IMPROVEMENT OF THE PACKAGING FLOW WITH USE OF PROBLEM-SOLVING TOOLS

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Abstract

In the supply chains, packaging logistics is an important component of the material and information stream, which ensures an adequate level of service for all participants in the chain. It is particularly important from the logistics operator's point of view to ensure proper (efficient and economical) packaging rotation between the chain links. Disruptions in this area may lead to delays, additional costs, and other difficulties that ultimately translate into a decrease in efficiency and performance in the supply chain. The paper presents the possibility of using a tool (A3 report) in improving the pallet turnover of a logistic operator.

Keywords: Process improvement, packaging flow, pallet turnover, logistics operator, A3 report

1. INTRODUCTION

Searching for new solutions and management methods that will enhance the company's competitive advantage and allow it to better adapt to the turbulent environment, especially including those related to customers, is the domain of managerial activity. In that case, process management is an important area in which all changes are made. The trend is to introduce management methods and techniques that depart from the classical ways of improving processes and replace them with new, unconventional methods [1]. The essence of these methods is to focus on reducing waste and loss. Lean Management is currently the most widely used concept in enterprises, with the main goal of eliminating loss-making and finding the right solution for the process by using appropriate tools and adequate staff involvement. Over time, Lean Management has developed tools that enable you to diagnose, evaluate and improve processes and activities. The most common and well-known of those tools are: the value stream mapping, 5s, Total Productivity Maintenance (TPM), Kaizen and others [2,3]. In addition to these solutions, there are a number of smaller, useful tools and troubleshooting techniques, such as the Pareto - Lorentz chart, 5 Whys, the Ishikawa diagram, sheets and control charts, histograms and other graphs and diagrams. The tool-bonding method provides solutions for diagnosing and evaluating interference and providing solutions that underlie continuous improvement. These include the 8D method, the five-step Kepner-Tregoe method, or the PDCA-based A3 report method. The purpose of this article is to focus on the last group of solutions that allow you to continually search for possible solutions of problems and ultimately improve your processes. The article presents the practical use of the A3 report in relation to the chosen element of the logistics system - packaging rotation based on an example of a chosen logistic operator.

2. A3 REPORT AS A TOOL FOR SOLVING PROBLEMS

Literature in the field of quality management and Lean Management provides many tools to assist with monitoring and gathering information about processes that occur in organizations. However, having only data or adequate knowledge is not enough to solve problems [4]. In order to make the right decisions, it is necessary to process them appropriately in accordance with the adopted process improvement procedures. One example of such a tool is the A3 report. It has been developed at Toyota, and is essentially a one-size-fits-all A3 format (11x17 inches) standardized approach to team-based problem solving based on the PDCA cycle [5]. A3 Reports exist as the following 3 types: (1) The Problem Solving A3 Report, (2) The A3 Report Proposal, (3)

The Status A3 Report [6,7]. It is a guide to effective and systematic problem solving and is a communication tool whose primary purpose is to produce a document in the form of a report on current issues, results of already made improvements and more. This report includes the following information: a definition and description of the problem, a description of the current state, a design of the future (target) state, which will allow the problem to be eliminated, as well as an action and control plan [8]. A3 is part of the improvement process which involves lean thinking in solving of problems. According to Lean Thinking, the most important part of the report is the first 4 stages of planning (left side of the report), the second part refers to the remaining stages of the Deming cycle (do, check, act) [9]. The standard structure of the A3 report is shown in **Figure 1**. The data presented in the report should be graphical, the words should only be used if the situation cannot be described by drawing, sketch, graph, diagram, etc. The report should be easy to read, logical, understandable for everyone and should "tell the story" [5]. You can use classic lean tools such as 5 Whys, Fishbone Diagram, Flow Chart, Histogram, Pareto Diagram, PDPC, Radar Chart, Relations Diagram, Activity Chart Diagram, Check Sheet, Control Charts, Gantt Chart, Matrix Diagram, Spaghetti Diagram, Value Stream Map, and more as visualization elements in the report [10].

