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KAIZEN APPROACH TO SUPPLY CHAIN MANAGEMENT: FIRST STEP FOR TRANSFORMING SUPPLY CHAIN INTO LEAN SUPPLY CHAIN

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Abstract: This paper provides evidence on how the use of Lean management approaches and one-day Kaizen workshop can help to discover root-causes of problems appearing in the supply chain, particularly in this paper focusing on late delivery. In addition, the well-known Quality concepts such as Ishikawa diagram and 5xWhy may enrich the Lean Management as applied to the supply chain. Also, this paper shows that problems in the supply chain are sometimes caused by company's internal procedures and its internal inefficiency. A case study from suspension and joining equipment factory in Croatia was used to support the research. At the end a simple solution for the discussed problem was proposed.

Keywords: Supply chain, Lean management, Kaizen, Ishikawa diagram, 5xWhy

1. INTRODUCTION

In the last few decades, almost everything related to production and business has changed: the world became more complex and the time became extremely precious. World becoming more complex means that demand on mass customized products is constantly rising, just as the need of being first on the market, and responding fast to changes. Those two factors brought significant changes in the way of operating a company, forcing it to shrink planning cycles and increase its efficiency. Less efficient activities are being outsourced and there is hardly any company left that is doing the whole process of transforming materials into goods for end customer, making supply chains more and more important. A key feature of present day business is that supply chains are the competitors, not companies themselves, and the success or failure of supply chains is ultimately determined in the marketplace by the end consumer [8]. That is why a lot of effort has been given to raising of supply chain efficiency.

1.1. Supply chain

A supply chain is the alignment of firms that bring products or services to market [1]. A supply chain consists of all stages involved, directly or indirectly, in fulfilling a customer request. The supply chain not only includes the manufacturer and suppliers, but also transporters, warehouses, retailers, and customers themselves [2].

As the supply chain connects a lot of entities, the coordination between them is needed for smooth operation of the chain. Therefore companies employ supply chain managers whose jobs include determining transportation vendors, credit and cash transfers, suppliers, distributors, accounts payable and receivable, warehousing and inventory, order fulfilment, sharing customer, forecasting and production information. The objective is to build a chain of suppliers that focuses on maximizing value to the ultimate customer [3]. If the company is using goods and services from outside sources it needs to choose one of the supply-chain strategies such as: negotiating with many suppliers, long-term relationships with few partners, vertical integration, keiretsu, developing virtual companies that use suppliers on an as-needed basis [3]. Choosing correct strategies is crucial for successful business. Sometimes companies in the chain strive to maximize their own business by seeking for a local optimum, but changes in their business can cause disruptions such as bullwhip effect in the whole chain. Bullwhip effect is defined as: distorted information from one end of a supply chain to the other that can lead to tremendous inefficiencies: excessive inventory investment, poor customer service, lost revenues, misguided capacity plans, ineffective transportation, and missed production schedules [4]. One of the possibilities to minimize a risk of bullwhip effect is implementing Lean management across the supply chain.

1.2. Lean Supply Chain

Lean manufacturing has been implemented by many companies in the world through different industries. But, for the full effectiveness, the Lean production system must be extended down through the supply chain. On the other hand it has to be stressed out that it is impossible to implement Lean management in a company and expect that this is not going to affect the

whole supply chain. The Lean Supply Chain means to identify all types of waste in the value stream of supply chain and take steps to eliminate them to minimize production lead time [5].

The objective of this paper is to determine whether the Lean management approach to supply chain, together with one day Kaizen workshop and use of tools such as Ishikawa diagram and 5xWhy can help to discover root-causes of problems appearing in supply chains. Research was conducted as case study research in a suspension and joining equipment factory in Croatia which is producing electrical equipment for high voltage transmission lines. The research focuses on two main aspects: (1) when faced with complicated problems in supply chain, such as delays in order fulfilment, can companies use Lean tools to find root-causes of the problems and (2) are simple Lean management tools good enough for solving complicated problems like delays in order fulfilment. As a part of the analysis carried out the following research questions are answered:

- i. How can one day Kaizen workshop and use of simple analyzing tools such as Ishikawa diagram, 5xWhy help to determine root-causes of problems appearing in supply chains?
- ii. Where are root-causes of problems appearing in supply chain, inside the company or outside?

