Application of Kaizen Philosophy in Business Process Improvement in the Automotive Industry

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Abstract **– This paper presents the application of the Kaizen philosophy in business process improvement in the automotive industry in the Republic of North Macedonia using methods and techniques for continuous improvement. The purpose of this paper is to indicate the benefit from the application of the methods and techniques from the adoption of the Kaizen philosophy and the Rational (Lean) production which are actually applied by the companies. Through the implementation of the tools, the processes, efficiency, effectiveness, and quality of the products are significantly improved, and therefore the companies become more competitive in the market.**

Keywords **– Kaizen philosophy, methods and techniques, continuous improvement, automotive industry, Lean manufacturing.**

1. Introduction

The development of the automotive industry is one of the most impressive and influential processes in the modern industry. It is a dynamic and complex process that has a great impact on the world economy, technology, and culture.

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The automotive industry has recognized the Kaizen philosophy as an effective method for improving its business processes.

In R. N. Macedonia, many companies from the automotive industry began to work through foreign investments that introduced a new working concept. The implementation of the Kaizen philosophy and Lean manufacturing grew into the employees' business culture [1]. The philosophy encourages the employees to become active participants in the process of continuous improvement by including them at all levels - from production to management. Adopting this philosophy stimulates innovation and creativity and creates a culture of respect for the knowledge and ideas of workers, which results in constant progress and growth of the company. In recent decades, the method of Lean (rational) production has become an indispensable method in the automotive industry, achieving significant improvements in the efficiency, quality and competitiveness of car production [2], [3]. The application of Lean production in the automotive industry allows the companies to identify and eliminate all types of waste and losses in the production process, whereas the "8 disciplines" methodology (8D) enables companies to identify, analyze, and solve the problems with quality, safety or production efficiency [4]. Through the application of 8D in the automotive industry, companies can improve their processes and products, thereby raising quality standards and reducing costs. The ability to identify, analyze and solve a problem is a key element for success in business. In this context, the method of problem solving represents a systematic approach to effectively solve the challenges and obstacles that may appear [5]. The application of the 5 Why method (5 Why) in solving the root of the problem is a simple but powerful method that allows a deep analysis of the causes of the problem. This method, which is well known in the quality management industry is used to find the real source of the problem, rather than hiding or superficially addressing the causes.

By applying these methods and techniques, the company's goal is to continuously improve business processes by discovering and solving problems [6]. Therefore, the purpose of this paper is to represent the benefit from the application of the methods and techniques from the KAIZEN philosophy and Rational (Lean) production which are actually applied by the companies in the Republic of North Macedonia.

2. Literature Review

Kaizen provides a systematic approach towards organizing the workplace and represents a sophisticated mix of efficiency, competitiveness and organizational survival [1], [3], [6].

The decision to introduce the Kaizen strategy in the automotive industry derives from the top management. Top management provides full support and guidance to middle management for the implementation of this strategy aimed at enhancing business processes in the manufacturing plant. The reasons for such a decision are usually the findings concluded during each tour of the company by the management [7], [8], [9]. The findings are mostly: untidy corridors and production lines, items whose functionality and real position were unknown, semi-finished products, and products of questionable quality for which there was simply no standardized process. For the implementation of this strategy, the top management first forms cross functional teams from the middle management, which define the problems, activities and strategies for implementing and achieving the desired goal [10], [11].

Therefore, the middle management hierarchically shares the information for implementation through standard operating procedures and trainings with other colleagues such as shift leaders, team leaders, auditors and operators in order to involve everyone and have the opportunity for everyone to contribute to the improvement and realization of the processes [12], [13], [14].

