Occupational health and safety-driven WCM developmental framework in a manufacturing company

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Abstract. World Class Manufacturing represents an innovational framework, system and program based on the cycle of Deming, providing the elimination of all types of waste and loss of production, also targeting the "zero accident" goal, based on a participatory management style. The present paper introduces to Romanian specialists the basic principles and characteristic features of WCM – OHS driven framework and implementation requirements of such a model. Our goal is to summarize the basic characteristics and mechanisms of a WCM management system implemented and operational in a Romanian company, in order to make available to decision makers in our country a model of good practice on the integrated business management framework, from the OHS perspective.

1 Introduction

Both available literature and industrial practice shows that to achieve a significant improvement of any company's operations it is required to change the way of thinking of all employees [1]. Corporate culture, awareness of workers, motivation and training systems have to be changed [2]. Human resources become the leading element of the process [3].

WCM has its foundations in the Total Productive Maintenance (TPM a maintenance process developed in Japan for improving productivity by making processes more reliable and less wasteful [4].

What is WCM? The definition belongs to Professor Hajime Yamashina, the mentor and consultant of the WCM program. A professor at Kyoto University, Japan, Professor Yamashina is an authority on consulting production practices and strategies, and the highest authority that can assess on the basis of a score, which is the level of development of WCM in a factory [5].

What does this term WCM actually mean? Why WCM, and more than that, why WCM now? WCM stands for World Class Manufacturing. A first interpretation places WCM in the context of "world-class manufacturing." Perfectly correct, but what does "world class" really mean? The answer is given by three terms or indicators that define efficiency, when we discuss production / manufacturing [6].

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i. Availability 99%: (Factory / machine availability defined in relation to time. E.g. for a planned production period of 8 hours, and machine operation of 4 hours, we have 50% availability).
ii. Performance 99%: (The amount of products obtained, compared to the ideal quantity. E.g. for a given value of 100 pieces per hour, and achieved by 50, we will have 50% performance. It is an indicator given by the operating speed of the machine).
iii. Quality 100%: (How many good products we have from the first, without other subsequent remedies. E.g. for 100 pieces of products sold, of which 50 products from the first, and 50 after the remedy, the value of the quality indicator is 50%).

Obviously, there are particularities related to the type of product, the type of process or rather the type of business. Figure 1 illustrates the content elements of the WCM concept [7].

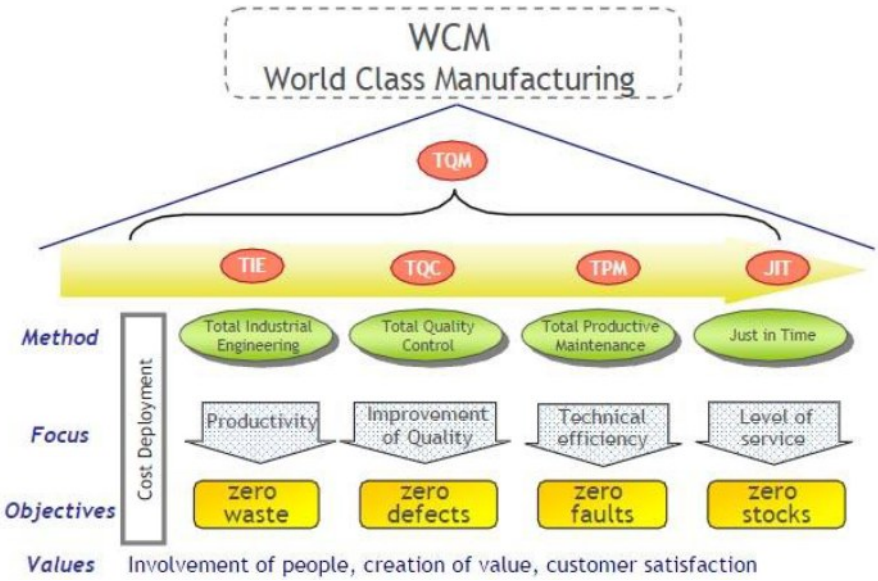

Fig. 1. Schematic representation of the WCM concept [7].

