WORLD CLASS MANUFACTURING – THE CONCEPT FOR PERFORMANCE INCREASEMENT AND KNOWLEDGE ACQUISITION

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INTRODUCTION

Is it important for companies to belong to the leaders in their line of business? Definitely yes, but nowadays many enterprises are managed intuitively, without clear rules and principles. If the company wants to be successful and be among the first, it must continuously improve all processes and find optimal solutions for increasing both the efficiency and effectiveness. This path is not easy. At the beginning, there must be a desire to become that leader. Also important is the courage to learn and to try new things, perseverance and the ability to deal with the details and correctly convert ideas into solutions.

One of the ways how the company can become a leader in its line of business is to apply in the right way the right concepts and methods that help the company to increase both the efficiency and effectiveness in pursuit of business activities. The article describes one such concept, which is World Class Manufacturing and within it the 5S method with the aim to highlight the benefits of implementing this concept and 5S method using the example of an automotive parts supplier in Slovakia.

1 DEFINITION OF WORLD CLASS MANUFACTURING

Becoming a world-class manufacturing (WCM) company serves also nowadays as a suitable goal for manufacturing companies. For some of them, this term could mean being the best in the world in its particular manufacturing sector, or for others it could mean to gain a level of performance that provides the company with the ability to succeed and survive into the future.

The term ‘World Class Manufacturing’ was first used by Hayes and Wheelwright in 1984. Hayes and Wheelwright described world class manufacturing as a set of practices, implying that the use of best practices would lead to superior performance [3]. The term “World-Class Manufacturing” was first used by Hayes and Wheelwright to describe organizations which achieved a global competitive advantage through use of their manufacturing capabilities as a strategic weapon. They cite a number of critical practices, including development of the workforce, developing a technically competent management group, competing through quality, stimulating worker participation and investing in state-of-the-art equipment and facilities [5]. Schönberger developed these concepts and provided a number of examples of world-class manufacturers located in the USA [7]. He focused on continuous improvement, adding the development of supplier relationships, product design and JIT to the practices cited by Hayes and Wheelwright. Generally speaking, a world class producer is the one who can compete with the best anywhere in the world.

In order to deliver successfully a particular set of competitive-edge criteria in the market place based on the World Class Manufacturing principles a plant must use an appropriate manufacturing approach. The right manufacturing approach often runs something like this [1]:

- deliver on the shortest lead time,
- always on time,
- a product with better features than those offered by the competition,
- made perfectly,
- to any design the customer wants,
- in any volume he wants,
- and by the way, be the cheapest in the business.

When implementing World Class Manufacturing concept, companies need to understand and identify the critical factors that affect the implementation process and address them effectively to ensure benefits and avoid failures. Therefore, the need for a systematic and deliberate study on the critical success factors for implementing WCM is important. These factors include: management commitment, quality department, continuous improvement and customer involvement [2].

The concept of World Class Manufacturing is in reality in the manufacturing settings implemented through the appropriate tools and methods like Total Productive Maintenance (TPM) and within it Overall Equipment Effectiveness (OEE), SMED, pull and kanban system, continuous flow, visual
management, team work, JIT, 5S, waste elimination, Statistical Process Control (SPC), Zero Quality Control (parts per million – PPM), etc. To implement all of these methods and tools is tough, but it is necessary to become world class. It means also to continuously search the improvements for the overall organizational effectiveness.

2 THE IMPLEMENTATION OF WORLD CLASS MANUFACTURING

So that any enterprise could progress in performance, management needs to create the conditions to make room for the improvement of both manufacturing and administrative processes. Firstly, such a comprehensive approach or concept as the World Class Manufacturing (WCM) is, an enterprise must have it defined in its strategy, that approach must become a part of defining and implementing the company strategy. Achievement of this strategy, which also includes the implementation of WCM, is usually organized in the companies by separate department whose mission is to train staff of how to use WCM concept and methods, then, coordination of individual projects, all that recording in the documentation, evaluation of results and their distribution. All this is also provided in the company, which produces external components for the automotive industry, and whose current practice is described in this article in the form of a case study.

In the aforementioned company, the introducing of WCM concept and its various methods is included in the strategy. These methods are used to achieve excellent quality, and to increase productivity. Actually, WCM is in this company as one management department, which deals with the activities of implementing appropriate methods for promoting the company prosperity in all of its processes. It aims to increase productivity by eliminating losses along the entire value stream. Waste is everything that from the customer's viewpoint does not directly bring the added value to the product, or does not contribute to its transformation [6]. Waste is a symptom of malfunctioning. Detection and elimination of the root causes of problems represent the base for underlying elements with whom the WCM department deals with in the company.

