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IMPROVEMENT OF QUALITY IN PRODUCTION PROCESS BY APPLYING KAIKAKU METHOD

Abstract: *In this paper, Kaikaku method is presented. The essence of this method is introduction, principles and ways of implementation in the real systems. The main point how Kaikaku method influences on quality. It is presented on the practical example (furniture industry), one way how to implement Kaikaku method and how influence on quality improvement of production process.*

Keywords: *Kaikaku, 5S, lean manufacturing*

1. Introduction

Before it is defined concepts of kaizen and kaikaku it is necessary to define concept of production system and his improvement. Production is a process of physically making a product from its raw material (CIRP, 1990).

Generally viewed production is complex activity which includesdifferent elements like, materials, machines, human resources and information.Improvement of production quality can be performed on several ways and on any element of production like production processes, production equipment, management structure, employees and organizational culture. During research for improvement it is necessary to take all elements in consideration, and also every way of interaction between them.There are differentparameters which are used to measure competitiveness of production system. Production companies are constantly trying to improve these factors to get advantage on world market.

Generally there are two approaches for improvement of production system: continuous improvement and radical improvement (Kaizen and Kaikaku). The best way for improvement of production is combining of these two approaches.

Kaizen is the continuous improvement of an activity with purpose of increasing the performance in production system usually less than 20 or 30% in given period of time (Radharmanan *et al.*, 1996).

Opposite of kaizen is kaikaku which represent drastic change or radical improvement which is usually resulting of big investments in technology and/or equipment (Imai, 1986). This way of making improvements can be looked as impossibility to constantly improve process, so based on that there is need to conduct radical change in company (Pfeffer, 1998). Kaikaku is not

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like kaizen, which is started by all employees, kaikaku usually starts from top management of company and then goes to lowers levels of workers. This is because kaikaku represent crucial strategic changes (Radharamanan *et al.*, 1996).

Kaikaku is radical improvement where fundamental changes occur in the production system. Initiated often by top management and performance increase is often 30 to 50% or more (Yamamoto, 2013).

The paper is structured as follows: after introduction, realization of kaikaku method is presented in the section 2, example of implemented kaikakumethodin section 3, in the section 4 implemented kaikaku example analyses is presented and section 5 sets the conclusion.

2. Realization of Kaikaku

To determine when to conductdramatic changes it is necessary to take into consideration strategic analysis. There are different internal and external factors that need to be taken into consideration. The external factors are competitive position of company, financial situation, business strategy and similar and internal factors are performance of currentproduction system, skill and knowledge of the employees, technical level of equipment. Upon conducting thoroughness strategic analysis, if it is crucial to conduct radical change in company it is time to carry out it in practice. Constant monitoring of these factors will enable to see on time need for conducting kaikaku and to make detail preparationin order to make better implementation of improvement.

There are several theories that describe process of realization radical changes of quality in production and this can be divided into two groups: systematic approach and contingency and learning approach.

Systematic approach has well defined processes in order to implement radical improvement and contingency approach look on realization of improvement like there is no one best way to organize process in order to achieve results. According to this approach process depend on several internal factors so any changes must start at specific time which is defined by those factors.Researchers, production companies, employees and different consultant firms developed several kaikakumethods for conducting radical improvement. Some of these improvements are Lean Production, Total Maintenance, Total Quality Control, Six Sigma etc.

Lean Production or Lean Thinking is the English name popularized by MIT researchers to describe system that is created in Toyota company (Larman and Vodde, 2009). Lean represents the best production strategy and reason of increasing competitiveness of companies throughout the world (Demeter and Matyusz, 2011). The best proof for this state is increasing number of companies that have implemented this strategy during last few years (Bruun and Mefford, 2003). By implementing lean production in companies sales of products will increase, problems will be eliminated and all expenses correlated with bad quality of products are eliminated and there is increased number of satisfied customers (Carreira, 2004). All this influence on survival of companies on world market allows lower prices of products that attract customers with good quality, time of delivery and similar.

Next to the lean production one of kaikakumethod that is also used in large number of companies is Six Sigma. This is kaikakumethod based on detection and elimination of wastes and their causes in production processes. Improvements of this method provide high quality level of products, high profit to companies and through this improve reputation of company (Lazic, 2011).

Another example of powerfulkaikakumethod for improving quality of production process is Total Productive Maintenance. With

implementation of these method company creates base of information about equipment, expenses of maintenance, performance of critical parts which allows employees to take into consideration all these information and to act on time and stop possiblefailures of equipment.The goal of TPM production is zero defects and zero failures so when that is achieved work of equipment is improved, price of production is better and also quality of products and production process is increased (Bakri, 2012).