The general acceptance is that the correct application of WCM techniques and methods ensures the maintenance of the three key indicators, expands the process of continuous improvement by reducing long-term losses, ensures competitiveness and detachment from competitors in the market, and last but not least provides support, sustainability and profit [8].

Japanese production methods offer high performance models, cost analysis, product quality and mass production [9]. The model is based on the PDCA (Plan - Do - Check - Act) principles, globally accepted principles as a model for continuous improvement [10].

What is the philosophy behind WCM? The problem, or rather the common weakness of the various systems that aim to improve performance, is the direct relationship or feedback between the different activities and the visible financial benefits in costs [11]. What should be the areas of interest, in which, if acted, the most important benefits in costs would be generated. What should be the criterion by which the use of available resources can be prioritized in order to eliminate losses? Is the existing financial system capable of achieving

this, or does it need substantial reform? The answer is given by the ability of the system to evaluate and accept its own operating cost. And this is done by developing the concept of Cost Deployment. Cost Deployment is a technique that establishes a cost reduction program, scientifically and systematically, through cooperation between the finance and production departments. Cost assessment involves investigating the relationship between different types of costs, types of losses and process areas, as well as clarifying how it is possible to reduce or eliminate these costs, based on priority algorithms [12].

The paper aims to synthesize the basic characteristics and mechanisms of a WCM management system implemented and operational within a Romanian company, which is part of a multinational company of global reference, in order to make available to decision makers in our country a good practice model for the integrated business management framework from the perspective of occupational safety and health.

2 Brief description of the investigated company

The group to which the company belongs has a long tradition, is present in 59 countries and has developed with the industrial revolution, diversifying its fields of activity, expanding worldwide. After 1970, the group established itself worldwide as one of the leading players in the market for building materials, innovative materials and the distribution of building materials, with companies established in Germany in 1853, in Italy in 1889, in Spain and Benelux in 1904, in Brazil since 1937, USA since 1967.

The investigated company is one of the largest construction materials companies in the world. The company's most important products are high-performance building materials and glass. In Romania, the group owns nine companies. Part of the Group, the gypsum board factory is located in Transylvania, the object of activity being the production and sale of gypsum boards. The factory is supplied with raw material, gypsum rock crushed by the contractors, with transport vehicles (8x4 trucks), the storage is done in a covered and closed hall; the material is picked up by a band relay encapsulated and transported to a metal hopper. Grinding is done in the calciner mill. The gypsum powder, due to its very high reactivity, rehydrates in contact with water, turning almost instantly into calcium sulphate dihydrate. This restores the chemical structure of natural gypsum, mixing water with additives and plaster in the encapsulated system. The production capacity is 60 million sqm boards / year.

The facilities and technical equipment of the production line include: plate forming equipment; gypsum rock unloading area - covered deposit; mill supplier conveyor belt; calcining furnace; bunker for plaster; plaster board preparation area; mixer area - plaster + additives + water; plate forming area; plate conveyor belt; plate cutting area; waste area; recycling factory; plate dryer; final cutting area; palletizing area; additive dosing area filters; additionally, forklifts with thermal engines are used - 9 tons.

The staff structure includes a total of 120 workers, of which: administrative technical staff - 8; production staff - 75; maintenance staff - 15; logistics staff – 22.

The operations and work carried out within the company include activities of:

a. **Manufacturing** (production managers + production operators = 4 + 71): preparation of cardboard for introduction on the line; gypsum supply calcination / crushing area; feed with additives the silo of additives; preparation of plaster paste and pouring into the plate; plate drying in cross dryer; plate cutting; stacking plates; transporting stacked plates in the warehouse; storage;
b. **Logistics** (warehouse manager + forklift operators + logistics staff = 15): preparation of goods for shipment; loading into trucks; unloading of goods and

raw materials, (additives, pallets, spare parts); preparation of transport orders; procurement of raw materials, services;

c. **Maintenance** (head of maintenance + electricians & locksmiths = 15): maintenance planning; making repairs;
d. **Administration:** factory manager, engineers, accountants, planners, supply - 8; other people working - various contractors providing services (security and protection; maintenance; transport; cleaning services; catering) - 90 people.