The key principle for the purpose of the Kaizen philosophy is to include all the employees in small daily improvements in their work environments without any large investments. The constant improvement of processes and products, as well as the delivery of quality products with the best use of time, materials, equipment, space and labor are the basic principles of the production system of companies from the automotive industry [15], [16]. The unified way of production is the driving factor for achieving world-class results. In this regard, the employees are actively included, thereby raising operational value and expanding the business. The implementation of the Kaizen methodology is based on the PDCA (Plan-Do-Check-Act) cycle, which can be seen in Figure 1. The realization is completed through the following steps [1], [9]:

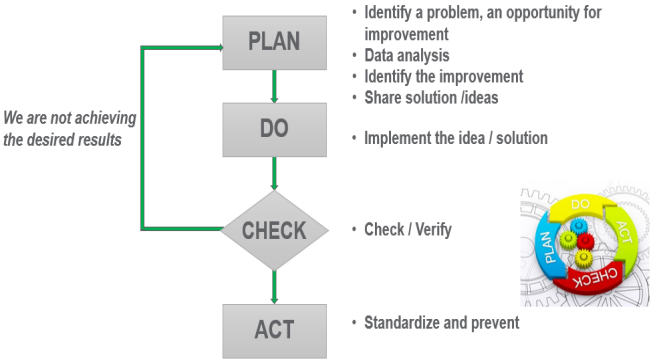

Figure 1. Application of PDCA (Plan-Do-Check-Act) cycle in business process improvement in the automotive industry

3. Results and Discussion

Further in this paper, we show the application of the Kaizen methodology and its tools and techniques for improving the business processes and the quality of work in the Macedonian automotive industry. The main objective of the research is to increase the productivity and the number of final products with minimal errors and defects in the production. The benefits from the application of this methodology are presented through the analysis performed for the individual operations of the automotive production.

3.1. Implementation of the Kaizen Philosophy in the Automotive Industry

The company in the automotive industry, specializing in the production of car seat covers, is the first of its kind in North Macedonia and the eastern region. It has been actively operating for 13 years, with its headquarters situated in Shtip within the technological industrial zone. This is a global automotive seat cover manufacturer for multiple car models and classes for Ford, Mercedes, VW Golf and Volvo. The company has built its own facility with huge plants that are equipped with the most modern ordinary and special machines such as Lectra, Teseo and others. This company produces about 2000 different covers and is recognized for the high quality of its products, which are installed in the cars of the most prestigious brands in the automotive industry. The automotive industry is one of the most dynamic and influential industries in the world, thus this company adapts to global standards, technologies and innovations to improve production processes. During these 13 years, this company has succeeded to establish itself in the market and to demonstrate that it is a desirable and caring employer for employees in R.N. Macedonia.

It is a company that brings value on a global level, offers products of the highest quality for customer satisfaction and contributes to the socio-economic development of the country. The implementation of the Kaizen philosophy in the company from the automotive industry is realized through various tools.

3.2. Application of Improvement Tools and Techniques in the Automotive Industry

Top management on a Gemba tour finds problems in the manufacturing plant. The management decides to form a team for improvement from all necessary sectors, from different levels and positions, which should analyze the situation, discover the problem, create alternative solutions and make a project for implementation and traceability of the solutions. In order to come up with ideas and create solutions, the management team decides to use the Brainstorming tool [9].

Through this tool, every team member, regardless of his/her position or from which sector he/she comes, has the opportunity to provide his/her idea or solution without being criticized. Many ideas can arise from that meeting that will help in the process improvement. Findings identified as problems are most often: untidy corridors and production lines, unupdated information boards with results, semi-finished and finished products of questionable quality, overcrowding of materials and components in cells, non-observance of processes, unsorted waste, unmarked positions of objects and placed objects in an inappropriate place.

In order to improve the processes and eliminate the problems, it is necessary to determine which methods and techniques would be used from the Kaizen philosophy. One method that is very effective for organizing and maintaining the workspace is the 5S tool, as shown in Figure 2.

Figure 2. Condition before and after the application of the 5S method in business process improvement in the automotive industry

This method focuses on efficient organization of the workplace and standardization of the working procedures. 5S simplifies the processes and reduces waste and non-value-added activities, whereas at the same time it improves the quality, efficiency and safety. This tool is composed of 5 processes improvement procedures [9]:

- Seiri (SORT) Sorting unnecessary things;
- Seiton (Set in order) Set in order and marking where and what should be placed after sorting;
- Seiso (Shine) Shining or daily cleaning of the workplace;
- Seiketsu (Standardize) Standardization and acquisition of routine;
- Shitsuke (Sustain) Sustaining all the steps previously taken and motivating employees to constantly respect the entire process.