In particular, the research focuses on the use of one day Kaizen workshop to increase an understanding of importance of using that approach in identifying root-causes of problems appearing in supply chain.

Following these questions, we tried to formulate valid conclusion on how one day Kaizen workshop followed by analysis of results can lead to discovery of root-causes of problems, in our case late delivery, in supply chain.

2. METHODOLOGY

Case study research methodology was used. A single case study was chosen because of the exploratory nature of the study. Using single case design allows an increase in the quality and quantity of data obtained [7]. Researchers were involved in the planning, preparation and execution of the one day Kaizen workshop. One of the researchers was facilitator of the workshop and other two were observing the process, and collecting the data. This particular approach to research enabled a deeper understanding of the processes in the company but also relationships between different departments involved in the supply chain as well as the nature of their communication.

Before the start of this research project, researchers were already involved in the activities of process optimization in the company. During the interviews which were conducted as part of improvement activities, late delivery was detected as one of the main problems. Going deeper through the analysis and interviewing employees in the production planning and technology department, it was noticed that there is a problem with later delivery of raw material which is then leading to late delivery of final product. As material supply is part of supply chain, it was decided that new research project will be done analyzing the possibilities of implementation of Lean tools while analyzing the whole supply chain. After the literature was reviewed it was concluded that one day Kaizen workshop approach is going to be used to analyze the possibilities of improvements in the supply chain with the aim to find root-causes of late delivery. Second reason why one day Kaizen workshop was chosen was that employees were already familiar with the concept. The settings of Kaizen workshop part of the paper are described in details in the case study. After the workshop, results were analyzed and conclusion was given that Lean tools, in our case, one day Kaizen workshop, can give solid framework to search for root-cause of problems appearing in the supply chain.

3. CASE STUDY

Case study was conducted in suspension and joining equipment factory. The company faced a serious problem of delivery delays to its clients that caused serious expenses. A goal was to find root-cause of this problem and later an easy adoptable and affordable solution to that problem. At the time of research, the company was at the very beginning with Lean journey. It was at the stage of learning about Lean and implementing first Lean tools.

Top management, as well as shop floor management, both were convinced that suppliers have the main impact on delivery delays. Delivery delays of supplies and poor quality supplies were common. Supplies delivered with delay or poor quality, both lead to production start delays, and eventually to late delivery of products to company's clients. At the same time, strategy for choosing a supplier was price – the cheapest supplier got the job. Other important data as estimated delivery, time or quality of delivered supplies were not considered. Still, a thought was, that supply chain should be analyzed to find a solution to a problem.

A first task was analyzing existing supply chain and its efficiency, by conducting metrics suggested by [6]. Planned metrics included customer service and internal efficiency, with metrics such as on-time completion rate and on-time delivery rate, value of late orders and number of late orders, number of warranty returns and repairs, inventory value, inventory turns, return on sales. Statistics and available data were used to gain information, as well as interviews with employees from different departments. Unfortunately, it was found that, even though employees are aware of existing problems, there were no data records available for some important things such as accurate inventory lists and its value or a list of on-time delivery dates. After this part, it was clear that delivery delays problem is something complex. As the company was already implementing Lean philosophy and had plan of

implementing a Lean supply chain, the idea of using Lean for solving mentioned problem seemed like a next logical step. Kaizen was recognized as a powerful tool by top management, and delivery delay problem was chosen as a first problem. This is where Lean and supply chain management were matched.

3.1. Kaizen workshop:

Kaizen workshop with a delivery delay as main problem was planned. As it was already known that it is a complex problem, and believed that the reason lies in the supply chain, employees from different departments involved in supply chain were chosen for this workshop. Representatives of purchase, production, inventories, sales, IT and planning were all involved. Main goal was to find a cause for main problem, and try to find a solution for it. Usual tools were used – Ishikawa diagram, brainstorming and 5xWhy. The workshop started with a short explanation on tools: Ishikawa diagram, brainstorming and 5xWhy. Short introduction to the problem was done by the facilitator as well as the objective of the workshop: find the root-cause of late delivery and find one feasible solution to this problem. After as-is analysis, possible solutions for improvements were discussed. One solution was chosen and discussed in depth as well as its to-be analysis.

