Analysis of efficiency improvements of the material handling at PPS AB

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Abstract
This article is a summary of my Master Thesis in Engineering Logistics at Lund Institute of Technology. The thesis is based on a project carried out on behalf of PPS AB. Since the European production consolidation 2000 shipped volumes have continuously grown and PPS are now facing growth issues in their internal logistical order and manufacturing process. The objective of the project is therefore to map the current activities in the warehouse, analyse identified problems and thereafter give proposals how they could be more efficient with support from different investments.

The project presents and recommends both direct procedural improvements and fresh investments. One example of the direct procedural improvements is to reduce number of pallet types from two to one for customer shipments. This will significantly decrease the complexity of the warehouse and improve profitability. Recommended investments could be summarized with a new palletising system, a functional warehouse management system and automatic lifts.

1 Introduction
PPS is a world leader in the manufacturing and marketing of medical technical products. The business unit in Småland manufactures, develops and distributes the products. The plant in Småland is developing strongly in the areas of volume growth, product development and logistical solutions. The turnover is +1000 MSEK.

Today there are about 450 employees. Customers consist of distributors, county councils, hospitals etc.

Since the consolidation of European production 2000 volumes have continuously grown. The growth in production volumes has resulted in the requirement of higher efficiency levels in internal logistical procedures, as well as better usage of current facilities. PPS has solved these requirements by continuous investments in re-building of existing free floor stacking to high density racking equipment, in order to provide sufficient storage space in the warehouse as well as established intelligent straight forward manual activities.

Today there is no space for further re-building in the current facilities whilst planned volume growth for the coming three years is doubling. The intention is also to process the increased volume with the same number of employees or less.

PPS will in the near future implement a new business system where one part of it is a Warehouse Management System (WMS). Could that be a solution on PPSs coming volume growth? The purpose of the project is therefore to map current activities, analyse them and thereafter to give proposals on how the internal logistical order and manufacturing process could be more efficient with support from different investments, e.g. a Warehouse Management System.

The project is focused on the physical activities and information flow at the warehouse for raw materials and finished products. Business processes not addressed in this project but being affected of the investments are customer service, shipping, purchase, planning and quality.

2 Method and Theory
To be able to give proposals and recommendations for the future logistical order and manufacturing process a detailed account of
the warehouse has been created. The most important theory in this phase has been “Process Flow Analysis”. This analysis is intended to provide a clear picture of the activities. When, who, why, how are important questions to answer.

The main method to find the answer on these questions has been interviews with staff who work within the different areas. I have also spent a lot of time observing the warehouse team performing the different activities.

Other theories which have had large influence on this project are theories about how to make the process more efficient and in which order it should be implemented. Japanese production philosophy, e.g. Toyota principles about waste, has also affected my thoughts and thus this project.

3 The material flow

The material flow starts with raw material arriving to the warehouse for raw material from the supplier. The raw material will there be physically checked and counted against the delivery note before putting goods into the warehouse. There it will be stocked until the team at the warehouse receives a demand requisition from production.

The complexity of the material flow into production is low due to the automated production lines PPS uses. The transformation process from raw material to finished product is just a one step process from a warehouse perspective; deliver raw material to the production line.

The number of warehouse employees for raw material are 15.

When raw materials have been transformed in the production lines to finished products they are automatically packed into cases, palletised and transported to the warehouse for finished products. The team in this warehouse will there receive the pallets and put them into different racking systems.

Next step in the total material flow is order picking. Every day 500 – 1200 pallets are picked and shipped from the warehouse. The capacity of the warehouse for finished products is 21500 pallets and the number of warehouse employees are 29.

For the purpose of the project the above described process flow has been divided into eight different activities and analysed from each of these perspectives. These activities are:

- Put away finished products from production.
- Material flow for re-packing.
- Receive finished products from supplier or an own European warehouse.
- Order picking.
- Shipping.
- Stock taking.

4 Identified problems

In this chapter the most significant problems will be identified.

4.1 Administration in the warehouse for raw material

Manual administration is one of the major problems in PPSs logistical activities, especially in the warehouse for raw material. For example, when a warehouse employee has received a delivery he or she needs to fill in and create three to five different documents and place them in different locations, e.g. the warehouse office for transactions in the business system, quality department for inspection, received goods to be able to locate it etc.

This administration is also a source to a lot of the transportation waste in this area of the warehouse. Below a couple of legible examples will be presented:

- There is only one office where you can take care of all documents but the warehouse is placed at different locations in the plant facilities.
- Pallet/Location tags need to be placed both in a “Stock Locater” and at the received goods. “Stock Locater” is a method to know where you have stored everything in the warehouse. One tag is placed in the locater and one is placed at the raw material.

4.2 Order picking

The main problems with order picking could be divided into transportation wastes and order structure. These two are also connected to each other; a complicated order structure generates more transportation.

What is the reason for the transportation wastes? That is not an easy question to answer and the answer is for sure not one thing. Like the problems in the warehouse for raw material, administration has a great influence. The set up of the administration with a “Stock Locater” (same method as for the warehouse for raw material), tags, manual documents creates a lot of transportation.
PPS modifies around 50% of all pallets coming out from the palletising system. A modification could be one or two extra layers on top of the normal pallet or decrease layers when the customer only wants e.g. 1.3 m pallets. This creates extra transportation and additional work load compared to picking normal pallets.

Why are PPS doing this with their pallets? The answer is cost reduction. PPS saves a lot of freight cost by doing this. The question the management should ask themselves is not if they should stop modifying pallets, but if they are doing it in an efficient way.