The 5S method is based on the Lean production guided by the motto that a well-arranged, clean and organized workplace is more productive, makes the working process easier and safer for employees (there are fewer injuries during working hours), improves the feeling of everyone in the environment, increases employee satisfaction, develops teamwork, increases quality and reduces losses in the process, achieves greater motivation and creates a better image for the company.

To solve the problems, improvement teams define a plan of actions which will be implemented in order to improve the processes and reduce the losses. For untidy corridors and production lines, an idea was adopted to define a schedule of daily checks by conducting an audit by an authorized person, a representative from the administration, or a team leader and the findings to be entered directly into electronic records (eLPA). In order to standardize the solution to the problem, it is adopted to perform a checking process in the same order and for this purpose, a 5S checklist with questions was created, so that the same steps are always done regardless of who is performing the checking process, as shown in Figure 3.

5S CHECK LIST

	Criteria
Sort	The waste is properly selected. Waste from processes in the "Scrap" bin. Plastic waste in a plastic bin, etc..
	All unnecessary items have been transferred to the "Red Tag" area
	There are no obstacles along the paths (eg to cell, fire hydrants, emergency exits)
Set in order	All means of work (tools, materials, components, threads...) are in their intended places
	The floors are properly marked and reflect the locations of all items
	The shelves, component boxes, are clearly labeled
	Needle boxes are locked. A key is available and the needle sets are arranged accordingly
	SAB threads and critical material are in labeled place and locked
	All other threads are on their holders
	The Team Leader's desk is arranged according to the visual support template
	All measuring instruments/tools are in their places
Shine	The floor is clean and accessible, without obstacles ... There are no boxes, plastic bottles, materials, in the cell, on the path and the entire area of
	Осветлувањето е задоволително (нема прегорени неонки, нема изваден или прегорени светилки на машините)
	There is no dust or waste on the machines. The pockets are empty.
Standardize	All forms and checklists are up to date
	Trash cans are properly marked...
	All First Aid boxes are in their positions and locked. The key as well as a list of items are available
	All ODS are placed in the intended location on each machine
	Operators wear appropriate Personal Protective Equipment ... Glasses, coat
	TPM sheets are filled out at the start of the shift ... At the start of shift of each machine's
	The "First Cover" process is planned and communicated with Quality Control for approval
Sustein	Were aspects of 5S reviewed during the change shift
	All measuring devices are calibrated

Figure 3. 5S checklist

To facilitate the process for detecting deviations, all objects are marked where they should be placed. If it is determined that there is a deviation, it is immediately reacted to place the object in the defined location. If it has been moved to an inappropriate place or if the item is missing, it is requested to return it to the marked location. In order to continuously remove the irregularities, the management obtains an idea every day 5 minutes before the end of the shift, each employee cleans his/her workplace and leaves it tidy for the next shift. In order to motivate the employees, the management creates a reward criterion on a monthly basis, so that every employee invests and engages in making his/her work environment tidy.

Another tool that belongs to the 5S method is applied to solve all unnecessary items, which is the Red Tag. The Red Tag system is a simple communication tool that is used to identify objects that a person has marked for removal from the work environment. This tool is the first step of the 5S process, as shown in Figure 4.