3.2. Ishikawa diagram

Ishikawa diagram, also known as Fishbone diagram or Cause-and-effect diagram is considered as one of the seven basic tools of quality control. In our case study, Ishikawa diagram was used for the representation of major problems and their root-causes. Even though top and shop floor management were convinced that main cause are suppliers, everyone else had its own opinion about causes and many of them were found very easily. At first, every person was filling out its own Ishikawa diagrams, which were then discussed, and suggestions with the most votes were taken into new Ishikawa Figure 1.

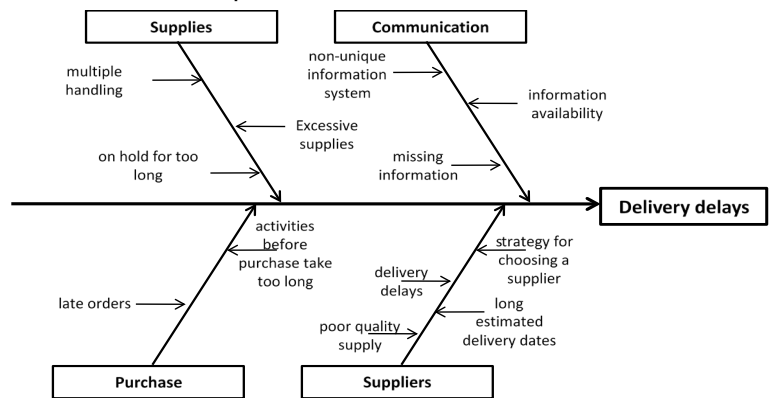


Figure 1 – Ishikawa diagram of a delivery delay problem

After a long discussion, it was agreed that this four reasons are root-causes for delivery delays to company's costumers (Table 1).

Table 1 – Main causes for delivery delay

Root Cause	Explanation
Excessive supplies	Not only did it take a lot of space, so additional handling was needed for current projects, but they also meant a lot of frozen capital. That way, a flow of money was prevented, what meant less capital for investing into relationships with suppliers.
Ineffective communication	Communication was slow, sometimes taking even few days for information to reach a person in neighboring office. Information system was also not making information flow easier, in contrary, two different systems were used but information were not exchanged between departments, what made it very hard for production planning. For example, a planning department never got final information on supply delivery date from purchasing department. Neither literary, neither from software, what made accurate planning almost impossible and eventually led to gaps in production.
Complicated purchasing procedure	Purchase was a large problem as the procedure took sometimes up to a month for allowing contracts with suppliers. It is a procedure shown on Figure 2 that involves many people. At first, a design department creates a list of supplies needed. That form has to be signed by three different employees just to get to the purchasing office and to be converted into order-formed paper that again needs to be signed by two top managers before it is signed with the supplier. Physical papers were used and they were brought to each person's office. Up to 50 different papers were used daily. Since this procedure sometimes takes up to a month, it is obvious that it leads to late order that demanded unrealistic short delivery dates of supplies. Since suppliers' delivery policies usually have long estimated delivery dates, it made significant effect on company's production as well. Later production starts usually lead to production finish delays, and finally, late delivery to costumers as well.
Suppliers	Just one of four mentioned causes involved suppliers. Supplier related problems such as choosing a supplier by price or their delivery delays and incorrect deliveries were recognized. It was clear that no deeper relationships with suppliers were built.

6.2. Brainstorming

Observing that suppliers cause only one quarter of delivery delay problems, it became very clear that focus has to be on improving company's processes. Using a brainstorming method, a lot of ideas about what and how should be improved were given. They were discussed, and next it was concluded, that the main thing that should be done is shortening a process before purchase.

6.3. 5x why

Finally, 5xWhy technique was used to find a source of paper-allowing delays. It was discovered that papers sometimes stay too long in the offices just because a person didn't see the new ones coming. As a conclusion to the workshop, the idea of creating a unique place in the factory for managing purchase process was made, Figure 4.

