Material supply to assembly stations
- A study at Nederman, Helsingborg

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This articles based on a study at AB Ph. Nederman Co, in Helsingborg. The goal with the study was to improve the material supply to assembly stations. The study provides two frameworks. One framework identifies which components that should be stored in the station buffer and be ordered with Kanban. The other framework identifies components with a low inventory turnover that should be ordered in smaller quantities. The study do also provides solutions that will facilitate the implementation of Kanban.

Keywords: Material supply, Lean, Assembly, Inventory turnover, Kanban, Lead time, Stabilize the load of work

Background

Nederman is one of the world's leading companies within industrial air filtration. Their products create a clean and safe working environment by focus on air and recycling.

The business concept of Nederman is stated as followed; *Through products, systems and application expertise to provide solutions that safeguard a clean working environment, efficient and safe production and eco-friendly recycling.*

The current financial situation and Nederman's global competition is forces that affects them and creates a need of staying competitive in every process.
Nederman's site in Helsingborg assembles, mainly manually by operators, components into finished products for shipping to end customers. To be able to be competitive with labor-intensive assembly operations, high utilization rates of the assemblers are necessary. This is especially due to the relative high total labor costs in Sweden.

In a long term perspective the goal is to increase the number of products assembled in Helsingborg. An increase of the number of assembly stations is therefore needed. The site in Helsingborg has today almost reached its limits due to lack of free floor space. A significant amount of the floor space is today allocated to store components. By reducing the components stored in the assembly area, an increased floor space can be achieved, which enables future expansion. [1]

Problem Discussion

Nederman's site in Helsingborg faces some challenges to their future expansion. To be able to expand, space for new assembly stations is needed. At this moment, a lot of the goods that should be stored in the warehouse are placed at the assembly floor space, due to limited storage space. One challenge is to find ways where the material supply can reduce the inventory and release floor space.

A current problem at Nederman is the high amount of time used for non-assembling activities, such as material ordering, material supply or search for components. The non-assembling time can be considered as waste, which needs to be eliminated in a competitive environment.

Another problem is the lack of method of how to determine if components should be stored at the assembly station or at the warehouse. Today no standardized procedures exist for the material supply.

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[1] Nederman, *Annual report 2009*, retrieved 2010-12-01, <http://www.nederman.com/Financial/Financial/~/media/Nederman_Group/Financial/Nederman_Annual_report_2009%20pdf.ashx>, p. 1-7

As a result, the inventory at the assembly stations is high and ordered without further consideration. Nederman aims to reduce inventory and find the right components that should be stored in the assembly area.

Those problems can be summarized as;

- How can the waste of time be reduced in the material supply?
- How can the utilization rate at the assembly stations be increased?
- What ways exist to release floor space at the assembly stations?
- Which parameters determine where a component should be stored?

- How can suggested solutions be financially prioritized

The studied system, see *Figure 1* is affected by a number of components that has to be taken into consideration: the structure of material flow, the processes within the system and the management components that are controlling the system.

