

Inventory Management in Small and Medium-Sized Manufacturing Companies and Its Main Dilemmas

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Abstract

This paper briefly reviews some recent work aimed at inventory management and its problems and dilemmas in today's competitive world. The study is focused especially on small and medium-sized manufacturing companies with very complex production processes. The main goal is to outline the major difficulties influencing the performance of small and medium-sized manufacturing companies in connection with the complexity of their production processes. Some examples from the Czech business environment and results from the previous researches of the author are briefly analyzed and discussed in several parts of the essay. The final part includes a short case study describing the implementation of several small improvements that should positively influence the inventory management and gain some saving for the company.

Keywords

Inventory management, production complexity, production process performance, stock level

1. Introduction

Many production companies are permanently expanding and modifying their production portfolios in order to succeed in today's competitive environment what increases the complexity of their production processes. As Deshpande (2010) explains, not only a huge number of components (materials, production resources, final products etc.) make systems extremely complex. It is also another issue – variability or uncertainty – which influences a high complexity of any system. In case of production process, it is especially variability in customer demand. All mentioned above make production and inventory management extremely difficult. Sharif (2012) in his study from an Indian industry area pointed the gap between demand and supply which also causes a lot of losses and production problems.

The importance of inventory management for Small and Medium-Sized (SMEs) manufacturing companies proved Rajeev (2010) who analyzed its influence on economic performance. His study was aimed especially at machine tool industries sector in India which is an extremely inventory intensive. The results showed that inventory management has really some impact on labor productivity, capital productivity and returns to scale in respondent companies.

Despite their broadness, SMEs (mainly micro and small enterprises) often have limited ability to compete with large companies, especially due to the higher prices of their products and longer delivery times. It is caused by higher production and logistic costs and higher complexity of production process which are influenced especially by higher demand variability. Therefore, the concept MTO (Make-to-Order) do not have to be efficient in all cases. However, on the other hand, it is very hard to create some minimum stock levels for final products in such a complex production processes.

Boysen et al. (2013) in their study created some models for solving single-machine scheduling problems in which the processing of jobs leads to a release of a predefined number of product units into inventory. These models can be useful for optimizing product inventories and meeting customer requirements at the same time. However with the raising complexity of the product portfolio, using of any general model is more and more complicated. In large companies, the majority of problems are solved by using some advanced software tools, but small companies do not have enough financial resources for these sophisticated applications. Therefore, the main goal of this paper is to find out and analyze basic problems of inventory management especially in small and medium-sized companies and try to provide some inexpensive solutions.

2. Position of Small Enterprises in Czech Republic and Other European Union Countries

Small and medium sized enterprises (SMEs) provide a significant source of jobs and economic growth all over the world. SMEs include micro, small and medium enterprises. In European Union, their performance is measured by three main indicators: the number of enterprises, their gross value added and the employment (Ecorys 2012). In 2012, SMEs provided more than 67 % of jobs in the non-financial business economy in European Union countries. The majority of working people are employed in micro or small enterprises (enterprises employing between 1 and 50 persons). The next figure (Figure 1) shows employment in all basic types of enterprises in European Union countries in 2012 (Ecorys 2012).

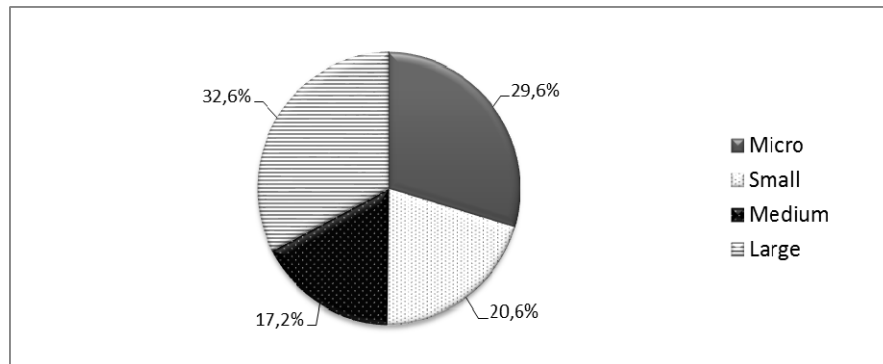


Figure 1: The employment by size-class in EU-27 in 2012 (source: Ecorys 2012)

