KAIZEN AS THE TOOL FOR SUPPLY CHAIN FLEXIBILITY RAISING

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Abstract

Present, very dynamic competitive market environment requires supply chain very quickly responds on changes on the market. Thus companies involved within supply chain are seeking for methods how effectively and reliably fulfil often hardly predictable requirements of their customers. This contribution deals with tools used when Kaizen is applied which allow continuous improvements of processes without implementation of an expensive innovations. Results of primary investigation focused on estimation of implementation of these tools for production process improvement in chosen company are here given.

Key words:
Kaizen, PDCA, SDCA, 5S, continuous improvement.

1. INTRODUCTION

In the present period of recession, a lot of enterprises aim to improve their services and strengthen the customer loyalty through enhanced quality, lower costs, saved time, meeting deadlines, and all of that without the risk of long return of new investments. Kaizen, as a strategy based on the opinion that whatever you do, you can do better is one of possible tools how to achieve it. For kaizen application in operations, the Japanese have their own term, so-called Gemba Kaizen. In economics, it represents a workplace, a production operation, where the value that makes the customer satisfied is added to the products or services [1]. Kaizen is a way of thinking focussed on the production process, as compared with the Western way of thinking, focussed on innovations and results. While innovation represents a fundamental improvement as a result of large investments into new technologies or facilities, kaizen denotes small improvements in the period of status quo as a result of incessant efforts [2]. Innovations and inventions are basic preconditions for successful business, which can be characterized by a continuous change, elimination of conservatism and excessive caution, continuous renewal of the ability to compete and grow [3]. Enterprises mostly opt for the kaizen way due to lower costs without affecting the level of quality. In practice, it means reaching compatibility between enhanced quality and lower costs [2].

This paper deals with the tools used for application of kaizen, particularly in production. It presents the outcomes of a primary survey aiming to describe and evaluate the impacts of kaizen implementation on the improvement of the production process within a selected enterprise in the Czech Republic. Targeted literature search in scientific literature, a method of in-depth interviews with the production technologist responsible for application of kaizen in a chosen company and an analysis of the provided intracompany documentation were used as research methods and sources.

2. ESSENCE OF KAIZEN AND USED TOOLS

Imai explains kaizen as an improvement strategy, a strategy how to do things better, while all activities should finally lead to the increased satisfaction of the customer [2]. Kaizen focuses on small, gradual, and frequent improvements over along period of time with minimum investment of financial resources [4]. Pernica points out that the approach of a continuous improvement leads to small but frequent effects through tiny changes in the existing system [5]. Liker describes kaizen as an overall philosophy striving for perfection every single day [6]. It is the process of ensuring growth improvements, however small they are, and achieving “leaning” in the form of elimination of all losses producing costs without adding any value. Kaizen
teaches individuals the skills of efficient work in small groups, problem-solving, documenting and improving processes, gathering and analysing data, and self-management within a group of co-workers. Its application in the workplace means permanent looking for and elimination of wasting and a continuous improvement in the production, quality and flexibility, involving everybody – managers as well as ordinary employees [1], [2], [7]. Wisner and Stanlay define continuous improvement as a process-oriented way of thinking and a proactive management approach to problem solving within an organization. Rather than waiting until a problem occurs or the competition is threatening their business and then reacting or „firefighting”, companies should be organized at all levels to make incremental improvements continuously, always with the external customer in mind [8].

The starting point of an improvement is the ability to see the need for an improvement, i.e. the ability to see and be aware of the problems and the places of wasting. That is why satisfaction is the main enemy of kaizen. As soon as the problems are identified, it is necessary to solve them. At the same time, the principal roles are played by the employees. When managers give employees the tools, support, and encouragement to help them identify problems, evaluate alternatives, and make the appropriate decisions, products and process will improve [8]. To make the achieved level enduring, each improvement must be standardized. When kaizen is applied in a workplace, everybody in the company must strive together with the others, for implementation of three rules: improvement, elimination of wasting, and standardization [1].

2.1 The Process of Improvement in the Operation

If a company wants to improve its present production activities and solve problems arisen there, it is important to start from the organization and cleaning of the entire production operation. For this purpose, the kaizen strategy uses a procedure known as five steps of good management, or 5S: Straighten, Scrub, Systematize a Standardize [1]. It aims to achieve a clean workplace and overall organization in the production as the basis for improvements.

