provide broader description of this model, meaning, objectives, tools and main key factors of the WCM. In addition, the fourth class, which is defined by us, can provide the different methodology for applying the con-

cepts of WCM and the application of the main pillars. While other classes play an important role for the new company during the implementation process of WCM. For example, the class number two, may give a methodology of monitoring the implementation, while the third give an opportunity to understand the main role of knowledge acquisition in order to successful implementation of WCM.

Limitations of this work. The first one is the overall number of reviewed literature. We have only taken twelve research papers to build a classification. Nevertheless, chosen articles and researches have been considered the most significant and complete ones in each class of topics. This is due to the fact that we found few especially academic literatures on some topics, for example, there is only one literature on monitoring the implementation level of WCM. Another limited research in the third class. Few literatures can provide the main role of the knowledge acquisition during the implementation. Our taxonomy is not enough to classify all issues that are related to World Class Manufacturing model. This classification includes the limited aspects of WCM. For example, in this analysis, we studied the WCM model for mainly in the production and manufacturing. Another limitation is to classify some literatures, because these literatures have been addressed several issues. Therefore, it will create a little difficulty during classification.

In general, there are not available plenty of researches that was studied World Class Manufacturing method, because, the WCM is a new methodology and it has been studied and becoming a popular since 21st century. It requires more efforts on studying all the aspects of WCM in deeply and broadly. Reviewing the literatures provides that there is no unique standard model of implementation of WCM. The implementation process is vary with respect to company's capabilities, country origins and the cultural behavior of the company. The taxonomy cannot provide a complete classification for WCM literatures.

Implications

For researchers - The scope of this paper is to provide researchers with complete overview of the literatures that are related to WCM. The first class gives an opportunity to research on the critical success factors of WCM implementation in different countries, companies and in different industries as well. The current literatures of the first class has a limitation in terms of country origin and company's business performance level. Based on the analyzed strategies and the

critical success factors (CSFs) of WCM, the new researchers may study in further research. He/she can consider the same CSFs in less developed country or in developed country. By comparing the result, researches make some draws about the impact of CSFs and strategies in different country origin. The proposed taxonomy can be initial framework of classification of WCM literatures.

For practitioners – usually a practitioner is a company. To make a class of the literature based on the same issue, can be helpful for a company. We have define four classes of the WCM literatures. Based on the discussed topics in the first, a company may realize the most critical success factors for the implementation of WCM. Topics may provide clear description of the strategies that are demonstrated by researchers in different areas of the world. By looking through the second class, an enterprise is able to figure out their own strategies. Furthermore, companies pay more attention focusing on the more significant factors for the successful implementation that are provided by the taxonomy. Another important implication of taxonomy for practitioners comes from the second and third classes. The second class includes the monitoring the implementation process, so, based on this topic a company is able to audit their implementation and to determine the level of getting successful implementation of WCM. However, the third class also provides an important issue for the company during the execution of WCM. Company may get an information about collaborative learning, creating an organization and acquiring competence by training the employees. Finally, the last part of the taxonomy, gives broader information and different methodology for the implementation of WCM. Basically, company acquire a knowledge about the conceptual framework of the implementation of WCM. Additionally, they can understand the role of each pillars of WCM in modern production management. Because, the four class includes the topics that describe WCM pillars, and their implementation in the modern manufacturing especially in automotive companies. Nowadays, the top executor of WCM in automotive industry is Fiat Chrysler Automobile (FCA) groups. This company requires supplier to implement WCM in their manufacturing too. There are case studies based on the implementation WCM in FCA. The fourth class may provide not the best model, but generalized framework of WCM implementation in automotive industry. It can be useful framework for other automobile companies, who are planning to execute the WCM in their enterprise.

For new researcher – as we mentioned, this work has

limitations. We would like to suggest for new researchers to study on this issues. First, the number of selected papers are limited scopes even if they are most significant and complete. For example, the second and third classes include only one literature. It means that there is an opportunity to improve this class. These two aspects: monitoring the WCM implementation and knowledge acquisition is less developed part of the WCM. For that reason, it limits the classes of these topics. New researchers can study on these issues and make some additional researches for both classes. And also, future researchers may improve the qualification of the classification of the current taxonomy by enlarging the number of literature available on WCM. In addition, future researchers pay more attention on the literatures that described several aspects of the WCM within one research paper. It will be improved by deep studying of those literatures and to distinguish them in term of their more significant focus. We will suggest to new researcher to take this work as an initial reference for the classification, then improve it by searching more literatures on the weaker part of taxonomy especially in the second and third classes.

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