Not just employment but also the value added of SMEs shows how important these companies are for our economy. As you can see on the next picture (Figure 2), the majority of gross value added is created by SMEs and it is still growing. Value added in the following chart is calculated from turnover, plus capitalized production and other operating income, changes in stocks, minus purchases of goods and services and other taxes and duties linked to production or turnover (Ecorys 2012; Eurostat 2009).

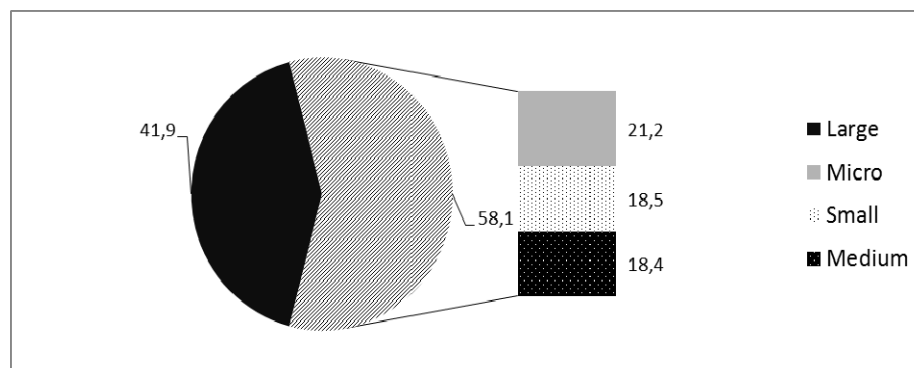


Figure 2: The gross value added by size-class in EU-27 in 2012 (source: Ecorys 2012)

The situation on the SMEs market in Czech Republic is very similar. In 2011, the majority of working people were employed in micro and small enterprises (around 50%) and only 30% of them worked in large companies. The share of gross value added created by SMEs in Czech Republic is also very similar like in case of other European Union countries. In 2011, the gross value added in SMEs segment was over 55% (European Commission 2013).

3. Research Methodology

The paper is based on the secondary research data accompanied by the results of previous researches of the author and case study from one selected Czech manufacturing company. The main goal is to analyze basic problems of inventory management in SMEs in connection with the complexity of their production processes, point out its main dilemmas and outline some potential solutions that are verified through the presented case study.

In the first part of the study, the main problems of inventory management in complex production processes were identified using the data from quantitative research realized in 2011 and 2012 among the Czech manufacturing companies. The mentioned quantitative study was realized as a questionnaire-based investigation and it included 50 respondents from the SMEs segment. In the next phase, interviews with production managers of five selected companies were conducted in order to better understand the problems arising from the product portfolio complexity and methods that are used for their solving.

The respondents were also asked to identify several factors connected with the inventory management in their companies that positively or negatively influence the company's performance. According to their answers a simple chart explaining the conflict between system flexibility and efficiency were created and several potential solutions were proposed and verified through the case study.

4. Results: Inventory Management and Production Complexity

Inventory management has a significant impact on a company's performance because it can influence all of the three key factors of competitiveness: quality, time (or flexibility) and costs. Difficulty of inventory management increases with the product portfolio complexity. From an accounting point of view, inventories are considered to be assets. However, in reality, inventories negatively influence company performance as they absorb financial resources that could be used for more important business activities.

On the other hand, having enough finished (or semi-finished) products in stock helps to react more flexible on customer's demand what positively influences the quality of provided services and delivery times. So, what is better? Is it better to have zero inventories or to have enough inventories to satisfy all customer requirements? It is a very hard question and many authors have investigated this problem and created hundreds of models for how to calculate and manage the optimal stock level. However, unfortunately, no model is suitable for each company. Especially in companies producing products with the fixed lifetime, the inventory management is extremely difficult.