WCM department addresses and aligns three areas: People, Process and Production (or Production Flow):

1. Area: People
   Teams and individuals in the company work in a safe environment to achieve the objectives set by management of this enterprise and at the same time to satisfy the customer needs. Great emphasis is placed on health, safety, environmental thinking and behavior. Among the important points in this area are that management considers also an education and training of people, then leading people to teamwork, leading people to focus on analyzing the causes of the problem, building customer thinking and leading the leaders to the proper valuation of the of people’s benefits and teams to achieve corporate goals.

2. Area: Processes
   Company that is the subject of this case study defines the process as “a series of individual actions performed in a specific sequence that create value.” It is important that processes must be standardized, must be capable, that is, to give a consistent output over time and that the maintenance of processes and equipment must proceed well.

3. Area: Production (Production Flow)
   Flow is the rhythmic and continuous transmission of the right material and accurate information within the manufacturing operations at the right time, in the right quantity and in the right way. The key is then the continuity of this transfer. The objective of flow production is to reduce product throughput time and human effort through a series of appropriate actions [6].

In the framework of WCM implementation, the function of WCM engineer was also in the company established, whose role is to:
1. implement and communicate the WCM concept in a company and oversight its proper implementation;
2. to train top management and other company managers in WCM practices and assist them in implementing their training sessions;
3. introduce indicators, collect and visualize the results achieved by the company;
4. find solutions in WCM area of how to optimize resources for individual company departments;
5. find solutions to the demands of workplaces regarding WCM methods;
6. collaborate in defining company strategy in terms of WCM activities;
7. prepare meetings with company management;
8. introduce methodological procedures;
9. plan the necessary financial and human resources in the implementation of WCM.

WCM department in the company focuses on high orientation of the outcome, on the analysis of the definition of wastes and focuses on critical places to optimize resources and achieve results in the shortest possible time. To achieve this performance, the correct measurement of business performance is helpful.

As the strategic goals – indicators of business performance – are set as follows:
1. profit maximization – reducing defective parts and PPM;
2. ensure a safe workplace for the employees – Frequency Rate of Lost Time Accidents;
3. increase capacity utilization – increasing OEE of the press and paint shops;
4. increase the amount of assembled parts without repair – Assembly Right the First Time;
5. deliver to the customer products of the highest quality – Customer PPM;
6. reduce the time of delivery to the customer in collaboration with the Supply Chain Department – Lead Time;
7. reduce the price for poor quality production “CNO” – Cost of Non Quality;
8. continuous process improvement and readability of processes;
9. streamline the material consumption – Material Consumption Efficiency.

Achievement of strategic objectives and performance measurement in the company is based on "Industrial Performance Indicators" (IPI) – indicators of the company performance. IPI are the target data, which quantify or demonstrate results. They are oriented towards activities leading to productivity increase. In theory, there is a rule: "what is not measured, it cannot be managed nor being improved" [4].

IPI indicators are divided into:
1. **People**, here are included: accident rates, absenteeism rates (fluctuation), deficiencies in security, discipline, and environment (Top Safety).
2. **Process**, here are included: the rate of waste (defectiveness), Right the First Time, OEE (overall equipment effectiveness), PPM customer (Parts per Million), NNPM (number of nonconforming parts per million).
3. **Flow**, this includes: number of undelivered parts, service delivery rate, Lead Time (stock coverage).

For each indicator, the relevant department or section is responsible to attain it.

### 2.1 5S IMPLEMENTATION

One of the key solutions for error prevention on the workplace was to implement 5S. The team was appointed who was given the task to implement 5S. The team was in addition to a leader composed of employee from the respective department, the coordinator from the same department, maintenance employee and consultant from the WCM department. All employees on the workplace have undergone training to know what to do and how the result of this project would affect their work.

In the first step, it was designed the layout of work zones and places were designated, where the standards of 5S areas will be placed. Very important was the participation of employees of the department who knew how to define the layout to meet their requirements. After that, the individual steps of 5S method followed:

1. **– Sort**

   Is everything that is unnecessary away?

   In this step, the team walked through the 5S workplace and easily separated items that were needed in the workplace, and those that were not. The frequency of usage was evaluated and according to that it was decided whether the items remain at the workplace or will be removed.

