Application of the suggestion system in the improvement of the production process and product quality control

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Abstract. The elaboration is a case study and the research was carried out in the company Alco-Mot Ltd., which employs 120 people. The company specializes in the production of lead poles for industrial and traction batteries using gravity casting. The elements embedded in the cast are manufactured on a machining centre, which provides the stability of the process and of the dimensions of the product as well as a very short production time. As a result of observation and analysis the authors have developed a concept for the implementation of a dynamic suggestion system in ALCO-MOT, including, among others, a standard for actions in the implementation of the suggestion system, as well as clear guidelines for the processing and presentation of the activities undertaken in the time between the establishment of the concept (suggestions) and the benefits analysis after the proposed solutions have been implemented. The authors also present how suggestions proposed by ALCO-MOT staff contributed to the improvement of the processes of production and quality control. Employees offered more than 30 suggestions, of which more than a half are being implemented now and further actions are being prepared for implementation. The authors will present the results of improvements in, for example, tool replacement time, scrap reduction. The authors will present how kaizen can improve the production and quality control processes. They will present how the production and quality control processes looked before and after the implementation of employee suggestions.

1. Introduction
The modern market and its tendency to undergo constant changes along with the growing demands from stakeholders of organizations make it necessary to search for solutions that will guarantee achievement of success in the long-term perspective. Short-term reflection on results does not guarantee success, and moreover, it is not sufficient in competition with world-class enterprises [1]. The desire to increase the value of companies and their ability to compete not only domestically but also abroad has resulted in a situation where the improvement of the production and quality control processes is a problem which has to be faced by every company. Companies that have decided to operate in accordance with the principle of continuous improvement find it easier to take steps to
improve the performance of the production process and the effectiveness of their quality control systems. Companies choose different paths in pursuit of this goal, starting with the fulfilment of the basic assumptions of the concept of lean management through continuous improvement of technological processes, focusing special attention on increasing the stability of the production process as a result of extending service life and a reduction of maintenance costs of machinery and appliances, defect prevention during the manufacturing process through the use of e.g. the Poka Yoke method [2], or through ensuring the appropriate level of process safety [3]. In production systems, the level of safety (process safety) depends on its relative dynamics, which consist of the characteristics of a temporary flow of risks and a corresponding defensive and supporting action flow of the system. Recognition of flows and their dynamics is one of the most important factors in decision supporting systems for constant safety and also quality improvement [4]. Manufacturing organizations apply various quality control techniques to provide customers with high quality products. Many of them use methods based on parameters, support vector machine, statistical quality control, neural network, statistical process control. Also in the last years particular attention has been paid to methods which refer to mathematical modelling of controlled products [5].

Kaizen tools were developed for organizations which are constantly seeking effective solutions, among others, in the area of production process and quality control improvement, which do not want to waste time developing complex systems from scratch but want to implement proven methods of improvement. The essence of the many Kaizen tools is appropriate involvement of employees in solving current problems in companies. Today, companies (not only those which operate in the Kaizen culture) more frequently than not recognize the fact that qualified, competent and committed staff is the wealth of the company. Therefore, for example, for several years now companies have been showing a growing interest in the implementation of the Japanese approach to improvement called Total Productive Maintenance, where operators perform basic repairs, maintenance, redesign and hardware configuration to make it more reliable and easier to use [6]. Another tool which directly involves employees in solving problems is the suggestion system. Many Japanese companies involved in the Kaizen program have quality control and suggestions systems which cooperate closely.

In the article the authors attempted to prove that the use of the suggestion system is feasible and effective in Polish enterprises and that small steps improvement, as opposed to innovative changes, is a huge benefit and does not require big expenditures.

The aim of the article is to present how one of the Kaizen tools, the suggestion system, can be used in the improvement of the production and quality control methods.

2. The essence of the suggestion system
The fundamental condition for a long-term existence of organizations is that they learn, regardless of whether they do it consciously or not [7]. Such an approach to the functioning of organizations relies on the continuous improvement of processes by the employees who implement them. The results which this mechanism brings depend on many factors. The following examples are worth mentioning – the skills and experience of employees, their commitment, awareness and responsibility for the quality of products and many more.