Manufactured products include standard plates (length: 1500-4000 mm; width: 600-1200 mm); fire resistant plates (length: 1500-4000 mm; width: 600-1200 mm); moisture-resistant boards (length: 1500-4000 mm; width: 600-1200 mm); sound insulation boards (length: 1500-4000 mm; width: 600-1200 mm); thermal insulation boards (length: 1500-4000 mm; width: 600-1200 mm.

3 OHS-driven WCM system's developmental framework

Within the Company, Occupational Safety and Health Management is integrated into the continuous improvement program **World Class Manufacturing** [11]. This program was introduced in 2003 at British Plasterboard Ltd and was later extended to the Group. WCM is a program of continuous improvement in several areas, a program based on the involvement of staff in the current activities of Safety, Production, Maintenance, Quality, a framework that once implemented helps to aim for zero defects, accidents at work, complaints. By participating in this program, over time, a corporate culture is created. The company's vision regarding corporate culture, as appears on the time / TF (frequency indicator) chart, is that it can be achieved naturally in a period of 15 years (Figure 2).

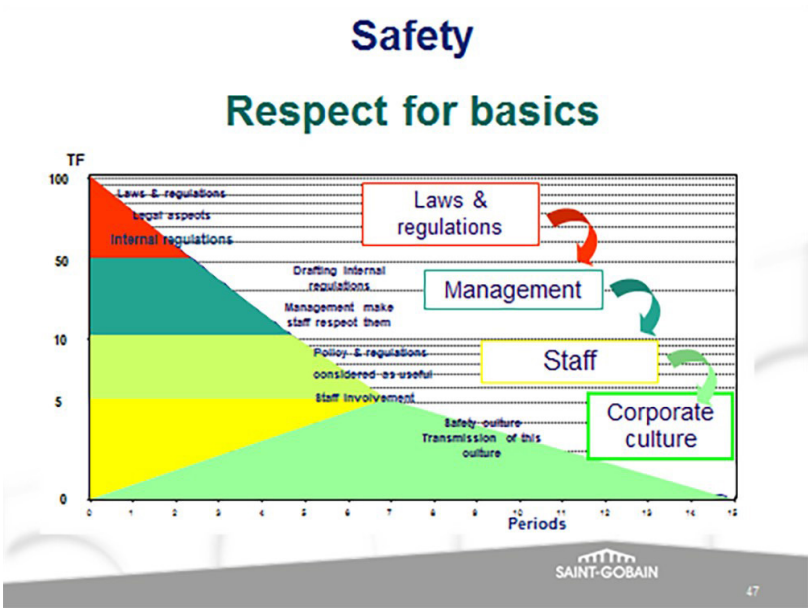

Fig. 2. Investigated company vision regarding the temporal evolution in the corporate culture development.

Company policy documents the importance given by management to the subject of OHS and is the document that underlies the systems implemented. The Occupational Health

and Safety Management System specifies the processes for the continuous improvement of the organization's performance in terms of occupational health and safety, and at the same time, their compliance with the legislation in force. The notion of SSO management system is relatively recent in the Romanian practice in the field, but it has an experience of over 25 years in developed countries such as Great Britain, Germany, Australia, U.S.A., Japan, etc. Within the WCM Program, the Pillar developed on the Health & Safety side is the first pillar and the basic one, according to the principle „**The road to excellence starts with Health & Safety**".

A "temple" graphical representation is used generically to represent the concept of WCM (Figure 3).