   Items were divided according to:
   1. Items with the highest frequency of usage, there are necessary for the work performance – items must remain in the workplace.
   2. Items with lower frequency of usage – items will be moved away.
   3. Items that are not used at all – items will be removed.

   All unnecessary items have been labeled with red cards and were photographed. After the completion of labeling, pictures were lined up and numbered and the dates of removal were determined and responsible person that would implement removing. It was important that by the
labeling, any objects would not be excluded such as cabinets, desks, drawers, in which the items that
are not used are usually accumulated.

2. – Set in order

Has everything its place?
In the second step, the team defined places for the items that were not labeled with a red card and
remain in the workplace. In determining these places, the team members took into account how often
the item is used and also the ergonomics of the workplace. After placing the items on suitable sites,
the team visualized these places. They visualized, that is, the places were made visible where the
items were placed, but some items were also visualized. The output of this step is the created layout
of the workplace where it is captured the deployment of items in this workplace.

3. – Shine

Is everything clean?
In the third step, all the items that were in the workplace were cleaned. The workplace was divided
up into zones and those responsible for the zones were identified. Before cleaning, all areas were
photographed for comparison of the areas or zones before and after cleaning. The thorough cleaning
work was done, which lasted 8 hours. While carrying out the cleaning, the inspection work took place
on various damages, loosened seals, and other reasons why the pollution has originated. All the
damages were removed. After a thorough cleaning, the frequency of the follow-up cleaning was set
either as the form of autonomous maintenance, or as defining requirements on the cleaning company.

4. – Standardize

Do we have the right standards?
In this step, all existing activities were standardized. Standardized were the procedures, that is
cleaning, but also workplace (layout). The purpose of the standard is that all workers should see how
the workplace should look like both in terms of cleanliness, or in terms of items laid out. Photographed
were cleaned and ergonomically designed zones and pictures were placed on the workplace. In the
workplace standard (zone), the responsible person for the zone was defined and also the frequency of
updates.

5. – Sustain

Do we improve our workplace?
To check if the standards are complied with those that were created, the team in this step
introduced the checks in the form of an audit. The Audit Form was created that was posted on a
message board together with the workstation standards. In each action plan, there are questions
regarding the zones that are displayed on the standard. Part of the message board is an action plan,
in which deficiencies are recorded. The Action Plan also includes the steps to correct them,
responsibility for correcting and the term of remedy. On both documents it was written who performs
an audit and who completes an action plan and what is the frequency of updates.

Fig. 1: Standard of the workplace layout

Source: Internal company documentation
Following the introduction of the 5S audit, the team explained to all workers that they should not take the audit as something negative, but as something that motivates them to comply with the order and cleanliness, and monitors the compliance with standards as well as revision of the standards. Therefore, it is also required that the employees responsible for auditing zones write down the real condition of the workplace to the message board in terms of 5S.

**Tab. 1: Audit of the workplace**

| Level | Num. | Activity | 1 | 2 | 3 | 4 | … | 30 | 31 |
|-------|------|----------|---|---|---|---|----|----|
| 1 – Separation | 1 | Bins for separation are on place | | | | | |
| | 2 | Nothing is on the floor, under the workbench, and under the conveyor belt | | | | | |
| | 3 | No unnecessary tools on the workplace | | | | | |
| 2 – Cleanliness | 4 | The floor is clean | | | | | |
| | 5 | No cables and cords on the floor | | | | | |
| | 6 | Clean computers, chairs, and workbenches | | | | | |
| | 7 | No materials on the floor | | | | | |
| | 8 | Bins are not full | | | | | |
| 3 – Marking | 9 | Marking on the floor is distinct | | | | | |
| | 10 | Data results on the computer monitor are distinct | | | | | |
| | 11 | Working tools are on their place and are labeled | | | | | |
| | 12 | All dangerous substances are labeled | | | | | |
| 4 – Standardization | 13 | Zone 1 corresponds to the standard according to the picture | | | | | |
| | 14 | Zone 2 corresponds to the standard according to the picture | | | | | |
| 5 – Optimization | 15 | Metrics are showed on tables | | | | | |
| | 16 | Action plan is available and kept | | | | | |
| | 17 | Audit of the workplace is according to the timeline | | | | | |

*Source: Own compilation based on internal company documents*

**Summary of the 5S implementation**

The introduction of 5S method on respective workplace has proved to be the right move. By the introduction, the amount of scrap was reduced that was generated by poor handling, on average of 75%. With the calculated average price of part equals to 50 EUR, the average savings per week is 2 540 EUR.