4.1 General Results of Quantitative and Qualitative Study: The Main Problems of Inventory Management

In the study 50 SMEs manufacturing companies from the Czech Republic were asked about their main problems with logistic and inventory management. More than 70% of them mentioned the lack of the unified inventory management system and permanently actual information about the availability of each product and each material for everyone who needs this information for his work (sales representative, production planner etc.) what causes a lot of other problems like non-realistic delivery times promised to the end customer, chaotic production planning, stress and disgust of production workers etc. These types of companies often do not devote time to implement a new methods and approaches into their current management processes even when they know that they need it. Often it is just because of the high complexity of their production processes which does not allow them to stop for a while and create new rules and reorganize their logistic processes as I learned from the interviews with several production managers of selected companies.

Each of the interviewed companies confirmed that the main problems of the current business environment are permanently higher customer's requirements for delivery times, product innovations and high unpredictability of customer demand. These factors negatively influence the complexity of the whole production process and production and logistic costs. Then, the production planning is chaotic, production orders are often delayed and all engaged people are disgusted. It is especially because of the following reasons:

- Lack of communication between individual departments and people inside the company, especially between a sales representative and logistic or production manager
- Absence of unified standards and procedures (for example the standard of communication with the end customer – what can be promised, in which delivery times etc.)
- Absence of any inventory management system
- Absence of classifying produced items and related materials into several groups according to their turnover and material costs

4.2 How Inventory Management Affects the Company's Performance

The company's performance can be measured in various ways. The most common measure is Return on Investment (ROI) or Return on Average Capital Employed (RACE). As Cox and Schleier (2010) say, both of these measures are influenced by the following tactical objectives:

- Decrease inventory
- Improve quality
- Increase sales
- Decrease costs
- Improve due date performance

As you can see, all of the five tactical objectives influencing ROI or RACE, mentioned above, relates somehow to inventory management. However, some of them are contradictory to each other. For example, when company wants to improve quality of provided services and increase sales, it is often necessary to increase inventory and costs. In general, we can say that the flexibility of a system comes into the conflict with its efficiency (Figure 3).

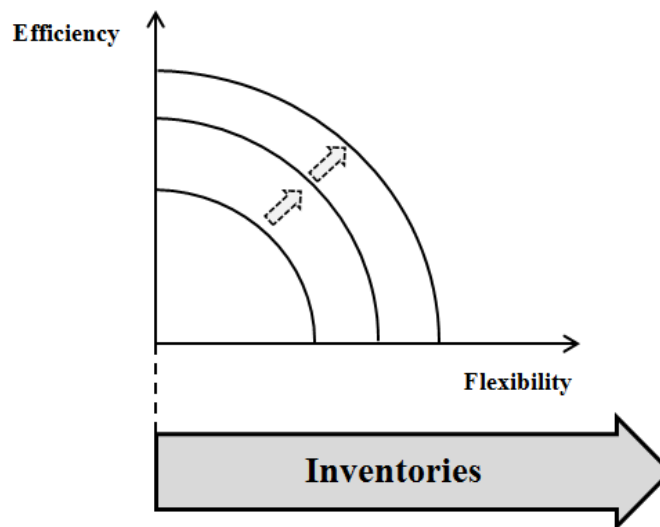


Figure 3: System flexibility vs. system efficiency (source: autor's own)

The higher flexibility of a system almost always negatively influences its efficiency. Therefore, the best decision is such decision which helps to reach the higher performance curve, i.e. higher level of the combination of system's flexibility and efficiency (Figure 3).