If the managers are to make right decisions about the production and eliminate shortcomings, they should fully understand and know the whole production process and they should not rely on reports from workplace supervisors only [2], [9]. That is why kaizen points out that understanding of the operation is the first step towards effective production management, and for that Imai has created the following five rules of workplace management [1]: Discover the problem, its origin, and if it has arisen in the production process, visit it. Check the material objects in the production process, i.e. a broken machine, for example. Take temporary measures at the site. Find the original source of the problem, using the method of asking right aimed questions. Introduce a standard to prevent recurrence of the problem - It is introduction of standards /instructions for the staff to be strictly observed.

However, introduction of these steps may bring a problem of potential opposition to the changes from the side of the staff. Therefore it is necessary to make your staff familiar with the details of the application and with the outcomes to be achieved before the actual start of the process of improvement. To motivate your employees, it also proves to be useful that the company management takes records of the changes in the workplace from the state before introduction of 5S, during the whole course and after its introduction [1].

A tool used to ensure a continuous process of maintenance and improvement of standards is the repeating PDCA cycle (Plan, Do, Check, Act), also known as the Deming wheel [1] [10]. In the first phase, a plan of activities is created to achieve the improvement target. Such a plan is drawn up using the statistical tools used for analytic problem-solving in the case there is enough data, so-called seven QC (Quality control) tools or the New Seven in another cases [2]. The second phase consists in implementation of this activity plan. The check phase determines and decides whether the implementation goes well and brings the expected improvement. The last step resides in implementation and standardization of new procedures or in setting new targets for further improvement [1], [2]. However, before you start working with this cycle, it is necessary to stabilize all the running processes. It happens within a so-called SDCA cycle (Standardize, Do, Check, Act), which refers to maintenance. The company management might not see any benefits for the company in
these improvement processes at first sight. However, without implementation of these improvement processes, the company can hardly find any abnormality in the operation in time and start solving it immediately. 5S ensures that the operation is clean and well-organized, the PDCA cycle the possibility of solving the arisen problem. To solve the problem properly it can be also use e.g. Ishikawa diagrams, tree diagrams, and flow diagrams [1], [8].

To improve entrepreneurial activities in the area of quality, cost, delivery (QCD), the company management should introduce the three systems: total quality control (TQC), total productive maintenance (TPM) and just in time (JIT). The main target of the quality management is the overall quality as a tool for building interaction among all the elements responsible for the company activity aiming to achieve better quality and to satisfy customer requirements. The management often delegates the quality control to the production staff as they are usually the first employees who discover a problem and also they have an idea of how to cope with it best. Therefore so-called quality control circles are established as voluntary employee teams [1]. They choose a problem in the production by themselves, and under supervision of experienced advisors they solve its elimination and propose remedial measures. They carry out their activities continuously as a part of a company-wide quality control program, self-improvement, mutual improvement, flow control and general improvement of everything in the workplace. The role of the management is to motivate the employees in the circle. It is also essential that the management does not focus their evaluation on the outcomes, but on the process (activity, attendance, number of resolved problems, etc.) [1],[2].

TPM aims to focus on the quality and ensuring the maximum possible efficiency of the production facilities for the whole period of their life. TPM concerns everybody in the production process. Its essence lies in overcoming the traditional way of dividing the employees into those who operate the machine and those who maintain it. That is why the essence of TPM is transfer of the biggest possible number of diagnostic and maintenance activities to the worker operating this machine [11]. However, it is conditioned by high-quality training of the operators. JIT is not limited to a separate company, but its proper implementation requires involvement of all the suppliers. It is focussed on the costs and supplies in the entire supply chain. As a communication tool, and at the same time as the supply control system, the company management can use so-called Kanban cards [1], [10], [12].

2.2 Elimination of Wasting

Wasting represents activities that do not add any value to the product. Ohno defines seven categories of waste: the waste of overproduction, inventory, making defects, motion, processing itself, waiting, and the waste of transportation [1]. The management aims to eliminate all these types of waste [13, [19]. It is also connected with elimination of irregularity (mura) and strain (muri). Anything that is irregular or needs effort gives a signal that there is a problem. Any interruption of a smooth workflow, production plan or movement of the products on the line is closely related to generation of waste. For instance, work of the others has to adapt to the slowest link. Strenuous conditions for the staff, machinery, and the entire working process can arise, for example, by hiring a new employee without sufficient training.