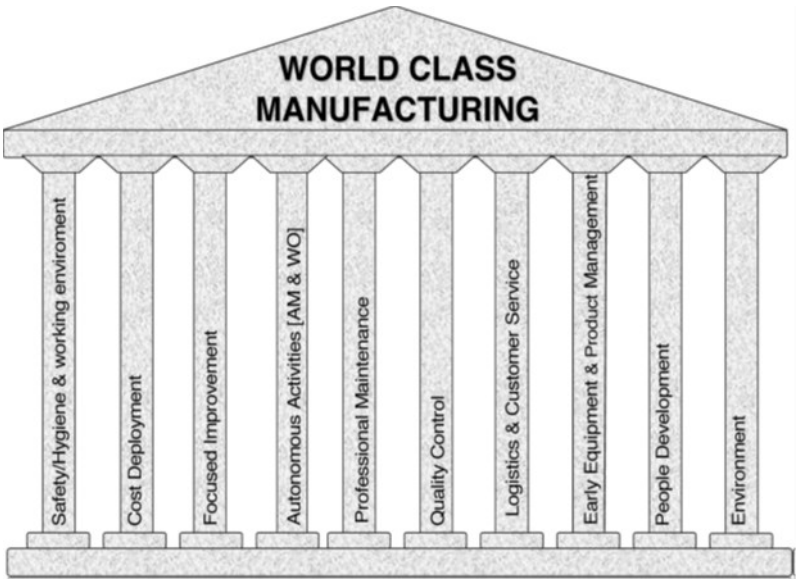

Fig. 3. Temple" representation of the World Class Manufacturing pillars [13].

The activities are divided between the 10 pillars, and the pillars are based on a foundation given by 5 elements: Involvement, Communication, Evaluation, Standardization, and Documentation. There is a strong dependency between the 10 pillars, and they must all contribute equally to success [14]. The general model of the 10 pillars has been developed in many Japanese companies and reflects the culture for details, standards and discipline. The management of OHS within the investigated company is included in the WCM program of continuous improvement, its visualization being done in the form of a Pillar, the first and most important of the "temple" [15].

On the safety side, the deployment cost is represented by the risk assessment. A brief summary shows that the philosophy behind WCM is based on cost and its systematic approach to minimizing cost. Companies that apply WCM strategies to improve operations tend to eliminate work accidents and losses on an ongoing basis, and the effect is on high productivity obtained. In addition, the traditional sequential methods of performing tasks are gradually being replaced by competing methods, and the involvement of teams in the development of tasks reduces the time of their performance. Undoubtedly, the implementation requires a long time, which is often met with the argument "we have always solved it this way". The strongest resistance comes from middle management, but it can be just as obvious in the case of operators. Only a sustained involvement in the program can determine the success of WCM. Involvement must be accompanied by a solid "Training" package to ensure that WCM techniques are properly applied and understood.

WCM members need to be aware that the benefits can be substantial if the starting point is the right one that the best approach is to streamline operations and identify opportunities.
Like any other performance-enhancing system, WCM is not a universal remedy; it should not be embraced "as a religion." It is an operational strategy that, if properly implemented, will certainly ensure new dimensions of competitiveness: rapid response to change, productivity, the highest quality products, and their delivery in the shortest time, the elimination of accidents and incidents, as well as continuous risk reduction. The Health & Safety pillar has 4 constituent parts, parts that complement each other, and that help to visualize the activities carried out. The constituent elements (modules) of the Health and Safety pillar are developed as follows:

Module I of the pillar comprises:

- A1- Management vision
- A2- Short-term (annual) and long-term objectives (4 years)
- A3- Goal tracking (monthly)
- A4- Pillar maintenance team - data updating
- A5- Matrix of responsibilities
- B1- Performance indicators - TF - frequency rate (TF1 and TF2)
- B2- History: Implementation of standards
- B3- History of discussions within SMAT - Safety Management Audit Techniques
- B4- Risk level - history (last 3 years)

Module II of the pillar includes:

- C1- Performance indicators - TF - frequency rate (TF1 and TF5)
- C2- The pyramid of incidents
- C3- Incident analysis
- D1- Alignment with legal requirements and company standards
- D2- Safe behavior observation program
- D3- Implement warnings
- D4- Risk level centralization
- D5- H&S activities in the action plan - (identified, planned, completed)
- D6- Health & Safety Communications (CSSM, department, workshops, regular)
- D7- Incident matrix
- D8- 5S implementation areas
- D9- Audit results history
- D10- Implementing Group good practices

Module III of the pillar comprises:

- E1- Identified risk level (by type of identification - assessment, warnings, communications, audits, incidents)
- E2- Risk assessment by company method / Prevention and Protection Plans
- E7- Risk level identified according to the COMPANY methodology