In addition, the realization of the 5S method has an impact on PPM and OEE of other departments, which are the other key performance indicators of this department.

The implementation of 5S method was obviously teamwork of not only the workers who work on that workplace, but also maintenance workers, foremen, supervisors, managers and, of course, WCM engineer.

The introduction of 5S method in this workplace has showed as very important, both in terms of increasing efficiency and optimizing the work, and in terms of first impression and order in the
workplace. By the introduction of the 5S method, this workplace in the company has become a model for other departments.

**Overall summary**

Autonomous maintenance takes place on the workplace, where the 5S method was introduced in relevant frequencies. The output is a weekly audit. After the introduction, the progress in the state of workbenches is visible. Desks are clean and undamaged. Minor fixes are made by every worker himself or herself and larger tasks by maintenance. Another improvement is found in the thinking and motivation among workers who make autonomous maintenance of the workbenches. They show more interest in their equipment and they report any discrepancies they observe. They have a feeling of more involvement and participation. With the introduction of autonomous maintenance of the workbenches, the company saves money on the escaping compressed air, leaking oil, but also on reducing the amount of scrap parts due to faulty handling causing damages on the parts.

**3 KNOWLEDGE ACQUISITION**

Obviously, with the implementation of WCM concept and its respective methods, including 5S, workers acquire valuable experience and knowledge that is needed to preserve them to the future and share them with others. Less known is, however, that for the successful implementation of any concept and methods, the total of four types of knowledge should be applied to, and these are as follows [8]:

- Knowledge of the purpose of the business, of its objectives, and environment.
- Knowledge of the work to be done, to attain those objectives.
- Knowledge of the capabilities of the organization, its strengths, its struggles, its weaknesses, and its current levels of performance.
- Knowledge of one’s own strengths and weaknesses as the leader, and current performance.

The first knowledge, knowledge of the purpose of the business and its objectives and environment, enables determination of a target or desired condition which is comprised of specific outcomes for the organization to seek and an image of that condition that is drawn as explicitly and as clearly as possible. The second and third knowledge depends on the capabilities of a leader to continually develop the capabilities of others and of himself or herself. This becomes the distinguishing characteristic of an effective leadership.

Effective organizations depend on developing the problem solving capabilities of the whole workforce. The basic nature of human learning is collaborative. At the fundamental level, collaboration between at least two people means learning together or creating knowledge together. Effective leaders establish systems to engage everyone to work together in identifying, signaling, and responding to problems. So collaborative learning is when two or more individuals intent on learning something together [9]. This all works well also in a company that was a subject of the case study described in previous parts.

**CONCLUSION**

The case study showed that by using the concepts and methods of World Class Manufacturing, better results can be achieved, which further motivate employees to perform better and show that successful are those who want those who are looking for a way to achieve success and have the courage and desire to be a leader. The result of the implementation of this concept and its methods is saved money, greater motivation of the people, greater safety at the workplace, better order and discipline in the workplace and greater cooperation among workers. The introduction of the WCM concept and its methods brings the company the increasement of efficiency and effectiveness and that the enterprises should look at this implementation as a challenge to further progress.

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**BIBLIOGRAPHY**

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Abstract

Although the term World Class Manufacturing (WCM) is known long ago, it finds out its application even today especially in production organizations. WCM still has one major advantage over the currently well-known and widespread concepts for process optimization such as lean production, JIT, six sigma, SCM, and TQM. While these concepts are generally focused on the achievement of speed and quality of the processes, WCM represents its title, among other things, the target set by the senior management that the employees in the organization have to strive for.

In the paper, the implementation of the WCM concept will be presented based on the example of a supplier for the automotive industry in the Slovak republic, and what benefits this implementation has brought to this supplier.

In principle, the introduction of the WCM concept is realized through the application of those methods and tools, as they are currently known from lean management and lean production concepts, like TPM and OEE, SMED, pull system, continuous flow, visual management, 5S, Zero Quality Control, etc.. However, because of the limited space in this case study, just the introduction of 5S method will be described. In the end of the paper, the knowledge acquisition through the case study of 5S implementation will be described.

Key words

World Class Manufacturing, lean production, 5S, knowledge acquisition

JEL Classification

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