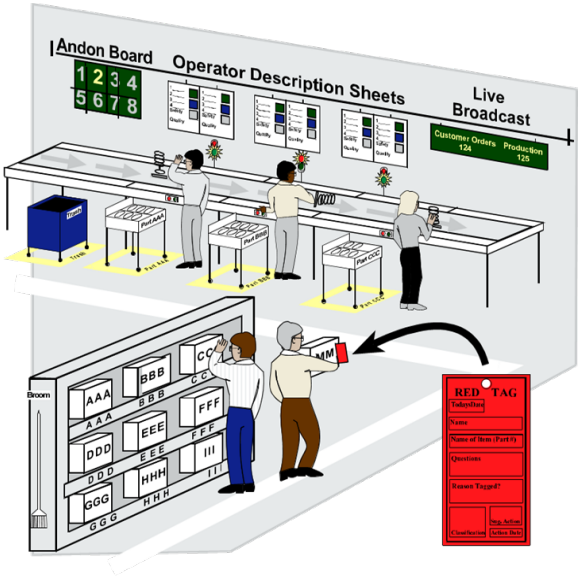

Figure 4. Red Tag work process

This activity can be performed at any time and by any employee in the organization. When the person finds an object that he/she does not even know what it is, he/she should mark it with the defined red mark. That should be a signal to everyone that person intends to remove the found object from the working area.

This prompts a discussion about what should happen next with the found object. The discussion and decision-making should involve the 5S coordinator and the person whom the coordinator thinks is necessary. Then the marked object is deployed in the Red tag area. The coordinator is responsible for the Red Tag area and for the records of the completed Red Tag documents, where all are listed by serial number (marked and left objects in the Red tag area). The 5S coordinator initiates the evaluation of items in the Red Tag area on a daily basis and with the help of a person or persons that the coordinator considers necessary. Depending on the evaluation, the 5S coordinator acts accordingly, discarding the object and/or returning it to use.

The visual factory and improvement teams are part of the Kaizen philosophy methods. Through the visualization of the factory, all non-standard working conditions can be seen and improvement teams are responsible for this, as well as all employees with the opportunity to positively influence the process of continuous improvement. In the production plant, visual markings are defined as markings for departments, cells and sub-cells. There are markings on the floor for the movement of material carts which are marked with a white mark, whereas items that should not be moved from the site are marked with a black and yellow mark. There are countless ways to every production process in a factory to be shown through standardized work [10].

Below are some examples of standardized work in a company from the automotive industry:

- People perform the work in the same order for the same amount of time;
- Production methods are documented with ODS (Operator Description Sheet) and placed on the workstation;
- Workers use the same tools and machines;
- Semi-finished products are always stored in the same place;
- Information is displayed in the same way in all work zones;
- With standardized work, the entire production process becomes predictable, repeatable and stable.

The Layout concept or the schedule in companies plays a key role in optimizing business processes. A well-organized layout can contribute to increased production, reduced costs and improved product quality. When the layout is established in the automotive industry, especially in production, the principles of Lean production are often applied. This includes concepts such as JIT (Just-In-Time) production and the Kanban order control system. In this context, the layout should be designed to minimize losses and increase efficiency. In the production department – sewing department, an arrangement of machines is established by cells/ subcells. Each machine has a defined schedule of operations which through the ODS (operational description sheet), each operator knows what, where, according to which specification, with which materials, components and operation he/she should sew. In a rational manufacturing environment, a process step adds value when it fundamentally changes the nature of the product, such as sewing covers. Any step that does not change the essence of the nature of the product is considered non-value added or loss. There should be no downtime in the production process at least technically. If it happens to be a stoppage of an operator in a cell, a rotation is made with a faster operator, because an operation does not have to be made on another machine that is not defined by layout, and each machine can be determined according to a different specification. The maintenance of the machines is the responsibility of all operators who work on them, but preventive maintenance according to a defined schedule is conducted by the Maintenance department. If a technical problem occurs, the responsible team leader, or the captain in the sub-line calls a mechanic through an electronic maintenance calling system. If the problem is quickly solvable, it means a maximum work of 20 minutes to correct the defect, but if the defect cannot be corrected, the machine has to be removed within the defined period and replaced with a spare machine in order not to block the production process. For even better control of the production process, the Poka-Yoke tool is also implemented [13].