In the author's previous researches (Ferenčíková and Pivnička 2012) the impact of computer applications in production management on the company's performance was investigated. It was found out that the most often mentioned benefits related to increasing sales due to better production planning and scheduling. What was surprising, a lot of respondents indicated increasing sales while reducing production and logistic costs and stock level. According to the results from that research, it can be stated that using some unified system (in that case some special information technology) for managing the production process and logistic activities can greatly influence the competitiveness and company performance. The mentioned research was focused on companies of all size but the advanced technologies were used more in large companies than in SMEs. The main reason was explained by several representatives of SMEs during the consequent qualitative study. In all cases, the respondents claimed that their companies do not have enough money for such an expensive investment. Therefore, the next part of the study is focused on proposing and discussing several solutions to the problems mentioned above that can be implemented without any advanced software support. After that, the proposed solutions are verified by the case study.

4.3 How to Deal with Major Inventory Management Problems - Case Study

The company selected for the case study is a small Czech producer of safety belts with less than 20 people employed. This company is a typical example of a highly complex production system. It produces more than 200 variants of safety belts and their accessories. Furthermore, its products are very specific and high-quality demanding with fixed expiration dates. Therefore, it is not possible to keep all products and materials in stock for a long time. On the other hand, the most suppliers come from other continents (especially Asia) and therefore the delivery times are quite long and delivery costs are higher. Because of the reasons mentioned above, the company had very serious problems with inventory management. It faced the conflict explained in the part 4.2 and figure 3 of this paper.

The process of solving the problems explained above included the following steps:

1. *ABC analysis*

In the first step, all products from the range were classified into three groups (A, B and C) according to their share on the sale. Standard principles of ABC analysis and Pareto principle were used for this classification (Koch 1999). The main purpose was to extract the items that make around 80% of total annual sales and concentrate the attention just on them. Only 30 variants of final products of the whole product range were included into the group A. In the next steps, only the group A is considered.

2. *Setting stock levels*

The most problematic part of the project was how to set up minimum stock levels for materials and components needed for the final products from group A. In case of this company, the production time was not regarded as a significant constraint because the processing time for batch of 20 pieces is not more than one shift. The most limiting were just delivery times of materials and components. Because of the fact that customer demand is highly unpredictable, the company needs to keep enough materials in stock. However, as was found out, it did not have any logical system of stock levels before what caused the delays in deliveries due to the lack of some component or, on the other hand, extremely high stock levels of other components. The main goal of the company was to be able satisfy all “normal” orders for group A products immediately. As a normal order was called order for no more than 20 pieces. Therefore, it was necessary to remove all extra orders (up to 20 pcs) from annual sales reports and calculate the normal weekly sales for each product from the group A (see Table 1).

Table 1: The example of calculation of average weekly sales for product Safety Belt SA04 (author's own)

Week	Dates of the sales	Total sold quantity (pc)	Normal weekly sales (pc)
1/2012	04.01.2012	12	27
	05.01.2012	10	
	06.01.2012	5	
2/2012	09.01.2012	65	15
	10.01.2012	10	
	13.01.2012	5	
3/2012	17.01.2012	15	15
4/2012	24.01.2012	10	14
	26.01.2012	4	
5/2012	01.02.2012	11	21
	02.02.2012	10	
6/2012	06.02.2012	5	22
	07.02.2012	5	
	10.02.2012	12	
7/2012	15.02.2012	10	10
8/2012	21.02.2012	70	12
	22.02.2012	12	
9/2012	27.02.2012	5	14
	28.02.2012	4	
	02.03.2012	5	
10/2012	07.03.2012	10	15
	08.03.2012	5	
Average weekly sales			16,5

As soon as the average weekly sales are calculated, it is possible to set up minimum stock levels for all components needed for this product in order to ensure delivering “normal” quantities on time. These stock levels are influenced by standard delivery times as well. For illustration, how the minimum stock level was calculated, several components of the final product Safety Belt SA04 were chosen (see Table 2).

