

DETERMINANTS OF THE CONCEPT OF CONTINUOUS IMPROVEMENT IN MANUFACTURING COMPANY - CASE STUDY

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ABSTRACT

The article concerns the application of the continuous improvement concept and its evolution taking place in a manufacturing company from its implementation to the achievement of the maturity phase. It presents a theoretical analysis of the continuous improvement concept from the Deming's definition to modern interpretations. Next, the results of research on the identification and analysis of the factors determining the realization of this concept are discussed in a company producing electronic components and the results of its application on the three levels of the organization are presented, such as: management, team and individual.

Keywords: continuous improvement, Kaizen, suggestion system, critical success factors

1. INTRODUCTION

Companies operating in the market today have to meet very high demands posed by the modern economy. Among many organization's improvement possibilities there is one, which has derived from Japanese companies, which brings them great success, it is the concept of Kaizen. Currently, it has become the basis for good management practices; it combines philosophy with troubleshooting systems and tools aimed at continuous improvement of external and internal customer-oriented activities. Japanese approach to Kaizen is based on the work, experience and approach of Imai, who described its role and place in the company's management and created the basis of this concept, meaning continuous improvement for both the management members and all employees of all levels [6]. However, at this point one should also pay attention to the concept of continuous improvement (CI), which, according to the analysis carried out by the author regarding the concept development, is usually considered as a synonym of Kaizen [4, 3]. It is defined as: continuous and infinite improvement of production processes and services that causes the improvement of the quality, productivity and reduces costs, or: the process implemented throughout the company, focused on continuous incremental innovations, or: planned, organized and systematic process of permanent, incremental and company-wide changes of existing practices, aimed at improving the company's activities [8, 9]. Continuous improvement is also related to quality management and is understood as a project undertaken in order to obtain additional benefits both for the organization as well as for its customers, which may concern both actions and products [5].

The purpose of this article is to present the concept development of the continuous improvement in the exemplary manufacturing company and an indication of the key success factors for its implementation and operation. In the conducted analyses, quantitative

(performance measurement) as well as qualitative research (direct observation, document analysis, partly structured interview) has been used.

2. APPLICATION OF THE CONCEPT OF CONTINUOUS IMPROVEMENT IN A SELECTED EXAMPLE

Research concerning the determinants of development of the continuous improvement concept was carried out in a company producing electronic devices. For many years, the company's strategical priorities have been the quality and efficiency, vital in building of the competitive advantage. In 2008, the company's management decided a formal introduction of the principle of continuous improvement to the set of organization's priority strategic objectives, making it a management concept. It began with launching of the improvement activities program at the team and management level. A year later, changes in the organizational structure were introduced and an independent new organizational unit was appointed, whose task was to manage the company's operational activities in the process improvement. In the company's organizational structure, it took an autonomous position in relation to the operation activity area, reporting directly to top management. It means a possibility of a self-activity, taking into account the objectivity and independence of the assessment of individual processes. It also allows the realisation of the objectives, which were assumed by the company in terms of continuous improvement, regardless of the current situation and possible obstacles appearing in the daily operations of the production system. It should be noted, however, that the goals of the continuous improvement section and operational objectives are consistent.

The development of the scope of the company's continuous improvement is included in three stages, in which changes in the company in the area of improvement, measurement and management have been indicated.

The first stage of the concept implementation, took place in the years 2009-2011, it included activities related to the preparation for the implementation of the principles of continuous improvement, the introduction of the first formal decisions and procedures for activating the program, initiation of rationalisation teams' work and the suggestion system and then the appointment of an organizational unit responsible for the program implementation. Measurements concerned the results obtained by the processes for the OEE (Overall Equipment Effectiveness) coefficient, they concerned costs of internal faults and results directly related to the program, which is the number of reported and accomplished suggestions. In the area of business' management principles, the changes concerned the introduction of the leadership, based on the culture and management principles arising from the concept of the continuous improvement.

The second stage in the concept development is a continuation of activities within the work of the teams of the continuous improvement and the suggestion system as well as the introduction of a new approach to process rationalization, based on methods related to the accomplishment of the Lean Manufacturing concept, i.e. 5S, TPM (Total Productivity Maintenance), waste reduction, the organization of the production pull-system flow, added-value analysis. That was due to the launch of the accomplishment of the perfecting projects. In the area of the management, a large emphasis was laid on the development of the employee's own responsibility and the continuous learning throughout upskilling and mentoring, what means discovering and developing the potential of the staff employed in the company.