Module IV of the pillar includes:

- E3- Health & Safety project matrix
- E4- Risk reduction in projects
- E5- Risk reduction depending on the level of risk

- E6- Risk reduction projects
- F1- Evolution of the Management System according to the internal audit
- F2- Performance measurement - internal audit result COMPANY
- F3- Health & Safety Meetings History

The industrial production group of which the investigated company is a part has developed on the basis of principles shared and implemented by members of management and employees who have guided the group's activities over the years. There has been a need for these principles to be put in writing in order to facilitate their dissemination and strengthen their practical application within the group worldwide. This document is intended to be a public testimony of how the group understands to abide by the fundamental principles of conduct and action, which are valid for all the companies of which it is formed, regardless of the country in which it operates. These principles are:

- environment of health and safety at work is especially necessary;
- Respect for others;
- Integrity in principles;
- Loyalty;
- Solidarity;
- Respect for the rule of law;
- Respect for the environment;
- **Respect for Occupational Health and Safety** - the companies within the group are committed to take the necessary measures to ensure the best protection in the field of occupational health and safety. Companies define their risk prevention policy and monitor its application and control. This policy is applied both to its own employees and to the contractors who work in the units. They have the ambition to bring the main performance indicators of their units in the field of OSH to the level of the indicators specific to the comparable effective units within the group - even if this sometimes involves exceeding the provisions of the local legislation.
- Respect for employees' rights.

The companies within the Group are diligently monitoring the observance of employees' rights, promoting active social dialogue. The President of the Group expresses through the Safety Policy as well as through the establishment of the objectives of Environment, Health and Safety the unconditional support in their implementation.

4 Conclusions

The shared principles of the group are not intended to be exhaustive, but rather essential. To these are added, or may be added, certain complementary or specific rules, which depend on local conditions or the level of liability, but which cannot limit the action of the principles. The application of these principles is a condition that must be met by anyone wishing to be part of the group of industrial companies that was the subject of the case study.

Using a tool common to all locations, the investigated company developed an internal audit system to help production unit’s progress, regularly monitoring the development of the Management System, and to support auditors to develop professionally and motivate them, to facilitate the application of good practices and comparison of the implementation stages of the management system. In this spirit, auditors must ensure that the management

system is applied in accordance with existing documents, is effective and consistent with the objectives set.

The management process starts from respecting the legality and setting the OSH management, relying on the involvement of the staff through participatory management in order to implement an organizational culture of safety, as a basic pillar of the WCM "temple". The first ten steps of the audit, the conventional part, are more about legislation, documents and internal rules. Steps 11-20 represent the participatory part, where employee involvement is measured. The result of the audit, the grade obtained, indicates the stage of development of the management system, making a parallel with the WCM continuous improvement program. The development of the management system, until reaching the point where we have a safety culture implemented, is followed by the audit in 20 steps, audit organized by the company every 4 years, the results indicating at what point of development the organization is at the time of audit. The result of the internal audit gives individual grades on each of the 20 steps, each step being composed of a series of questions, which in the end generates a score on Environment, Health and Safety, as well as a global one on that step.

The importance of implementing proper management always depends on the will of the management, the awareness of the importance being later transformed into a way of working that makes the objectives set: zero accidents at work and zero occupational diseases to be really objectives that guide the activity. Different pillars of the World Class Manufacturing model show the diversity of issues to be tackled, diversity of models, tools and techniques.

The importance of Health and Safety becomes more and more increasing as the employees, the Romanian society realizes that a healthy work environment brings benefits to the society. The involvement of the staff in the OSH activity is very important, one designated person / OSH department per unit cannot include and monitor the complex activity that is carried out. Properly trained, supervised employees, involved in risk assessment / reporting / reduction projects / programs, become more responsible, and at some point form crystallization points that attract other people with the same or similar concerns around them. The critical mass thus formed, as it grows, will attract more and more workers, who will turn into employees who observe - react - act and then communicate. This is what we want to achieve, at the moment when the company will have a functional generative organizational culture.

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