This paper includes which methods that have been used in the study as well as the theoretical framework of the study. After, the paper will introduce five proposals for Nederman. Last, conclusions from the study will be summarized.
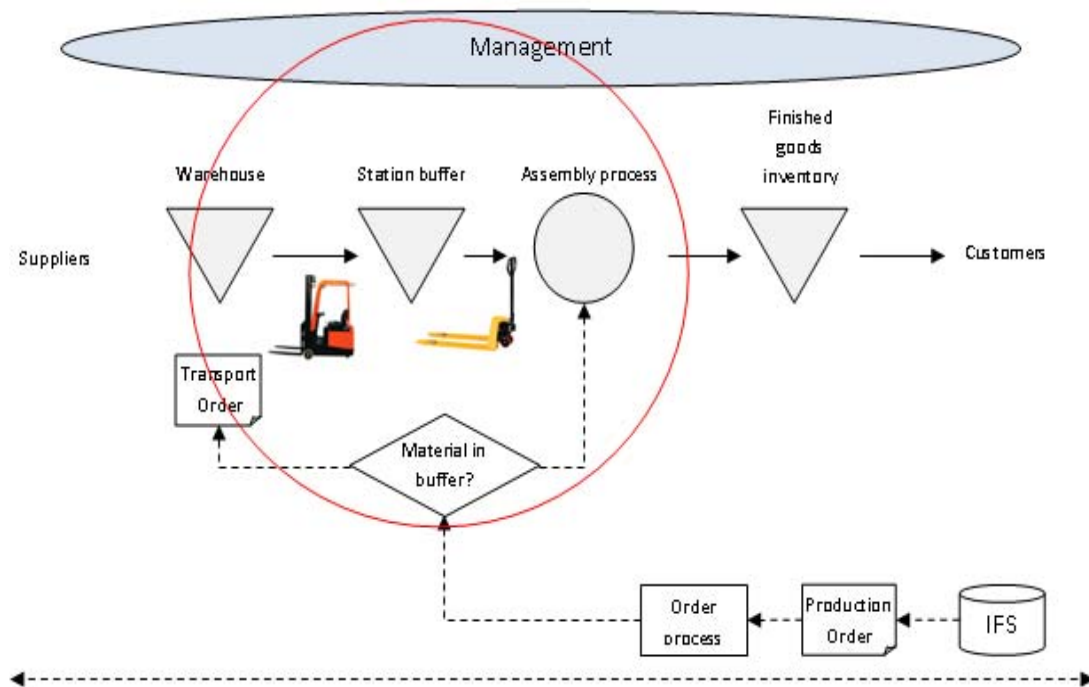

Figure 1- The studied system

Method

This study is based on a system approach since the problem at Nederman is not just a single sub part problem. To solve the problem, synergy effects and bilateral interactions between sub parts with indicator-effect-connections have to be considered. The system approach supports this thinking and we feel comfortable in its wide approach of explanatory and understanding knowledge.

The study has an abduction research approach since a wandering back ad forth between theories and empirics to find connections and make conclusions have been made.

The study has used both primary and secondary data. Initially the secondary information was used to achieve knowledge within the field of material supply. To get a deeper understanding and basic knowledge about Nederman's processes, observations and interviews were made. A company visit has been made to observe a best practice assembly process and to gather information and data regarding successful solutions of material supply at Thorn Lighting. The study has also been using a large amount of quantitative data from the enterprise resource planning program. Missing data has been treated by a list wise deletion, which means that when any of the variables are missing, the entire observation row is omitted from the analysis.

Theoretical frame of references

In this study several theoretical areas are studied. Concepts and terms related to material supply have been studied, for example demand and the variability factor of demand.[2] The variability factor of demand is one of the parameters in the framework to identify Kanban components. Two other studied terms are inventory turnover[3] and lead-times[4]. Both

were used in the mapping of the material supply at Nederman.

To be able to identify Kanban components, three types of ordering processes, Kanban[5], Two-bin Kanban[6] and material requirements planning (MRP)[7] have been studied. Further, theory about improvement tools, mostly related to Lean, such as stockless production[8], standardized working methods[9] and stabilize the load of work[10], were part of the framework.

Finally, two mapping tools, mapping of the material and information flow[11] and mapping of waste[12] was used to map the material supply at Nederman as well as map non-value adding activities in the material supply.

Proposals for Nederman

The five following sub-chapters describe the developed proposals for Nederman based on the study.