In the third stage of the concept development of the continuous improvement in the company, some new activities in the area of perfecting appeared, these were the Lean activities which were also launched in the areas of administration and development. Additionally, projects were launched in accordance with the DMAIC (Define, Measure, Analyze, Improve, and

Control) approach, which is the optimization of processes using statistical analysis. In the management area a new approach was undertaken, it is called the Lesson Learned Approach, therefore accepting the principles of the self-learning organization. In the measurements emphasis was put on the measurable objectives and analysis of the obtained results.

2.1. CI at the management level

In the management basing on the concept of the continuous improvement, the action basis is deemed to fulfil two functions: maintenance and standards improvement [6]. According to this approach, one may not make any amendments without pre-determined standards; therefore standardization is one of the natural elements of the concept. In the company, in which the research was conducted, the standardization has been ensured through the use of tools such as manuals and procedures, describing the way of acting in the processes and workplaces. To a large extent, this has been helped by the quality management system, existing in the company, in accordance with ISO 9001: 2008, which became the basis of obliging and structured solutions in workflow and processes.

The accomplishment of the principles of the continuous improvement is also associated with the interdepartmental management; it means to coordinate activities in the accomplishment of the interdepartmental goals and objectives at the level of processes. Thanks to the flat organizational structure it is coordinated by the company's chief operating officer, assisted by the section of the continuous improvement. For the top management two categories are important: relating to factors such as: profit, market share or production volume and relating to the improvements, various company's systems and interdepartmental-actions. In the company, not only targets are determined but also ways of achieving them. Both the objectives delegation and the interdepartmental management, PDCA cycle applies. The interdepartmental objectives are defined before the departments' ones.

The annual targets for the profit rate and CI are determined on the basis of long and medium-term company's goals. In formulating the objectives, one takes into account the results of the last year and the assessment methods for their rationalization. After determining the annual goals by the management, they are delegated to lower levels. In order to accomplish the company's policy, managers of lower levels must start acting. The lower the level, the strategy becomes more precise, till the detailed measurable targets. Delegating objectives requires interpreting strategies according to own responsibilities and procedures.

2.2. Continuous team -oriented improvement

In the analyzed company, actions at the team level are stable, reproducible activities are represented by CIP teams (Continuous Improvement Project), which are the equivalent to the Japanese so-called quality circles and so called Kaizen teams invoked to solve the problems reported to date. During their work teams use old and new tools of the quality management and in order to design the process flow the SIPOC (Suppliers, Inputs, Process, Outputs, Customers) technique is used. The company applies a temporary workers' release from their daily responsibilities and redirects them to the group participating in the improvement workshops. The number of people participating in the meeting depends on the scale of the problem and ranges from 6 to 12 participants, among whom a team leader is appointed, as well as a moderator, so called sponsor (the owner of the process whom the problem concerns), and possibly also an expert mastering extensive knowledge on the subject. The average duration of such an improvement workshop is about two working days. Undoubtedly, the success of the Kaizen' teams' work depends on the proper definition of their tasks and goals, on the possibilities of cooperation with a thoroughly selected expert and the attitudes and actions of the team's leader (actions' coordinator). A large impact on the effect of their work has also the meetings organization and directing of its course. Therefore, the company

has adequate tools, allowing a perfect preparation of the workshop, such as: ‘a check list’ designed to check the status of preparations and the agenda containing the initial objectives of the project, e.g. a tools selection to solve the problem, a set of data necessary for analysis, or a possible proposal to the expert. Each project, which is accomplished through the workshop, requires a description of the current situation and the problem as well as the identification of goals that the team intends to achieve. At this stage, an estimation of financial and non-financial effects takes place that the goal accomplishment may bring. Conducting workshops ends with the elaboration of proposals to solve the problem, defining the project range and the date of its completion. A coefficient to measure the realised goal is determined.

The practice of the workshop conducting, which are attended by Kaizen teams, thanks to their organization's refined procedures and their conduct has become one of the most important techniques for collective problem solving. Each year the number of such meetings increases (from 2 meetings in 2011 to 17 in 2014), what proves a high effectiveness of this action form. Due to such action, determination and realization of the goals increases team's integration, its members share and coordinate tasks more efficiently, the vertical and horizontal communication is rationalised additionally employees' morale goes up. Except that, the employees, through participation in workshops and continuous improvement projects, broaden the range of their skills and knowledge.

2.3. Continuous improvement at the level of an individual employee

Kaizen oriented on a unit appears as a form of a suggestion system, which enables the possibility of rationalisation of the operations performed by a single person and has a positive effect on the level of their work commitment. The management does not expect immediate economic effects but also pays attention to the employees' morale.

The suggestion system, however, must be properly organized. In the analyzed company it was divided into two parts: individual suggestions and group recommendations. The suggestion system enables the opportunity of a direct conversation between the employee and their superiors, improves bilateral communication and gives employees the opportunity to help employees in problem solving.

