

# A flow analysis of a new production facility for drug production

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*This article is based on a master thesis conducted at QPharma in Malmö during 2012. The goal for the thesis was to investigate, and if possible improve, warehousing, transport and production related to the new products to be manufactured in the new production facility. The article will briefly explain the problem description, the current situation, the analysis and the recommendations made to the company. Finally there are some brief conclusions about the work.*

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## Introduction

QPharma is a company producing drugs located in Malmö, Sweden. The company has about 120 employees and total sales over 160 MSEK (2011). QPharma was established in 1999, but the current production site was founded earlier, back in 1975. Since 2000 it is a subsidiary of Nordic Group BV.

Nordic Group BV and the companies owned by them has two major focuses: Sales and marketing of drugs and development, logistic services and production of drugs. QPharma is an example of the latter and mainly on the production part. The drugs produced in Malmö are sold mainly in the Nordic countries and in Europe, but also to some extent in North America. Different tablets makes up for most of the production, but also gums and polymeric rings are produced here.

## Problem description

Due to increased sales and rising demand, there was a need for bigger facilities and additional production capabilities. In 2011, this need led the company to initiate the construction of a brand new production

facility. The construction was complete in 2012 and it is the flows of material and products to and from this building that is the main focus of the thesis.

The problems the company wanted to investigate in the study was:

- Where are the various raw materials and products going to be stored and in what way should the warehouse be organized in order to best handle these new flows
- How much storage space will be needed for the new products and the raw material used to produce them
- To make the transports to and from the new production facility as efficient and smooth as possible
- Search for, find and define possible bottlenecks and waste in the flow of raw material and products in order to improve them

The goal with the thesis was to answer these problems by investigating and understand the flows related to the three new products to be produced, in order to be able to make recommendations how to

improve them. An additional goal was to find any other relevant problems linked to the production of the new products and solve them too.

## Current situation

Due to the fact that no actual production has started yet, all information about the products had to be estimated. Lead times of raw material, transport times to and from production and cycle times of the production along with the demand of the different products are the ones that had to be decided on. To do this, as many people as possible who are involved in the process has been interviewed and been asked to estimate these factors. Together with the Director of Production, the most likely values have been found and these are the ones used in the thesis.

Not only the future production itself and the warehouse have been investigated. Functions, which are considered to be supporting ones for this purpose, are also closely looked at. These include the weighing of raw materials (needed to ensure that the exact amount of each raw material is used and that the drug gets the right properties) and the quality control. The latter one is actually twofold and consists of two separate departments, Quality Control (QC) and Quality Assurance (QA). QC tests every raw material and finished product to make sure that it has the right quality and properties. QA in turn checks QCs work thoroughly and makes the final decision to release the produced goods to the customers.

The three new products, a tablet, an intrauterine device and a polymeric ring, have been mapped and investigated mainly with tools from the Lean

methodology.

Each product has been mapped separately from the receiving of raw material to the point where it is transported to the customer. Apart from the earlier mentioned cycle- and takt times (based on the demand of the product) of the production, other information has also been collected/estimated. The amount of pallets handled per year, mean number of pallets to be stored and total transportation time of the products are among them.

## Analysis

As stated earlier, the focus has been on the flows to, from and within the new production facility, hence this is also the focus of the analysis. Every product is analyzed individually from the production perspective, while the warehousing and transport to and from the facility of the products are seen as a whole.

The first product to be analyzed was the ring. It was found that with the current estimated production times, no major changes had to be made in order to cope with the future demand. Due to the fact that the product is to be sold in many countries, packaging may differ a lot because of different regulations. It was found that the only cycle time higher than the takt time was for the packaging for a certain continent which affected about half of the tablets packed.

The second product was the intrauterine device. Out of the 12 different steps in the production, only three had a cycle time lower than the calculated takt time. It was further established that some of these production steps cycle times had to be greatly reduced to meet said takt time. One had to be reduced to one thirtieth of

the current calculated time, which calls for major changes.