Introduce segmented Kanban/MRP approach

A framework is proposed that Nederman can use to identify potential components that can be targeted for Kanban or MRP. The framework, see Figuren 2, is referred to as the demand variability and picking frequency framework. Components that are not ordered with Kanban should not be stored in the station buffer and hence only be ordered in demanded quantity. As a result, only Kanban components are stored at the assembly station. The framework

[2] A Norrman, Lecture Notes – Logistik i försörjningskedjor (MTT240), 2009 p.49-52
[3] JJ Vogt, et al. *Business Logistics Management,* 2006, p.97

[4] P Jonsson, et al. *Logistik- Läran om effektiva materialflöden, p.131*
[5] S Shingo, *Den nya japanska produktions filosofin,* 1984, p.172
[6] http://www.gembapantarei.com/2008/02/three_essential_supervisor_skills_for_standard_wor.html
[7] K Lumsden, *Logistikens grunder, 2006, p. 425*
[8] J-E Ståhl, *Industriella tillverkningssystem – länken mellan teknik och ekonomi*, 2008, p.264
[9] J Liker, *The Toyota way- Lean för världsklass,* 2009, p. *176-179*
[10] S Shingo, *Den nya japanska produktions filosofin,* 1984, p.138
[11] B Oskarsson, et al. *Modern Logistik- för ökad lönsamhet,* 2004 p.176-177
[12] J Liker, *The Toyota way- Lean för världsklass,* 2009, p. *50-52*

identifies suitable component ordering process for each component and hence determine where a component should be stored.

The framework considers Cimorellies' (2005) conclusion regarding the variability factor and which products to put on Kanban.[13] Still though, floor space at the assembly stations has to be minimized and building safety stock for high variability components is not an option. Therefore, a relative low accepted variability factor for Kanban-A, 0.6 has been chosen. A component with a high picking frequency is by us defined as a component that is picked every second day over a one-year period. With 250 working days the Kanban-A frequency boarder is set to 125. This boarder is set to narrow the search for the most suitable components that could be tried in a pilot study. The area of those components is marked by the crosshatched Kanban-A area in Figure 2.

With an organization and a material supply that is working with Kanban, a yearly picking frequency of one per week would be more realistic, which is marked by the crosshatched Kanban B area in Figure 2. A possible third area of accepted Kanban components is the Kanban-C area. The Kanban-C area accepts components with a higher variability and lower demand frequency.
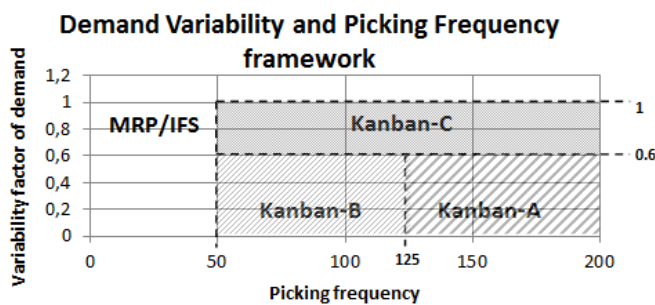

Figure 2 – The variability and picking frequency framework

Frameworks like the variability and frequency plot should only been seen as a guideline in the searching of decision parameters for where a component should be stored. Size of the components and special treatment arrangements can be other factors that also have to be considered.

By implementing Kanban A-C the time reduction in the assembly process would be 73 hours per year for the three studied assembly stations. As a result of the time reduction, the utilization rate at the assembly stations will increase.

The study shows that implementing Kanban at the three studied assembling stations will release 29 pallet locations.

We propose that Nederman should start with the Kanban implementation at assembly station 189. One reason of starting the project in a small scale is to avoid big problems that create disturbances in the assembly process. Another important reason is to establish early success stories of the Kanban project. Due to the past experiences, an implementation of Kanban today cannot afford early failures. With a suitable assembly station chosen it is important to start with a component that perfectly matches the criteria for Kanban, e.g. Kanban-A components. Further on when the procedures of treating the Kanban components are established, an expansion of number of components at the chosen station can be made.

To achieve a stabilized material supply, the component ordering process has to be spread out during the day. When implementing Kanban the ordering will not be done at a specific time during the day, instead it will be done continuously. This will reduce a significant amount of the irregularities due to the fact that most of the components can be ordered by Kanban.