Next to systematic approach which was explained here, large numbers of companies consider that the best solutions for radical improvement can be found in literature. This representscontingency and learning approach. Contingency approach considers that production process is inflicted by large number of factors and that there is no one best way to conduct changes, every change must be implemented in exact period of time based on changes of the structure in organization. The best way for implementation is chosen based on analysis of external and internal factors which influence on production process. This was contingency approach and learning approach is connected with improving skills and knowledge of employees inside of company. Advantage of this approach is increased skills of workers but also revaluatedvalues, politics and organization of company. With increased knowledge employees take part in organization of company and they have larger influence on goals of companies, and it can be positive or negative influence.

3. Example of implemented Kaikaku method

Example of kaikaku implementation was conducted in small wood production company which has five employees that are highly skilled workers. After meeting with company top management, in this case owner of company and his main engineer, conclusion was that it is necessary to conduct large improvements in quality of products and production process.

Strategic analysis had been carried out, all internal and external factors was taken into consideration, like competitive position of the company, market situation, financial situation of company, business strategy, performance of current production system, skill and knowledge of employees, awareness of need of change, technical level of equipment etc.

After detailed examination and tracking of these factors it was defined which improvement was necessary to conduct in order ofincrease performance of whole company. It was concluded that it wasnecessary to implement basic tools of lean production like 5S, Visual Management, Value Stream Mapping and to improve production equipment, in this case to buy some new specific machines that will open new markets with new company's products.

5S was selected because this tool creates organized, clean and standardized work environment in order to improve profitability, effectiveness and safety by lowering losses in production area.

Implementation was conducted through next steps:

- Creating organization for promotion of 5S,
- Set up promotion plan of 5S,
- Prepare materials for 5S campaign,
- Education inside of company,
- Implementation of 5S,
- Evaluation.

In organization of promotion 5S were included external consultants and top management of company and they created detailed plan of promotion and find best education for employees. Since employees was very open to new ideas and improvements they accepted to participate in presentations and workshops after work so they will understand better what is 5S and how to implement it.

Implementation has been conducted through five main activities:

- Sort
- Set in order
- Shine
- Standardize
- Sustain.

Main objectives that were conducted in first phase of implementation was sorting and tagging of necessary and unnecessary items.

Activities of this phase were:

- Picturing of current condition
- Tagging
- Creating red zone
- Moving unnecessary items to red zone.

In second phase of implementation was created plan of current working environment and moving routes of workers, figure 1.

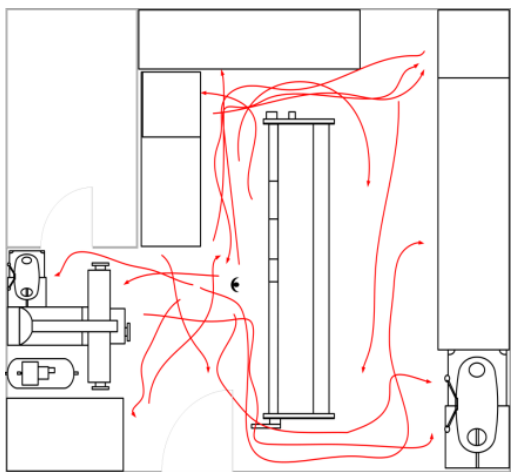


Figure 1. Current plan with moving routes

Conducted activities of this phase were:

- Team starts with reorganizing of work place,
- Analysing and improvingcurrent working environment plan and moving routes of workers,
- Creating new, better, improved plan, figure 2.

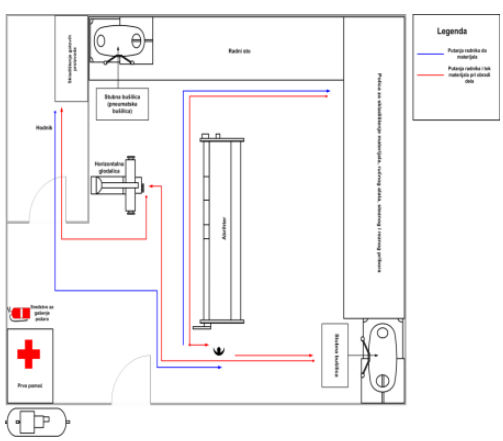


Figure 2. Improved plan of working environment and moving rout of workers

In third phase was conducted cleaning of all areas, including cleaning of work place, degreasing of, removing of waste, defects etc. In this phase are also identified problems with leaking oil, electrical wires and similar. Activities that were conducted in this phase were:

- Cleaning,
- Removing of waste,
- Removing any obstacles,
- Creating charts of waste for current condition and after this phase, including all kinds of wastes, figure 3.