Topic: What is the problem?	Owner	Date
1. Description of the case/ Business justification	**5. Suggested remedies**	
Why should we solve it?	How can we solve the problem?	
2. Current state/ Description of the problem or possibilities	**6. Plan**	
What is the situation at present? How the problem manifests itself?	What action needs to be undertaken?	
3. Targets/Indices	**7. Further actions**	
What do we want to achieve?	How to maintain the achieved results?	
4. Analysis		
What are the causes of the problem?		

Figure 1 A3 report creation stages (based on [11])

3.   CHARACTERISTICS OF PALLET TURNOVER IN A SELECTED ENTERPRISE

Problems with correct and unobtrusive execution of processes arise in every organization. Sometimes they are easy to solve, but more often this is not the case as, due to the complexity and the interpenetration of processes, it seems impossible to solve the problem. These difficulties are particularly apparent in logistic service organizations that have a unique and exceptional character [12].

The EUR pallet is the most frequently used transport and storage support element [13]. According to EPAL Poland, there are nearly 10 million pallets in circulation, taking into account the unit price of 20 PLN per a used pallet and up to 32 PLN for a new pallet, they total to nearly 300 million EUR of frozen turnover value. That huge amount can be lost irretrievably due to a negative assessment of the usability of the pallets in use. The assessment itself is based on the guidelines contained in the pallet assessment cards, not in the rules. In order to reduce and diversify the risk of loss, pallet handling is increasingly reported to logistic service providers who assume responsibility for the proper pallet status. This has created a new service that deals with the marketing of packaging (pallets), which is currently provided not only by specialized logistic operators but also by other companies that deal exclusively with the return of recyclable packaging.

The process of recycling the packaging (pallets) has been analyzed in case of a chosen logistic operator. The operator offers two alternative forms of pallet circulation to their customers: two-way and one-way. In the two-way form, the supplier and the pallet recipient are subject to individual settlement. The pallets exchanged between the supplier and the customer are verified based on a pallet assessment card, and the operator offers the pallet provider to return pallets to the recipient. The returned pallets come from the palette pool available

at the logistic operator branch. The original Euro pallets are in compliance with the standard. If the operator discovers technical, quantitative pallets or non-compliance of the pallet with PN-M-78216 (UIC 435), the supplier is required to exchange the pallets with EUR pallets and correct the number of pallets to be returned on the bill of lading. On the other hand, the recipient is obliged to return the received number of Euro pallets that conform to the standard and marked as returnable on the bill of lading. The consignee which returns empty pallets is obliged to fill in the bill of lading, as the sender enters their data and their identification number and, as the consignee, enters the operator's data and the number of pallets returned. Once a month, a rotation report is generated for each of the parties, which is a base for settlement of the pallets.

 Based on the analysis of quantitative data from the logistic operator, it was noted that the number of pallets in circulation was not equal to the number of pallets recovered from the recipients of the operator. The level of deficiency is 25% of the total number of pallets traded in the two-way form and 35% for the one-way pallet trade.

4.   ADAPTATION OF PROCESS IMPROVEMENT TOOLS FOR PALLET MANAGEMENT

1 to 1 pallet trading service accounts for 98% of pallet management services in the surveyed company. Due to its specificity (contract only with the ordering party) the records show only the number of pallets not returned by the recipients, without taking into account the reasons for not returning pallets. In the surveyed unit, pallet retrieval in the 1 to 1 service was 62% during the period considered. This means that the company did not utilize the potential in terms of profit from additional services such as pallet turnover. Target recovery was 85%.