Kanban will reduce the number of orders that are placed manually which will

[13] S Cimorelli, *Kanban for the supply chain - Fundamental practices for manufacturing management,* 2005, p. 64-65

decrease the disturbances and increase the assembly utilization rate. By using a Kanban solution that is refilling material continuously and usage of the MRP function in Nederman's ERP-system, the time spend in the component ordering process will decrease rapidly and the assembly utilization rate will increase.

Quality circles

Quality circles should be started parallel with the implementation of Kanban. The quality circles are a perfect way to start up a Kanban process with involvement of employees. The creativity and knowledge from the assembly personnel is invaluable. Even if this study provides a framework of how to identify potential Kanban components, the personnel have the experience and *tacit knowledge* that can explain and solve single component problems. There are also these quality circles that have to reevaluate the implementations and continuously improve them.[14]

Standardized load-carriers

We have by the study concluded that the load carriers at Nederman should be standardized into bins. When replenish components from the Warehouse in bins, it is possible to deliver bins to several assembly stations in each route. Replenishing several stations in the same route will decrease the total transportation distance, which will decrease the total transportation time as well. The bins have grips, which make them easier to carry compare to cartons. The bins should be stored in supermarkets.

Supermarkets

A supermarket is a shelf that stores components in bins. A supermarket can supply one or several assembly stations. Since all bins have the same height, the supermarkets space could be fully utilized. A supermarket can replace 4 mixed pallet.

The bin can also be used as a Kanban card when using a two-bin Kanban solution.[15] When storing the bins in the supermarket, the time spending on searching for components will decrease since the assembler will know where in the station the bins are stored. When decreasing the time spend on searching for components, the assembly utilization rate will increase.

Reduce components order quantity

To be able to release floor space in the assembly stations, a framework to identify components with a low inventory turnover has been developed, Figure 3.[16]

We suggest that an inventory turnover higher than 50, which corresponds to a replacement of the inventory once a week, is an accepted inventory turnover. Components with an inventory turnover less than 50 should reduce the component quantity per load carrier. By reducing the accepted limit of inventory turnover, the buffer inventory has to be reduced and floor space will be released.
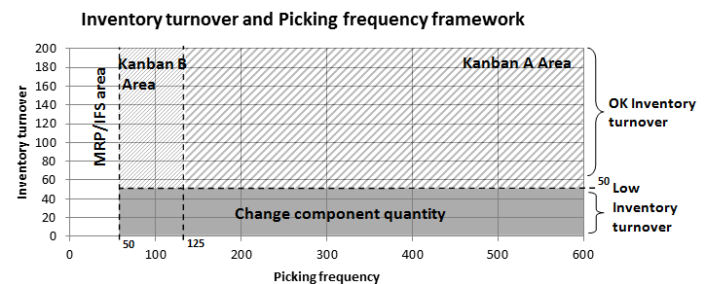

Figure 3 – Inventory turnover and Picking frequency framework

If the components are delivered in high quantities from the suppliers, new supplier contracts with less quantity per delivery could be interesting. If the components are delivered in big quantities from the warehouse, bins are more suitable to use.

Conclusions

The suggested solutions will improve the material supply at Nederman. The two suggested frameworks should be seen as

[14] R J Schonberger, *Japansk kvalitet och produktivitet, 1983, p161-166*

[15] B Oskarsson, et al. *Modern Logistik- för ökad lönsamhet,* 2004 p.96

[16] JJ Vogt, et al. *Business Logistics Management,* 2006, p.97

guidelines for Nederman. Starting quality circles at Nederman could facilitate the decision-making about where to store the components as well as simplifying the implementation of Kanban at the company. We also suggest that bins should be introduced as a standardized load carrier at Nederman. The bins facilitate an implementation of supermarkets. The occupied floor space in the stations could be decreased even more by reducing components order quantity in connection with the implementation of Kanban.

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