It is important, that this is a simple solution that is not changing procedure and therefore not considered as a radical solution. It is only helping to speed up the existing process. A board consists of cases for each person involved into process. Upper the case, a name is written, and between the name and the case, it is left some space for colored card. Red means that person's case is full, so it has to stop, open it, go through papers, sign them and put it in next person's case. Than it also puts green (meaning a free case) to its case and red card to next person's case (meaning that attention is needed).

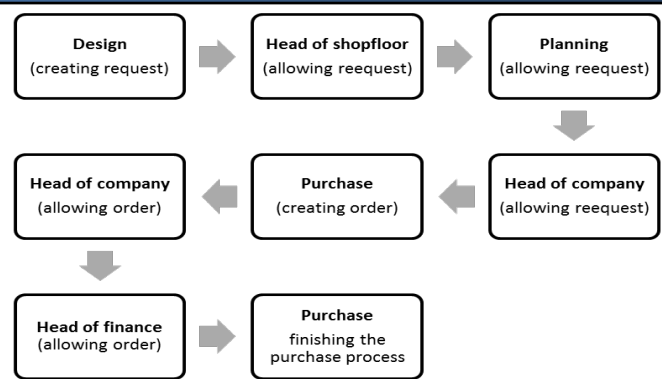


Figure 2 – Steps needed to finish a purchase process

Even though a board is a great idea to speed up the process, because no one wants to have a red card under his name, it has some disadvantages, such as supporting complicated procedure.

Also, there is still no backup plan for a case of responsible person being absent. These are still things that need to be sorted out. This is why this board is considered only a temporary solution that will show how time and money were easily wasted. It is also expected that cost benefits brought by using this board will stimulate and lead the company management to more improvements such as developing background plans, implementing electronic solution to this procedure, developing ERP system's properties, developing less complicated procedure. Solving this problem does not only lead to reducing wasted time, it is also a first step to building relationships with suppliers and therefore a first step to Lean supply chain.

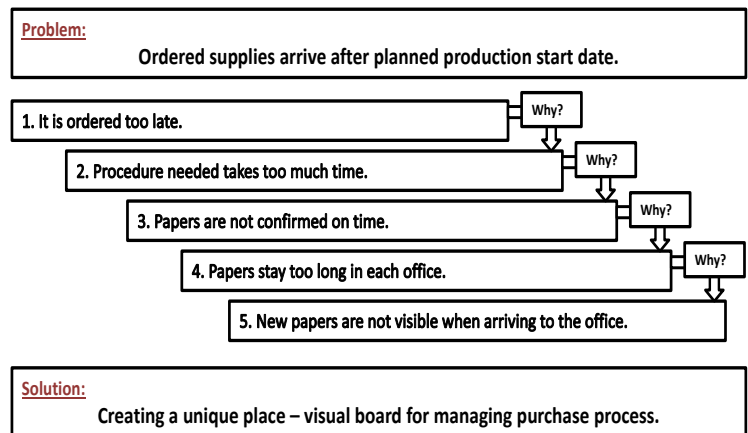


Figure 3 – 5xWhy work-sheet

7. CONCLUSION

As companies compete on the level of supply chains, those supply chains have to be efficient and thus companies have to analyze their processes with the aim of finding new possibilities for improvement. This paper showed how Lean management approach, one day Kaizen workshop and use of simple analyzing tools such as Ishikawa diagram, 5xWhy can help to determine root-causes of problems appearing in supply chain. Particularly, it was shown that facilitated workshop, usage of Ishikawa diagram and 5xWhy helped to discover root-cause problem for the late delivery of products. Although top and shop floor management thought that the problem is caused by suppliers and their late delivery of raw material, it turned out that the main problem was inefficient procedure of confirming purchase orders. A simple solution as a conclusion of the workshop for the problem was also proposed. Solution is shown on the Figure 4. Lean management approach together with one-day Kaizen workshop proved to be also helpful in determining that the root-causes of problems in supply chain can appear inside the company. Therefore, if the company strives to achieve Lean supply chain, first thing to be accomplished is improvement of its own processes. Thus, before the Lean supply chain, Lean company is the first goal to achieve.



Figure 4 – Visual board for managing purchase

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