To recognize and eliminate wasting, companies make use of various methods, e.g. the SMED method (Single Minute Exchange of Die) or the analytical VSM tool (Value stream mapping). The SMED method aims to reduce the changeover and start-up times of a machine/facility. It is implemented in three steps - analysis, proposal for an improvement, and implementation of measures for improvement, which should lead to standardization of the processes. See more about this method in, e.g. [14]. The VSM serves for value stream mapping in production and administrative processes. It makes use of graphic illustration of a value stream, which can be financial, material, information or another, and helps to understand the entire stream of production processes more deeply. In the practice, it is used as detailed visualization of processes, and enables the management to discover the roots of unnecessary wasting with the sources and discover the bottlenecks and the grounds of inefficient flows anywhere within the organization. Implementation of this method consists in identification of target products, plotting all the activities connected through the target, evaluation of the present state on the basis of the drawn-up map, and work on plotting the future state [15].
2.3 Standardization

After successfully achieved improvement, there is a step consisting in introducing standards. They are based on introducing pre-agreed, formally drawn-up plans according to which everyday company routines are performed. It is essential to check whether all the standards are updated and observed. If there is a problem, it is necessary to collect the needed information and make a proposal of a more perfect standard. Kaizen differentiates management standards concerning the internal staff management (these include, for example, directives and administrative regulations) and operational standards, focusing on the external staff management [2]. Also here it is true that the company management should primarily focus on sufficient familiarization of the staff with the benefits of the newly introduced standards, particularly where they will make their work easier, and then, after their implementation, check whether they are observed. As soon as an employee accepts a standard, he/she complies with it and it becomes a natural thing for him/her, the company management can consider another improvement. If a standard is unsatisfactory, or there is any abnormality during its observance, it is important that the managers solve this problem. They proceed according to the above mentioned four-step SDCA model implementing changes. If an operation fails to be successful, the managers should look for the original source of the problem, then take remedial measures and change the working procedure. This cycle repeats continuously and standardizes the existing processes in the company [2]. If a standard is introduced, the employees comply with it and the process is without abnormalities, the production process is under control, the staff work efficiently and the product reaches the given quality. However, it is necessary not to become satisfied with introduction of a standard, but continue in its improvement using the above mentioned PDCA cycle.

3. OUTCOMES OF KAIZEN APPLICATION IN A SELECTED OPERATION

The processes of kaizen application, used tools, and outcomes of this application have been researched at the Czech branch of a foreign manufacturer. The corporate vision is to provide their customers with complex services in the area of decorating products. The Czech plant belongs, due to its production capacity, to the biggest companies in the Central and East Europe. It deals with making a design and logo, production consisting in decorating, packaging and distribution, including production of exclusive gift and promotion sets. The company aims to build up direct cooperation with the end sellers, who are chain stores, small retailers, and at the same time big consumers. With respect to the strong competition, the company leads its individual production plants to mutual “fight for prestige”. Therefore, each plant makes an effort to bring improvements in their existing activities. The researched plant has decided to improve its present results in the production process through the kaizen strategy [16]. Its implementation was carried out under the patronage of the professional company Kaizen Institute.

The kaizen application itself was performed in the four steps: staff training, the SMED method application, the 5S application, the VSM application. Step 1 was staff training, which was carried out for the period of 4 months, always one day a week. The participants (the logistics management and the production technologist) were first familiarized with the basic principles, methods and tools of the Kaizen strategy. The first chosen problem to solve was a long machinery changeover time when a product or decoration changed. As there are 4 identical machines in the operation, the expectation was significant improvement in the form of reduced changeover time affecting flexibility of the entire supply chain. The SMED method was used to recognize and eliminate the waste of time.

That is why the attention in Step 2 was paid to the SMED method. There was a three-day workshop. On the first day, there was theoretical education of the staff involved in the changeover (i.e. operators and setters, line supervisors, technologists and continuous improvement assistants). After getting acquainted with the workplace, the time sequences of individual activities carried out during the changeover, including the time of individual journeys the operators need to get the necessary material and tools for the changeover, were monitored. The gathered data was analysed to identify and describe potential wastes. In total, a changeover of one machine took about 120 minutes. On the second day, the participants divided the changeover
activities according to external and internal times. Then there was brainstorming between a representative of the Kaizen Institute and the workshop participants, which aimed to propose technical and organizational improvements in the machine changeover. It resulted in suggesting the first improvement, focussed mainly on the internal activities. The estimated reduction in the changeover time was 40 minutes. On the third day, the machine was set up according to the proposal and duration of all the activities was recorded. When the outcomes were analysed, the participants drew up the final scenario of the changeover, which included, among others, new distribution of responsibilities, the way of reorganizing a part of the workplace, and some other steps necessary for the maximum time reduction. And finally, the results of the improvement were evaluated and presented. The original changeover time of 120 minutes was actually reduced to only 62 minutes. Another outcome was a significant increase in the time the machine was in operation. It increased from the original 45% to 91% through elimination of the planned shutdowns and reduction of unplanned shutdowns of the machine. At the same time, the operation revealed substantial shortcomings, e.g. a lack of working tools, inobservance of the obligation to use protective equipment, wrong material marking, or wrong tool placement. These shortcomings were the subject matter of the solution in step 3, where the five steps of good management were introduced.