4.3 Palletising system

The palletising system PPS uses transports cases from the production lines, palletises and transport pallets to the warehouse for finished products. The system could be divided into one new part handling cases and pallets from the three new production lines from the consolidation, and an old part handling the remaining lines.

This system in total creates a lot of transportation and time waste. Some of the reasons are summarized below:

- Pallets are coming with the short side first and PPS handles all pallets with the long side first, two and two.
- No sorting between the lines exist in the system.
- A lot of down time in the old system.

All these examples create wastage. The annual output per year is 160,000 pallets which shall be manually sorted and turned before the warehouse team can stock them in the racking system.

4.4 Usage of external warehouses

PPS is a frequent user of external warehouses. The motive for that is the vacation period during summer when no production of finished products exist. The shipments for this period need to be produced before the summer, in fact almost the whole year is used to build stock levels for the summer.

Usage of external warehouses in the way PPS are doing generates remarkably cost waste and transportation waste in form of shipments and order picking between different warehouses.

Below a short summary for the last three years will be described:

- 50,000 pallets have been shipped to external warehouses.
- 10,000 of these have been shipped back to the distribution centre in Småland.
- Total freight cost for these shipments is 4.8 MSEK.
- The external inventory cost is 9.6 MSEK.

Since the shipped volume grow these figures will also grow which means PPS has to do something about it.

4.5 Two pallet types

PPS uses two pallet types for customer shipments, blue pallets and white pallets. White pallets are used for all European customers except for the UK market. Both pallets have the same size and measures. The only differences between the pallets are the colour and how they are traded.

Blue pallet has a cost of 35 SEK per transaction and white pallet costs 65 SEK to buy. This means that blue pallet is favourable if you lose the pallet and white is better if you can get the pallet back or if you can sell it for a price higher then 30 SEK.

Why is there then a problem to have two types of pallets? There are three main answers to that question. For the first; the old part of the palletising system described in chapter 4.3 could only palletise on one pallet type per shift. This means that all pallets produced in the old palletising system for customers in the UK need to be manually exchanged. This is approximately 12,000 pallets per year.

The second answer is that two pallet types has a negative influence on the capacity of the warehouse. That is not favourable due to the reason described in chapter 4.4. Reason is that the new palletising system could produce on two type of pallets on the same shift, which means that some products are stored with both pallet types but in different storage locations.

The third answer and maybe the most important reason why PPS only should use one pallet type is that the complexity increases with two pallet types all the way from warehouse administration to picking and packing.

4.6 Deviation in work load

Deviation in the work level causes a lot of problems of different kinds. It could be problems with planning the resources, need of resources, planning and purchasing problems etc.

The investigation in this project has found that four activities with large need of resources have deviation in the work level and therefore bad influence on the total warehouse process. These activities are:

- Arriving raw material. Varies per weekday.
• Arriving finished products of particular products group from the supplier. Varies per month.
• Customer shipments. Varies per week day.
• Produced quantity in pallets. Varies per shift.

Below the first point of the four is graphically illustrated. It’s easy to see that the arriving of raw materials tend to decrease at the end of the week.

![Deliveries per week day (2004)](image)

Fig 4.1 Number of deliveries with raw material per day of the week 2004.

5 Conclusions

If PPS wants to be competitive in the future they need to automate their order and manufacturing process, as all other companies. The conclusion of the investigation in this project is that PPS should automate but not straight away. My suggestion to get optimal advantage of automation is to start with decreasing complexity and simplify the activities.

There are a lot of reasons for that. For the first, it’s waste to automate activities which will disappear when decreasing complexity. It’s also easier to automate activities with low complexity. Decrease complexity and simplify the activities also creates cost savings by themselves and help the cost saving of the total investments. The recommendations developed in this project is therefore to start with complexity and simplify according to below before automation.

The most evident complexity decrease is to change all customer shipments from two pallet types to one. This will also be profitable due to a decrease in usage of external warehousing and the work load for exchange pallets. According to my estimation PPS could save approximately 1.4 MSEK by doing this. But above all it will decrease the complexity in total for PPS.

To follow the intended path and simplify today’s activities, the palletising system should be re-built before further automation. It must be difficult to find a waste which is clearer than to sort pallets and turn them before putting them into the racking system. A re-building of the palletising system will also generate potential for other investments like automatic lifts.

How should a re-building be done? Below is one suggestion described:

• New palletiser for the old production lines, same as the installed during the production consolidation.
• One pallet line in the warehouse per production line.
• Pallets arriving to the warehouse with long side first, two and two.
• Prepared for modified pallets, 2.6m.

Approximately invested amount for the above will be 6.5 MSEK.

The investigation and identified problems in this project has convinced me that PPS definitely could have benefits from a WMS. With support from a computer system, bar codes, lift computers etc the warehouse team could take care of the administration in a more efficient way. This will also result in more efficient transportation.

Functions in a WMS as bulk picking, zone picking, electronic messages and rules for stock taking will also definitively decrease a lot of transport wastes and make the work more efficient. The system could also make it possible to use the racking system in another way and therefore increase the capacity of the warehouse. And that will lead to a great cost saving for PPS.

The estimated investment amount for a new palletising system and WMS is around 10 MSEK. These investments together with one pallet type for customer shipments will make a cost saving up to 9 MSEK per year. Driving force of the cost saving is mainly reduced usage of external warehouse due to better use of the own facilities and decrease in workforce.

The last thought I will discuss in this article is levelling the work load. To be able to succeed with the implementation and target for cost saving PPS will be forced to level the peak of work loads. When you decrease your workforce due to automation deviations in work load will hit much harder on the total organization.

The deviation in work load could doubtless be smoothed with an active process between PPSs customers, sales organisation, planning department, supplier etc.