The final product, the polymeric ring, and its production process also needed improvement. All production steps, apart from packaging, needed reduced cycle times. The highest reduction for a production step needed for this product was to one fifth of the current estimations.

When it comes to the warehouse and the transportation of goods to and from the new facility, it was found that the warehouse had the capacity to handle all the new storage space needed. There were simply put more pallet spaces empty on a regular basis than the number needed to store the new products. Some problems were found though. A number of raw materials (mainly Active Pharmaceutical Ingredients) and package material needs to be locked up when stored. This requires specially designed pallet positions and shelves. According to the investigation, the space needed would exceed the current space available on a regular basis. This had to some extent been foreseen by the company and measures had been taken to deal with this problem, why no further thought was put into this matter.

Another potential problem was the lack of pallet positions in the new facility, mainly due to the expected interim storage in this building.

Regarding the transports, the total time needed was closely mapped and analyzed. The amount of transport time for the flow of the new products was almost equal to the man hours of a full time employee. If the time needed can be extracted out of the current work force or if it can be reduced in some way, it might be possible

to cope with the new work load without hiring a new employee.

## Recommendations

Out of the previous information gathered and the analysis of this, a large number of suggestions for potential improvements could be made. Based on these, nine recommendations were finally made to the company. Six of these were specific to the new flows of the three products and three were made for the company as a whole. The most important ones are described below.

The first recommendation was to create a common room for packaging in the new facility for the first and second product. This process is labor intensive and no machines are needed, which is why they can use a common space. The number of interim storages needed will be much smaller due to a more line-based process, the lead time will be reduced, less storage space is needed in the new facility and the man hours needed are used more efficiently.

The second recommendation was to implement dual lead times for the purchase of raw materials. Due to the processes in Quality Control and Quality Assurance, the times to release a raw material for production vary. If dual lead times would be used for purchasing, amount of material stored could be reduced by about 20% and the capital tied to the stock would be decreased.

The third one was about standardization in the handling of production documents and implement an electronically system. It would reduce lead times and its variance for the product, minimize the number of

errors and lighten the workload of the workforce of the warehouse.

The fourth recommendation was to improve the flows in the production, by implementing changes made with the Lean methodology. These included more balanced cycle times by splitting and combining the different operations and would also make sure that the different cycle times would be lower than the takt time of that product. Ideas for Supermarkets were presented, simple FIFO-queues for the following flows and in cases where the cycle time of an operation could not be lowered enough and recommendations were made to acquire new machines and equipment in order to lower them. More employees and shifts would be the last resort, due to the higher cost over time.

It was also recommended that the packaging of the last product would take place in the new production facility. This would require the purchase of new equipment and the dedication of a separate room solely for this purpose. The benefits of this would be the same as the ones presented for the first recommendation, but due to the fact that the investment cost is substantially higher and the Pay Back time would be much greater, the priority isn't that high. Finally, it was also stated that the work the company had begun regarding 5S should continue and that the time of Line Clearance and set ups could be reduced by working with SMED (Single digit Minute Exchange of Die). As the production wasn't in place yet, no specific recommendations could be made yet.

## Conclusions

The four problems posed in the problem description have all been thoroughly studied and analyzed.

For the first two, no need for major alterations could be found. The one discussed earlier, the need for some materials to be locked up when stored, was foreseen.

Suggestions have been made regarding the transport efficiency, which was described as the third problem. These were found to be closely linked to the final problem regarding production (and packaging). It was concluded that the absolute majority of suggestions that improves the production and packaging also improves the transports.

A majority of the time and the final recommendations were about production and packaging, which is the last problem described earlier. Initial investigations made clear that the production of two out of three products could not meet the foreseen demand, which made the solving of this problem the main goal of this study.

There was no aim to develop new methods for solving problems like these; instead the work can be seen as test on how well the existing methods and models would prove to be.