In the first step of the study, the reasons for low recovery of pallets required a survey, based on a pallet assessment card. The study was attended by 50 suppliers of logistic operator (drivers) and 20 customers (recipients). The results showed that the rating was made with responsibility for classification as the main criterion. Study groups chose options that did not burden them with responsibility, as shown in **Figure 2**.
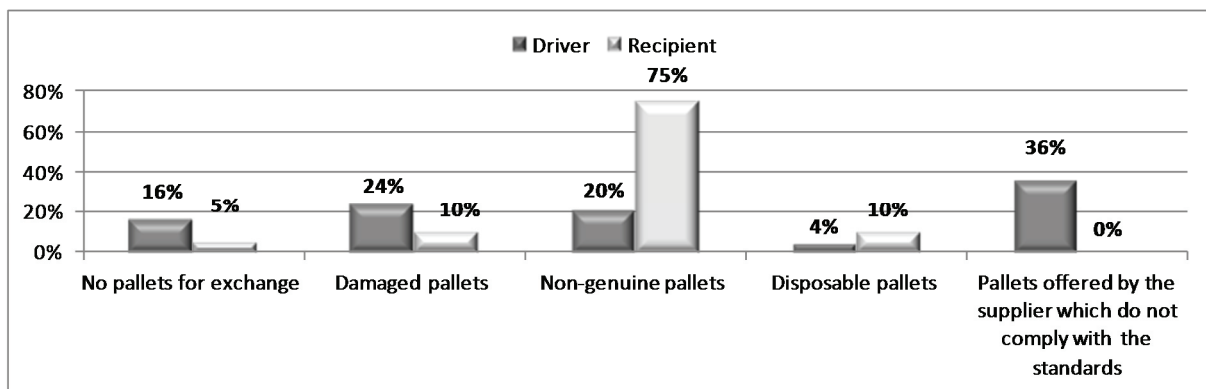

Figure 2 Results of a survey determining the cause of low recovery of pallets, study period: January-February 2015

In order to reach the origin of the problem, a detailed analysis of the data was made based on the A3 report. The first step was to set a business goal that was to improve customer satisfaction and increase the return from the pallet service. The analysis showed that the amount of lost profit from failure to perform pallet return service amounted to over 164,000 PLN for the surveyed branch, on a company scale it amounted to 1,170,000 PLN.

The next stage was a detailed analysis of the current state. This section analyzes the reasons for not receiving pallets from buyers during delivery. In order to identify the main reasons, all entries in the bill of lading were analyzed within the period from January to March 2015. The results are shown in **Figures 3 and 4**. The customer group that uses the most negative pallet verification record is the network receivers.

The next step was to determine the desired status. According to the strategic goals set by the company, it was to achieve a monthly pallet recovery of 85%. The auxiliary goal was to achieve a weekly recovery rate of 75%.

The Ishikawa diagram was used to identify the root causes. Participants in each stage of the pallet marketing process, including drivers, terminal workers and the pallet management administration in the surveyed office, participated in the identification of these causes. This helped to identify the causes/problems affecting low pallet retrieval. These reasons include (according to respective areas):

1) Responsibility of the driver: lack of knowledge of the pallet classification procedure, lack of time to wait for the pallet to be repacked in accordance with the EUR standard, lack of reliable pallet verification during the reception of bill of lading, driver dishonesty, pallet damage during loading/unloading.

2) Tool imperfections: verification is not possible, pallet assessment cards are not accurate.

3) Sender: no verification of resources during the order submission, erroneous data on the bill of lading, poor pallet quality, no pallet rules in place according to the contract, lack of knowledge about the pallet classification.

4) Consignee: no pallets to exchange on delivery, customer dishonesty (abuse of the record with negative pallet verification - according to the law, the palettes stay at the recipient), ignorance of pallet assessment cards (wrong verification).

5) Terminal/Warehouse: ambiguous assessment of pallets (classification), media damage due to improper handling of shipments, inaccurate verification of pallets during handling.

6) System: no verified pallet registrations (corrections - no pallet number of the recipient), lack of validation verification tool (entries on the bill of lading).
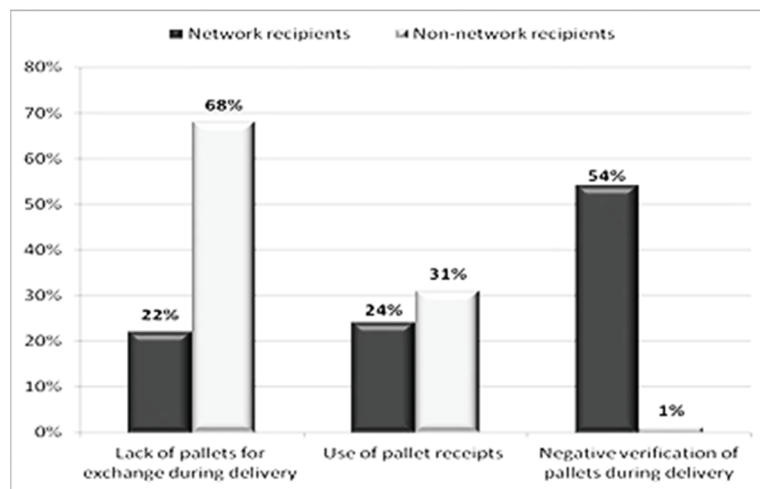