The Poka-Yoke or the Error Prevention Tool is a concept in manufacturing engineering that is used to reduce or eliminate the possibility of errors occurring in the product manufacturing. This approach is based on the idea that processes and tools can be designed to either automatically prevent errors from occurring or detecting them, so they can be corrected before they cause serious problems. In the field of automotive seat cover production, the application of the Poka-Yoke tool is a key element to ensure the process, quality and safety of the product. When it comes to sewing car seat covers, Poka-Yoke systems can be used in several ways to prevent errors and improve the production process. One example of the reliability of the Poka-Yoke tool would be an automated sewing accuracy check system such as the SAB machine, which is a special machine that makes the airbag portion of the cover. This machine is also a Poka-Yoke tool that defines a system - specification of stitches. Always at the beginning of a shift, the responsible team leader checks and verifies the accuracy of the stitches and immediately reports any deviation to the maintenance technician to set it correctly.

The operator who has to work on this machine should have special training and handling access. During the sewing process, if the operator exceeds the number of stitches or it is under the minimum tolerance, the machine immediately blocks. It is a sign that the operation is not performed correctly, there is an error in the sewing of the seam and the pieces should be removed immediately as scrap because no repair is allowed on this operation. Another example is the stitching of plastic components used to install the metal structure of the seat. On a regular machine, a laser is implemented to start and stop the position of the component. If the operator does not position the sewing component correctly, the machine automatically blocks and the component cannot be sewn. Also, the Poka-Yoke tool can be implemented to observe the correct sequence of materials and components for sewing. Marked boxes with materials and components are placed on the machine, on which there are light and sound signals. In order for the sewing process to run correctly, the operator is obliged to respect the sequence. If the operator picks up a material or component in an incorrect order, the sensors themselves automatically block. And for the proper continuation of the process, it is necessary for the responsible team leader to unlock the machine itself with a specific key. In the quality department, the Poka-Yoke tool is the scanner for scanning finished covers. When controlling the cover, the control scans the ID label and on the screen of the computer connected to the scanner can visually see the model of the cover and the correct bar code of ID labels. This prevents the possibility of error. In essence, Poka-Yoke systems for sewing car seat covers not only improve production processes but also guarantee a commitment to the quality and safety of the end product. Using these systems, companies can reduce losses and increase customer satisfaction, resulting in a better and specially designed product.

3.3. Benefits of Applying the Kaizen system in the automotive industry

The Kaizen system brings numerous benefits with it. Some of the more significant ones are improved communication among colleagues, team members and management, as well as employees, this increased awareness, i.e., understanding and seeing the overall goals of the company. Kaizen philosophy improves teamwork, participation of all employees and improvement of teamwork and empowerment for increased control over work and work environment. By analyzing processes and eliminating waste, such as unnecessary movements, waiting time or overproduction, Kaizen helps the automotive companies streamline operations and reduce costs.

For quality improvement, Kaizen focuses on the root cause analysis and problem solving, which leads to the identification and elimination of defects in products and processes. This results in improved product quality and fewer defects reaching customers. Through Kaizen initiatives, automotive companies can optimize workflow, standardize procedures and improve coordination between different departments to increase efficiency. This leads to increased efficiency in production and other processes. Kaizen enables employees at all levels to participate in problem solving and decision making, creating a sense of ownership and pride in their work. Engaged employees are more motivated, productive and committed to the company's success. Through daily improvements, cost savings are made by reducing waste, improving efficiency and quality, thus companies reduce production costs and improve profitability. They achieve this through short-term benefits, but long-term sustainable improvements. Today's automotive industry is rapidly evolving; therefore the companies need to be agile and adaptable to the changes in market demand, technology and regulations. Kaizen facilitates the way of thinking for continuous adaptation and innovation, allowing companies to respond more quickly to the new challenges and opportunities [3], [7], [9].

4. Conclusion

The implementation of methods and techniques derived from the Kaizen philosophy offers an approach towards continuous improvement within automotive companies. Kaizen has enabled the company to achieve sustainable growth and competitiveness by improving business processes and by fostering a culture and empowering employees at all levels to identify and address inefficiencies. By emphasizing the importance of small, incremental changes and including every employee in the improvement process, Kaizen fosters a sense of ownership, engagement and commitment throughout the organization. Through applications such as Gemba walks, PDCA cycles, Lean manufacturing, analysis and problem-solving tools, the company systematically identifies opportunities for improvement, streamlining processes and improving overall performance. The results and analyzes highlighted positive effects of the activities that were performed by standardizing business processes and work obligations through the application of the 5S method. By daily practice of this tool, the workspace becomes more organized and more pleasant for working.