Polish enterprises apply an employee suggestion system based on the assumptions of the Kaizen philosophy developed by Toyota and popularized by Masaaki Imai in his 1966 book “Kaizen. The Key to Japan's Competitive Success”, translated into Polish in 2007. In Japan the suggestion system is a Kaizen element oriented towards the individual, according to which the increase in morale and commitment of employees is more important than financial and economic motivators, which in turn are more important in American systems [8]. The employee suggestion system is a useful tool for organizations focused on continuous improvement of processes, expansion of their intellectual capital and implementation of inter-department cooperation instead of competition. Ideas are derived not only from people of above average intelligence, but also from those of average intelligence. Some of the
more progressive companies in the history of modern management realized the potential value of their employees’ ideas for the improvements in the general functioning of their organizations [9]. An employee suggestion should be formalized. Employees should clearly know how it works and be able to submit their suggestions. It is one of the necessary conditions for the stability of the suggestion system [10]. Another condition is making the assumption that even the smallest suggestion from staff should be considered and implemented, or not, as a result of assessment, but it cannot be left unanswered. The decision to implement a suggestion should always be determined from the point of view of the added value its implementation will bring. It is also necessary to allocate a specific organizational unit, which, in addition to promoting the principles of the Kaizen philosophy, will also deal with the analysis and evaluation of employees’ suggestions, communicate with employees, and conduct an ongoing analysis of the status of applications and of the level of their implementation. In addition, it is important to motivate employees to generate ideas and submit suggestions [11]. Incentives can be both financial and non-financial, what matters are that they fulfil their most important function of stimulating employees to think creatively. A situation in which an originator personally implements their proposed solution may be incentive enough. It will raise their morale, increase motivation and responsibility. In order to develop a suggestion system it is also very important to provide employees with adequate resources to generate ideas in the form of the necessary knowledge and tools. But they should also have a work environment which will affect employees’ well-being in the organization and encourage action contributing to increased productivity and creativity [12]. Another principle of the suggestion system is standardization. Implementation of a solution cannot be a one-off event, it should become part of the routine. A standardization process is necessary so that a suggestion once deployed should stay in force regardless of the rotation of employees. It is a key element without which the suggestion system will not be effective in the long term [10]. The employee suggestion system is a tool which, on the one hand, brings measurable benefits thanks to the implemented solutions and, on the other hand, by involving employees and through the visible effects of their ideas and actions, creates a bond among employees, instils loyalty to the organization, makes employees feel part of the organization and care for the best results of the implemented processes.

3. A description of the research and its objective
The research concerning the use of the suggestion system for the improvement of the production process and quality control was carried out in the company Alco-Mot Ltd., which employs 120 people and specializes in the production of lead poles for industrial and traction batteries using a machining process and casting. The machining process takes place on a machining centre, which ensures the stability of the process and of the dimensions of the product as well as a very short production time. The metal processed on the machining centre is brass and the parameters subject to monitoring are its internal and external dimensions and threads. The examined company specializes in gravity casting of lead. For the casting purposes the company prepares and produces moulds for lead. The parameters that are monitored are mainly the temperature of the moulds, the temperature of the lead and the details.

The main objective of the research was to test how the suggestion system can be used to improve the production process and the functioning of product quality control. The results of the research are based on an attempt to answer the following questions:

- How does the suggestion system influence the improvement of the performance of the production process?
- How does the suggestion system improve the efficiency of quality control?
- How does the suggestion system improve other areas of the organization, e.g. safety and ergonomics, power consumption, cleanliness at workplaces and around them, efficiency, impact on the environment?
How is the standard of conduct in the form of the procedure for reporting suggestions proposed by the author perceived by the employees, and does it needs improvement?
The study took into account all the suggestions made by employees in the period between 01.09.2015 and 31.12.2015 (four months). No rules were assumed for grouping employees, e.g. production staff as opposed to administrative staff.

4. The suggestion system in ALCO-MOT
In order to implement the suggestion system in ALCO-MOT the authors developed a standard of conduct in this regard, according to which:

- Each employee may submit a suggestion (an idea) that could improve the production, regardless of their position or length of employment.
- To submit a suggestion, an employee fills in the form “Suggestions cards” (Figure 1), which is available on the suggestions board and/or in the foreman’s office.

![Suggestion card in ALCO-MOT](image)

**Figure 1. Suggestion card in ALCO-MOT**
Having filled in all the grey boxes on the suggestions card, the employee hands in the completed suggestions card to the foreman or to the processes specialist (for employees who do not report to the foreman – the specialist, in this case, performs the tasks of the foreman).

The foreman checks the suggestions card for completeness and relevance. The foreman cannot express their opinion on the reported suggestion. If the form has been completed correctly, the foreman takes the application for consideration. If the form has not been filled in properly, the foreman explains what the employee should correct in the suggestions card and helps them do it.

The foreman forwards the suggestions cards to the production manager (Chairman of the Suggestions Committee) or to the processes specialist. The Suggestions Team includes (as required): production manager (chairman of the team), Chairman of the Board, Manager of the Plant, foremen, tool shop manager, technical operations specialist, processes specialist, and quality control specialist.

The processes specialist records suggestions cards in the suggestions register.

The Suggestions Team meets once a week on Tuesday at 11.30. At the meeting, suggestions cards are dealt with according to the date of their submittal and registration.

At the meeting, the Suggestions Team decides on the implementation of submitted suggestions. If the Suggestions Team accepts a suggestion, it decides on the manner and timing of its implementation. If the Suggestions Team does not accept a suggestion, reasons why the suggestion is unfounded are written on the suggestions card.

Members of the Suggestions Team sign all processed applications.

For every reported suggestion that has been accepted for implementation, employees will receive a prize of PLN100 net (on hand).

The team which will have the largest number of accepted ideas at the end of each quarter will receive an additional prize (each time the prize will be determined with a foreman).