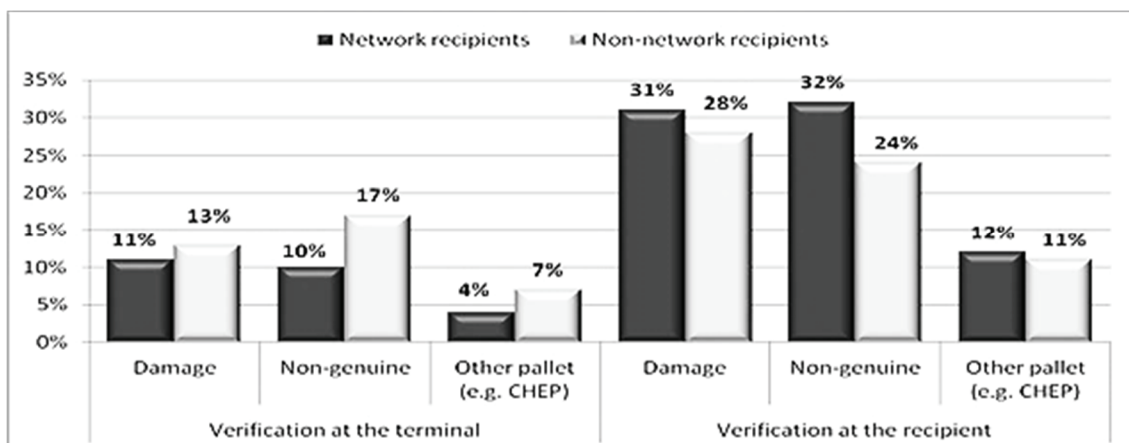**Figure 3** Reasons for not returning pallets to recipients

Figure 4 Reasons for negative verification of pallets by site of verification

Pareto analysis (**Figure 5** and **Table 1**) was used to determine priorities.

Table 1 Key factors affecting pallet retrieval

| Factor	Occurrences
Lack of knowledge of pallet assessment cards	68
No verification is possible	41
Dishonest suppliers	41
Poor pallet quality	38
Dishonest drivers	36
Lack of knowledge how to verify the pallets	32
No pallets for replacement during delivery	28
Pallet damage during handling	18
No verification of resources during the submission of an order	14
No time to replace pallets with negative verification	4
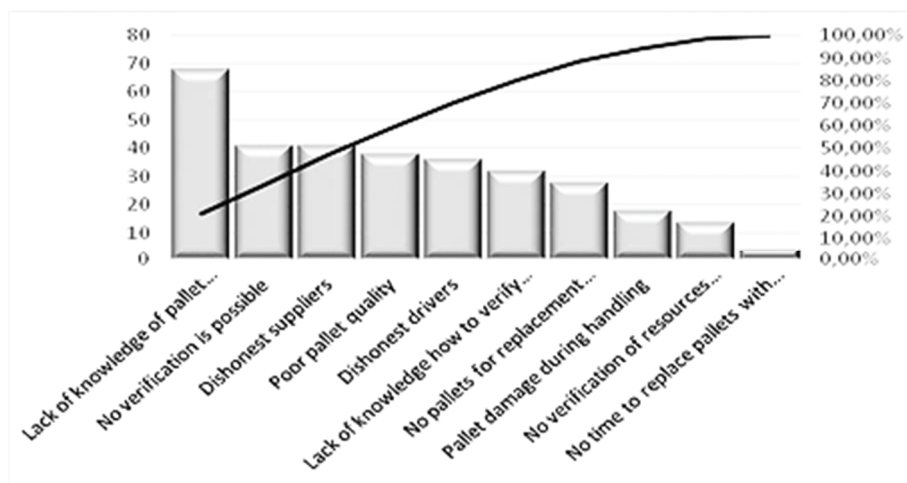
Figure 5 Pareto chart, defining key factors affecting pallet retrieval

The next step is to identify remedial actions that address identified root causes, including those:
1) Training for the drivers.
2) Handing over pallet score cards to all drivers.
3) Scheduling visits to customers with the largest number of pallets written off.
4) Creating pallet protocols for customers with the lowest possible pallets.
5) Introducing the requirement for photo documentation of pallets negatively verified.
6) Training for all staff who evaluate pallets for the bill of lading.