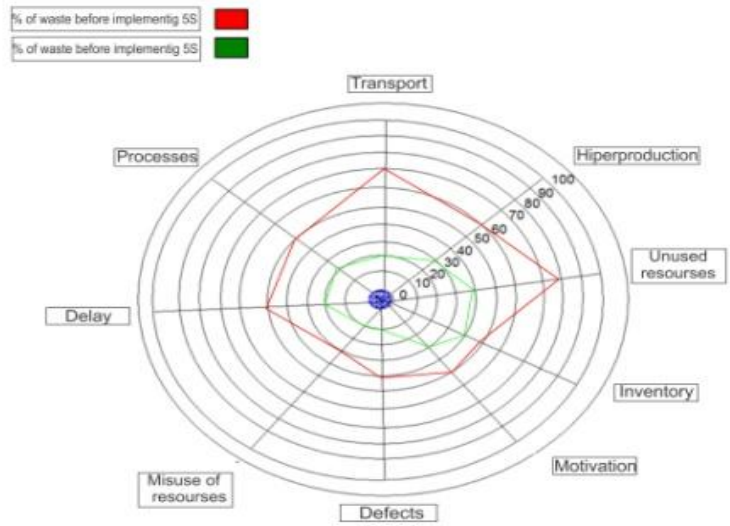


Figure 3. Radar chart of waste

In fourth phase of implementation standardization was conducted. Activities of this phase were:

- Defining place for every tool,
- Implementing internal standard, figure 5.

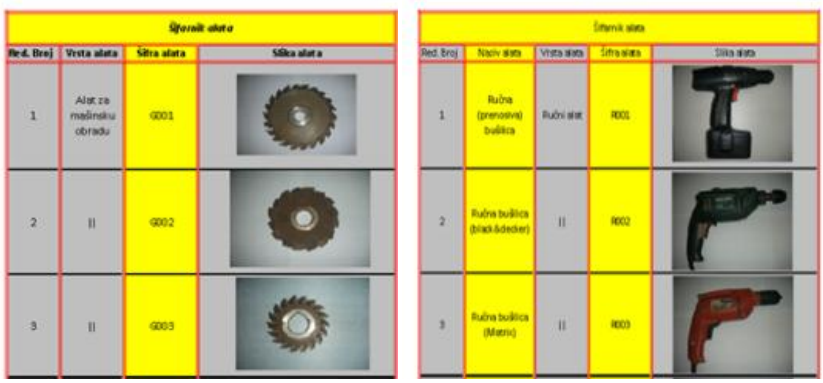


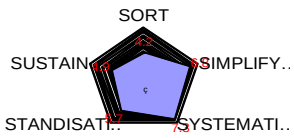
Figure 4. Creating internal standard

Sustain is the fifth and most important phase of 5S. Sustain was divided into several activities that were conducted and are conducting sill:

- Visual commitment of management, leader, encourage workers etc,
- Communication to keep everyone involved in all activities of company,
- Conducting of regular audits, figure 5,
- Rewards and recognitions for jobs well done
- Educate and reinforce the importance of 5S and
- Keep copies of all audits.

5S AUDIT

Date of audit:	12.03.2012.
Auditors:	M.Radenković
Area:	Production



Level	5S	Title	Scores
S1	SORT	" Separate things which you need from things you don't need"	4.2
S2	SIMPLIFY (Seiton)	"Keep conditions which allow you to easily access what you need, when you want"	6.8
S3	SYSTEMATIC CLEANING (Seiso)	"By cleaning you identify causes. Clean (all) places to keep dirties and dust away"	7.3
S4	STANDISATION	"Making abnormalities obvious with visual controls"	5.7
S5	SUSTAIN (Shitsuke)	"Make habit of obedience to the rules"	4.9
	Action plan	5S Result	28.9

Figure 5. Main regular audit of complete implementation of 5S

This main audit that is created from other five audits, figure 6, every for every step of 5s, is conducted regularly and stored properly so workers get to see results of their work after some period of time.