The number of the suggestions reported by employees is considered to be an important criterion for assessing the work quality of direct supervisors. Senior supervisors should support the staff directly supervising employees, so that they may support them creating more suggestions. The aim is to allow the presentation of a large number of suggestions, and information about that number is placed in an assigned, clearly visible spot of the production facility, in order to encourage employees' to compete (both between employees and between the teams). Standard invented by the employee themselves is also for them easier to accept. Operation of the company's suggestion system is considered to be effective, as evidenced by the results listed in Table 1.

Table 1. The results of the suggestion system

| Year | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|--------------------------------------|------|------|------|------|------|------|
| Number of completed applications | 24 | 153 | 393 | 641 | 1195 | 1254 |
| Number of applied proposals | 307 | 284 | 402 | 1335 | 1645 | 1626 |
| Percentage of completed applications | 8% | 54% | 98% | 48% | 73% | 77% |

Source: self elaboration

With the increase of the number of reported and accepted applications suitable for the accomplishment, an analysis of the average time to achieve them was ignited. In the period from January to September 2014 it turned out to be 30 days, which means the need of the

analysis of the reasons of such a situation and an introduction of actions enabling a quicker response from the staff responsible for implementing the changes.

3. KEY SUCCESS FACTORS OF THE CI CONCEPT

The conducted analysis allowed to confirm the efficacy of the continuous improvement program accomplished in the company as well as to identify the key factors for the program success. They were determined on the basis of nine areas, in area of which the requirements of the CI concept are accomplished (table 2).

Table 2. Key success factors of the CI concept

| Area / requirements | Key success factors |
|---|---|
| Program formalization and the determination of the action structure. | The formal program of continuous improvement. The formal structure of the action. A specific action plan for the development and improvement projects. |
| Determination of the continuity principles and control of their turnaround times. | Stable continuous improvement program based on the accomplishment of clearly defined development objectives. Monitoring of the objectives accomplishment. Analysis of the execution time. |
| The distribution and the activity range. | To reach all levels of the organization with the upswing procedures. System approach. |
| Training. | Special training in the area of: - methods and tools to analyze and solve problems, - the principles of teamwork, - methods and techniques for process perfecting. |
| Management commitment. | Providing required resources. Integration of CI with the strategic objectives. Setting up of the policy, system and procedures of actions. Building a culture of the continuous improvement. |
| Coordination of the program. | An appointment of the internal coordinators to support the CI activities, facilitating the access to resources and to the methodological advisory for the improvement teams' members and other employees. |
| Methods and tools. | The application of scientific methods and tools to identify problems and to analyze their reasons and to accomplish the projects included in the elaborated improvement plans. |
| Results measurement. | Defining of measurable goals. Monitoring results in the area of specific parameters. |
| Communication of the results, a form of motivation. | Application of selected communication forms: information boards, staff meetings. Identification and the application of the incentive system (recognition and encouragement). |

Source: self elaboration

In the area of the program standardization, the factors which successfully stimulate its accomplishment are: the introduction of a formal program for the company (in the form of existing procedures), the determination of a specific structure of its operation and the elaboration of the implementation of the actions development plan and the improvement projects. The activities continuity and the time control of their execution are ensured by the constant and consistent accomplishment of specific goals and the monitoring of its progress in action. In order to ensure the widest possible range of perfecting activities, the procedures

comprise the entire company and the system approach is applied. Another area is the training, which in the company is carried out primarily with courses prior to the accomplishment of Kaizen workshops, as well as the workers' assignment to external training. The company's management considers the continuous improvement, as an indispensable management tool and puts great emphasis on building an organizational culture based on the principles of CI. Other key success factors in the accomplishment of the concept are: actions of the organizational section responsible for the CI (coordination of the program), methods and tools which were applied (Kaizen tools and the quality management tools), the definition of measurable objectives and the results monitoring (performance measurement) as well as the use of some communication forms: information boards, staff meetings (results communication).

4. SUMMARY

As the presented research analysis concerning the application of the continuous improvement concept reveals, in order to be successful in this area, it is necessary to engage the top management, the program acceptance of all employees and to overcome resistance to changes. It is important to ensure appropriate conditions for its development, both in the social and the technical area. Therefore, it is necessary to build a work culture and an organizational system allowing the introduction of the substantive and technical improvement actions in terms of the accomplished processes. The identified key success factors should be considered by companies that are interested in the continuous improvement, as particularly important conditions for the concept development in its practical application. The results obtained in the analysis in polish enterprise, confirm the conclusions resulting from the research in different countries carried out by Aoki, Al Smadi and Marksberry with the team [1, 2, 7].

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