The action plan assigns the responsibility and timing of the action. Prior to this, training was provided for drivers who were to align their knowledge of the pallet classification and pallet reimbursement obligations. In addition, all drivers were provided with pallet rating cards. The biggest challenge was the change in the contract with the carriers. The annex introduces an obligation for the driver to make a photo record in the case of a negative pallet verification at the consignee. For this purpose, a mobile device that has a photo camera capability is used. Thanks to the integration with the system, the photo is assigned to the corresponding bill of lading and is immediately visible in the company's IT system. The driver billing procedure has also changed. In addition to the standard conformity of entries on the bill of lading, in the case of BL recording for negative pallet

verification, the clearing employee has the additional obligation to verify that the negative verification has been documented and that the verification is correct. Photos are available in the bill of lading browser and are the basis for the settlement of the driver. If it is determined that the photographed palette meets the EUR requirements contested by BL, the driver will remain unsettled. He is also required to return the pallet with incorrect verification and the sender is charged with the cost caused by this situation. Prior to the introduction of the annex, all settlers were acquainted with the Pallet Rating Cards.

The implemented activities translated into a 4% increase in the recovery of pallets during the period considered (**Figure 6**).
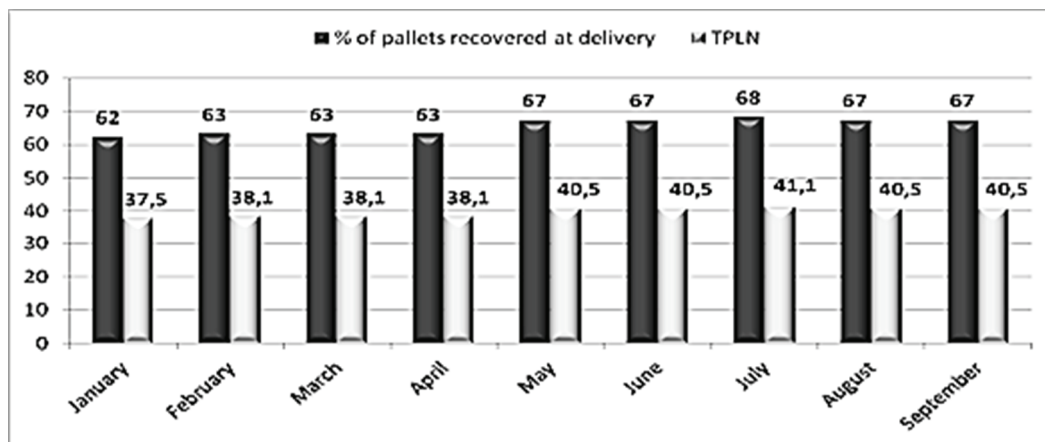

Figure 6 Recovery of pallets in a branch

The increase in the recovery of pallets in the branch has translated into a profit from additional services. Assuming an average pallet turnover of 11,000 units per month and a service fee of 5.5 PLN per a stacked pallet, the result of the branch was improved by 2,200 PLN per month [14].

5.   SUMMARY

Pallet handling in enterprises is a very complex process. As the research shows, the main problem is the classification of EUR pallets. Each pallet negatively verified by the recipient is a loss for the sender, on average 26 PLN. Pallet turnover significantly increase company costs. Recipients often overuse a negative verification statement, making extra income of the pallets. An analysis of the pallet rotation system at a chosen operator showed that the 1 to 1 system used in 98% of cases was incomplete. This is indicated by a reporting system that does not take into account corrections that refer to negatively verified pallets. According to the results of the study carried out with the help of the A3 and Pareto rules, the main factors influencing the low pallet retrieval in the surveyed branches are: lack of knowledge of pallet assessment cards, lack of check validation (in bills of lading), dishonesty of suppliers and poor pallet quality (shipped by senders). The A3 report, adapted from Toyota, is a useful tool for continuous improvement in various organizations, not only in the automotive industry. Simultaneously, it documents the key effects of problem-solving activities in a concise manner and includes well-established problem-solving methodology.

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