Num.	S1	Yes?	Coments and recomendations
1	Are there unnecessary thing in working enviroment?	☐	
2	Are there any **useless raw materials, semi-finished products and/or waste** left as is, nearby workplace?	☐	
3	Are there any **tools, spare parts, materials** left on the floor, nearby equipment?	☐	
4	Are all **frequently used objects** sorted, arranged, stored and labeled?	☐	
5	Are all **measurement instruments/devices** sorted, arranged, stored and labeled?	☐	
6	Does the inventory or in-process inventory include any unneeded materials or parts?	☐	
7	Are there any unused machines or other equipment around?	☐	
8	Are there any unused jigs, tools, dies or similar items around?	☐	
9	Is it obvious which items have been marked as unnecessary?	☐	
10	Has establishing the 5S's left behind any useless standards?	☐	

Figure 6. Audit form for first phase of 5S

Next to 5S it was also necessary to implement visual management and value stream mapping and advantages of these tools. Some of used floor marks work production area and warehouse are shown in figure 7.

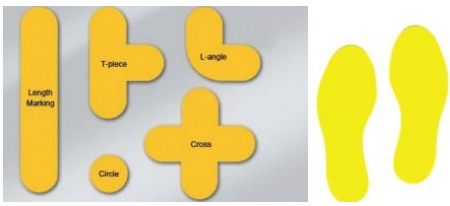


Figure 7. Marks used for floor in production area

Value Stream Mapping was used to identify waste, reduce process cycle time and implement process improvement. This tool was necessary for understanding of current performance and an idea of waste minimization that can be achieved. This was done with Value stream map symbols, figure 8, by creating current state and future state, and creating ideal state. With Value Stream Map workers can see problems in their production process and to find ways to fix it.

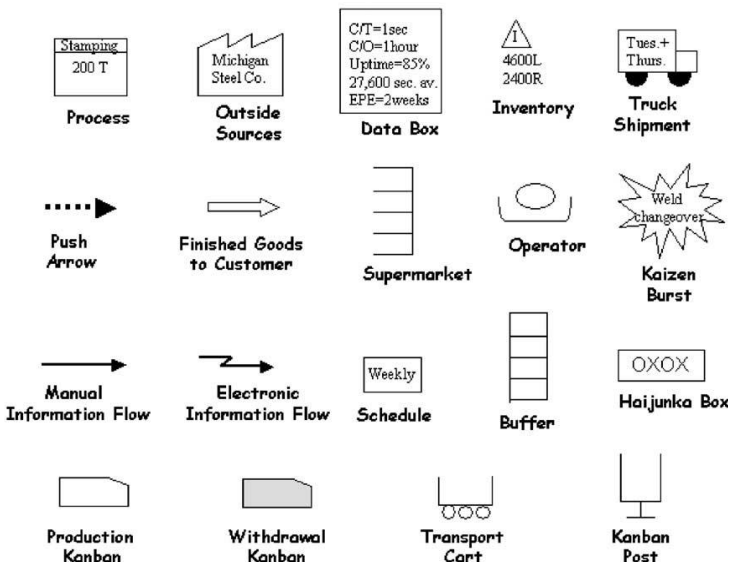


Figure 8. Value Stream Map symbols

At the end of this whole improvement process it was necessary to purchase new equipment in order to provide that company is competitive on market. This equipment required significant amount of money but was very important for competitive position of company, creating new parts and attracting new customers. After two, three years equipment should repay and after that it will start earning money. This will provide manager way to new markets and possibility for company to expand and employ new workers.

4. Implemented Kaikaku exemple analysis

Since organization of this company was traditional,conducted changes were radical, but not very difficult to implement since employees was opened to implementation of new ideas. Benefits of implemented kaikaku were inventory savings, reduction of floor space and last but not least higher quality. Higher quality is result from fewer defects produced before the defect is detected and

standardized work procedures that have all workers performing the operation on the same manner (Ohno, 1988). Before start of this implementation it was needed to conduct audits of current condition. Based on that audit and audits that were conducted when implementation was completely finished it is possible to see improvement of production process. We can see that whole production process was improved for 43%and that this improvement was reallykaikaku and not just kaizen.

5. Conclusion

As we sad in start of this paper kaikaku is radical change. It is shown in example how kaikaku can benefit to your company and how it effect on quality of products and whole production process. This strategy was adopted by many Japanese companies and in last few years' people all over the world start seeing benefits of it and started implementing this tool.

Main problem still exist and it is when to conduct kaikaku? This is not some annual goal or refund of investments it is long term scenario of how production system should be developed.

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