The employees were first familiarized with the principles of individual 5S steps and with the new procedures. The objective was to achieve a cleaner and better arranged production operation and also to encourage the employees to express their own ideas concerning the 5S procedures; continuously improve, develop and standardize the 5S in all the workplaces. For this purpose, a team consisting of the supervisors of individual workplaces of the production operation responsible for proper implementation and observance of the 5S in their workplaces was established. Before each implementation the team were trained. All the workplaces were gradually modified. They were tidied up and all useless, obsolete or damaged working tools were separated and subsequently removed. Storage places for necessary things were marked and each employee was made familiar with the obligation to observe them strictly when the tools are stored. At the same time, the space for putting down the products ready for firing was enlarged (about 22m²) as desired, as one of the workplaces was moved closer to the kiln workplace. For the reason of clearer arrangement, individual workplaces, including the working tools, were marked with different colours. This prevents confusion of the working tools between different workplaces. Reworking of the existing standards followed. It resulted in the standards displayed in a simple form as e.g. workplace visualization, packaging standards, which makes individual ways of packaging clearer according to the needed number and type of boxes. Then it was set that all the workplaces of the given production operation will be internally audited every 6 months. The internal audit aims to check and subsequently help improve the existing state. As an example of shortcomings discovered this way, some unnecessary shelves have been cancelled, some other useless things have been removed, missing visualization of the working tools has been completed, and material has been reduced. The discovered shortcomings, and also their potential elimination, are presented on the 5S chart placed directly at the entrance into the production operation.

In Step 4, the management specified the discovered shortcomings in the process of the production. The attention was focussed on mapping the value stream of a product chosen in advance to make the production more efficient. It was done using the VSM tool. The created map represents the journey of the order, including the information flows, from the customer via the sales persons into the SAP IS, creation of a production plan, placing an order with the supplier, receipt of pallets, the production process itself, packaging, as far as the moment the order is sent to the ordering party. The management’s evaluation of the existing state showed that there was excessive waste of time due to frequent stops of the order between individual posts. That is why the proposed changes concerned the scheme of the production line consisting for one thing in a new arrangement and for another in attaching a new belt. It aimed to decrease the need for transport and for stops of the order between two particular posts. This new arrangement makes it possible to work on two orders at the same time. It has resulted in a shorter route the particular monitored order had to pass by 20,632 metres (from 22,219m to 1,587m) and in the total necessary time on the production line by 1,700 minutes (from 2,375 to 675 minutes). This means that application of the VSM brought for one thing a
decrease in strenuousness of the employee’s work and for another an increase in the speed at which an order passes through this workplace.

Within searching for another improvement and elimination of wastes, the attention was turned again to the workplace, where the machines are changed over. It discovered the waste of time in connection with frequent machine changeovers for orders of smaller numbers of pieces. After a careful analysis, it was finally decided to invest into a new machine adapted specially for small orders.

4. CONCLUSION

The decision on application of kaizen in the production operation was made at the end of 2008. Since then, the gradual steps and implementation of the three rules including improvements, elimination of wastes and standardization have resulted in achievement of significant effects in the existing production system. The SMED method application has brought reduction of changeover times by 58 minutes, i.e. reduction of 48%. At the same time, the time this machine is in use has been substantially prolonged. The time it is not in operation has been shortened from the original 55% of the time to only 9% of the time. Introduction of the five steps of good management (5S) has resulted in better arrangement of the workplaces, saved space, modification and introduction of new standards. The VSM analytical tool helped propose a change in the scheme of the production line, which has shortened the transport of the products for one particular order (more than 15 thousand pieces) by 20,632 metres, i.e. almost by 93% from the original length of the route and time savings of 1,700 minutes, i.e. shortening of about 72% from the total transport time. It is clear that all the above measures lead to increased flexibility of the entire supply chain without costly innovations. The decision to invest into a new machine adapted specially for small orders then just confirms the necessity of a balance between innovations and kaizen.

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