Table 1: Calculation of minimum stock level for several components of Safety Belt SA04 (author’s own)

Component	Quantity per 1 pc of Safety Belt SA04	Delivery time of the component	Average sales of Safety Belt SA04 during delivery time of the component	Minimum stock level for the component
Black belt 40 mm	50 cm	2 weeks	33 (2 weeks x 16,5)	1650 cm
Black belt 100 mm	100 cm	2 weeks	33	3300 cm
Green belt 40 mm	50 cm	2 weeks	33	1650 cm
Green belt 100 mm	100 cm	2 weeks	33	3300 cm
Small clip	4 pc	3 weeks	49,5	198 pc
Large clip	1 pc	4 weeks	66	66 pc
...				

Maximum stock level was not calculated as it is influenced by requirements of suppliers for minimum ordered items. All calculations and tables (Table 1 and Table 2) explained above are enough simple to be programmed just using any basic spreadsheet and analysis program such as MS Excel.

3. *Simplified visual production planning*

The main purpose of proposed simplified system of production planning was to differ between several types of orders: normal order (up to 20 pieces), extra order (over 20 pieces), normal order with extended delivery time and make-to-stock production. It was necessary to set some rules, how all mentioned types of orders should be processed. Normal orders (up to 20 pieces) have the highest priority and all needed materials and component have to be always in stock. In case of extra orders or orders with extended delivery times special conditions must be negotiated with customers. It means that material and components are ordered separately for these types of orders and therefore delivery times are longer. The last type of production, make-to-stock production, is processed only in case of idle capacities and enough materials in stock.

5. Conclusions

As we learned from the previous part, inventory management can greatly affect the company’s performance and in complex production processes is much more important and difficult, especially in case of SMEs. In view of the fact that SMEs provide a significant source of jobs and economic growth of all (not only European) developed countries their performance should be given due attention.

It was said that ROI is the most often used method for measuring the economic performance and it is influenced by several tactical objectives. However, these tactical objectives do not always drive ROI in the right direction as they often come into conflict with each other. Therefore, enterprises must be careful about the reached improvements because they cannot always have only a positive impact on the company’s performance. They need to find an optimal combination of the system’s efficiency and flexibility.

The interviews conducted in selected Czech manufacturing companies showed that all problems with the inventory management in SMEs are influenced by the high complexity of production process caused by increasing customer’s requirements. However, it was also found out, that companies often do not have any unified system for managing inventories and unified standards of communication between individual departments. In large companies, this problem is solved by using some advanced software tools which are quite expensive for small companies. Therefore, some inexpensive solutions were provided to solve inventory problems in one selected company producing safety belts. After the implementation of all three steps of inventory management optimization described above, the company reached the following improvements:

- Reduction of delayed sales deliveries by 30%
- Reduction of stock by 15%
- Reduction of urgent (and therefore also more expensive) purchase deliveries by 10%

Improvements described in the case study helped the company to reach the higher performance curve (see Fig. 3) as it reduces stocks (improved efficiency) and reduced delayed sales deliveries (improved flexibility) at the same time. Company had tried to reduce stocks not systematically before what had led to the worse flexibility and slower reaction to customers' demand. However, as can be seen from described improvements, systematic stocks' reduction can help to improve both the production process efficiency as well as its flexibility. Therefore, we can conclude that all potential influences must be considered when implementing some new systems and concepts.

Acknowledgements

The author would like to thank to the Operational Programme Education for Competitiveness co-funded by the European Social Fund (ESF) and national budget of the Czech Republic, the grant No. CZ.1.07/2.4.00/31.0096 - "Building partnerships and strengthening cooperation in the field of lean manufacturing and services, innovations and industrial engineering with the emphasis on the competitiveness of the Czech Republic", which provided financial support for this research.

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Biography

Denisa Ferenčíková is a PhD candidate at Tomas Bata University in Zlín – Faculty of Management and Economics. In 2009, she received a Master's degree in Industrial Engineering. Her current research involves advanced methods for production planning and scheduling and its support in business information systems, inventory management, logistics and its main problems and benefits. She also teaches several subjects at Tomas Bata University in Zlín such as Business Information Systems, Logistics or Management and Organization of Production Processes.