The implementation of the Poka-Yoke method established a process that effectively prevented the mistakes made by operators. Following the innovations and the automation of the processes allows us to facilitate the way of manufacturing and achieving the desired quality of the product. The problem discovery steps identified solutions to all the challenges we faced in manufacturing, supply chain management and product design. After all the changes that have been implemented in the processes, we always have to monitor them and make improvements continuously, because this is how we develop the skills and awareness of the employees. By adopting the principles of Kaizen, the company can more easily adapt to changing market dynamics, encouraging innovation to ultimately achieve higher levels of customer satisfaction and operational excellence.

References:

[1]. Mitreva, E., & Stojanovski, G. (2020). Application of methodology KAIZEN in Macedonian insurance company. *ILIRIA International Review*, *10*(2), 57-77.

[2]. Rajenthirakumar, D., & Thyla, P. (2011). Quality and productivity improvement in automotive component manufacturing company using Kaizen. *Manufacturing and Industrial Engineering*, *2*, 36-38.

[3]. Sundar, R., Balaji, A. N., & Kumar, R. S. (2014). A review on lean manufacturing implementation techniques. *Procedia Engineering*, *97*, 1875-1885.

[4]. Wang, S. X., Lu, W. M., & Hung, S. W. (2020). Improving innovation efficiency of emerging economies: The role of manufacturing. *Managerial and decision economics, 41*(4), 503-519.

[5]. Carnerud, D. (2018). 25 years of quality management research–outlines and trends. *International Journal of Quality & Reliability Management*, *35*(1), 208-231.

[6]. Brito, E., Pais, L., dos Santos, N. R., & Figueiredo, C. (2020). Knowledge management, customer satisfaction and organizational image discriminating certified from non-certified (ISO 9001) municipalities. *International Journal of Quality & Reliability Management*, *37*(3), 451-469.

[7]. van Kemenade, E., & Hardjono, T. W. (2018). Twenty-first century total quality management: the emergence paradigm. *The TQM Journal*, *31*(2), 150-166.

[8]. Barouch, G., & Kleinhans, S. (2015). Learning from criticisms of quality management. *International Journal of Quality and Service Sciences, 7*, 201-216.

[9]. Mitreva, E., & Janeva, A. (2022). Improving Business Processes by Applying the Kaizen Philosophy in a Macedonian Textile Company. *CS. Journal of Digital Science*, *4*(1), 56-70.

[10]. Al Smadi, S. (2009). Kaizen strategy and the drive for competitiveness: challenges and opportunities. *Competitiveness Review: An International Business Journal*, *19*(3), 203-211.

[11]. Wahab, A. N. A., Mukhtar, M., & Sulaiman, R. (2013). A conceptual model of lean manufacturing dimensions. *Procedia Technology*, *11*, 1292-1298.

[12]. Suárez-Barraza, M. F., Ramis-Pujol, J., & Mi Dahlgaard-Park, S. (2013). Changing quality of life through the Personal Kaizen approach: a qualitative study. *International Journal of Quality and Service Sciences*, *5*(2), 191-207.

[13]. Vieira, L., Balbinotti, G., Varasquin, A., & Gontijo, L. (2012). Ergonomics and Kaizen as strategies for competitiveness: a theoretical and practical in an automotive industry. *Work*, *41*, 1756-1762.

[14]. Alukal, V. G., & Manos, A. (2006). *Lean kaizen*. Quality Press.

[15]. Dandin, S. V., & Mench, R. (2015). Development and implementation of Kaizen activities in an Automobile manufacturing firm. *Development*, *2*(6), 60-65.

[16]. Brown, A. (2013). Quality: where have we come from and what can we expect?. *The TQM Journal*. *25*(6) 585-596. Doi: 10.1108/TQM-04-2013-0045