Within three working days from the date of a meeting the processes specialist is obliged to make a note of the meeting and place it in the “Suggestions Team Meetings” catalogue.

Processes specialist puts a notice about the implemented suggestions on the suggestions board (a suggestion card filled in by the Team).

The above procedure for reporting, evaluation and implementation of suggestions was accepted by the Chairman of the Board of ALCO-MOT.

5. Achieved results

During the four months of the operation of the suggestion system in ALOC MOT employees reported 38 suggestions, of which 22 were passed for implementation. Table 1 presents a summary of the submitted suggestions along with an indication of which areas they referred to.

| Impact area       | Number | %  |
|-------------------|--------|----|
| Quality           | 6      | 27%|
| Safety/ergonomics | 5      | 23%|
| Work time         | 3      | 14%|
| Cleanliness       | 4      | 18%|
| Environment       | 0      | 0% |
| Efficiency        | 3      | 14%|
| Power consumption | 1      | 5% |
Figure 2 presents a percentage distribution of the suggestions.

![Suggestions accepted for implementation by impact areas](chart.png)

**Figure 2.** Suggestions submitted by ALCO-MOT employees accepted for implementation by impact areas

Suggestions accepted for implementation, however different were their impact areas, always contributed to the improvement of workplace operation. The most frequently mentioned effects include:

- shorter work time, e.g. replacement of the HSS knife for a carbide plate contributed to the shortening of changeovers time from 90 minutes to 10 minutes,
- reduction of the likelihood of deficiencies or mistakes, e.g. through the use of markings on products for reuse, redesigning of baskets for the details (pieces) which, after quality control, had to be returned to the good products container (those details often vary in length, which may lead to confusion of pieces – there are six types of them),
- no need to deal with the problem again by another employee, e.g. the proper way of collecting and securing cardboard waste at the place where it is produced so that the warehouse manager does not have to prepare it for transport. The transport is already prepared in the production area,
- improvement of working tools, e.g. changes to the construction of moulds led to workers not having to spend extra time on their cleaning and shortened the casting time as well as reduced scrap,
- improved communication between the production department and the department preparing moulds, e.g. changeovers cards were placed giving full information on the type of casting a mould is to be changed over for.

Implementation of the employee’s suggestions brought tangible benefits in the form of a noticeable downward trend in the amount of casting defects. The most common types of defects in the examined company are:

- dirt on the pin,
- unevenness on the pin,
• cracks on the pin,
• concaves on the pin,
• too large dimension of the pin.
These defects to a large extent result from flaws or wear of moulds as well as from employees’ inattention. Figure 3 presents a list of defects in the period between 01.2015 and 02.2016.

| Month | Number of Defects [pieces] |
|-------|---------------------------|
| I     | 1175                      |
| II    | 1280                      |
| III   | 1273                      |
| IV    | 1370                      |
| V     | 1357                      |
| VI    | 1385                      |
| VII   | 1377                      |
| VIII  | 1373                      |
| IX    | 1005                      |
| X     | 959                       |
| XI    | 811                       |
| XII   | 757                       |
| I     | 694                       |

Figure 3. Defects in the period between 01.2015 and 02.2016

It is clear to see that as of September 2015, when the suggestions system was introduced, the curve falls. But this is not the end of the work for the production management because the target set for 2016 is to reduce the level of defects to a maximum of 500 pieces. This amount, when compared to the scale of the production, is small and 70% of the material recovered from the defective pieces is used again.

6. Conclusions
Companies operating in the Kaizen culture constantly look for ways to improve their processes. The use of the suggestion system requires involvement of all employees in the improvement process. Their involvement will be the greater, the more the management of the company will respect, process and implement their ideas. When a suggestion is rejected, the employee must be informed of this fact and arguments must be presented. This ensures that the idea has been discussed and all the pros and cons have been considered. By implementing the solutions proposed by employees their workplaces are adapted to their needs, which improves the comfort of work. The article presents a case study of the company ALCO-MOT, its results lead to the conclusion that the use of the suggestion system is possible in a Polish company and it brings tangible benefits. The suggestion system improves the production process, among other, by shortening the changeovers time or the execution time of a process by as much as 80 minutes by changing the HSS knife for a carbide plate. If it had not been for employee suggestions the production management staff would probably have not focused their attention on the analysis of how the knives were selected. Quality control is also carried out in a more efficient manner, which is due to improved communication, the use of markings on products for reuse and the redesign of the baskets carrying the details. The article focuses mainly on the analysis of how the suggestion system improves the process of production and quality control, but other areas of ALCO-MOT operation such as safety and ergonomics, power consumption, cleanliness at the workplace and around it, and the environmental impact also have a chance to be improved through the use of the suggestion system. During the research ways of improving the system proposed by the authors were also considered. Following discussions with employees it was clearly stated that efforts should be made to improve the activities related to the standardization of the solutions in such a way that once implemented an idea becomes a natural method of carrying out work by employees. In summary, the suggestion system proves that no one knows the production or quality control processes better than the staff directly involved in their implementation. Organizations which aim to learn should consciously engage their employees in improvement processes.
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