MAKE TO STOCK DECISION MAKING IN METALLURGICAL COMPANIES

Leo TVRDÖNE\textsuperscript{a}, Radim LENORT \textsuperscript{a}

\textit{a} VŠB – Technical University of Ostrava, 17. listopadu 15, 708 33 Ostrava - Poruba, Czech Republic, leo.tvrdon@vsb.cz, radim.lenort@vsb.cz

Abstract

Make to Stock (MTS) production and inventory planning and control policy means finished goods are produced based on forecast and the customer buys from the finished goods inventory. Otherwise, Make to Order (MTO) policy is used. Thanks to its specific character, metallurgical production is considered to be a typical representative using MTO policy. The main problem of application of MTS policy in metallurgical companies is the wide range of produced assortment and high value of the final products. Strengthening competition and increasing requirements of customers however, especially in the periods of recession, force metallurgical companies to consider more and more often whether to transfer to MTS policy for selected assortment. The objective of this article is to define the possible utilization of MTS policy in metallurgical industry. This is the reason why the article identifies the factors which should be taken into account during MTS decision making in metallurgical companies, and it summarizes the current trends in this sphere. The final decision between MTS or MTO should be the outcome of a detailed analysis of advantages and disadvantages of both approaches. Dynamic simulation is seen as a tool which can significantly support this analysis. The possible utilization of dynamic simulation in this area is illustrated on an example of decision making concerning the increase of share of MTS in metal cloth production.

Keywords: Make to Stock, Make to Order, metallurgical company, metal cloth production

1. INTRODUCTION

An important ingredient of production specification is the production and inventory planning and control policy. Any order for an end product triggers a series of work processes in the company that must be completed so that the customer order is satisfied \cite{1}. Generally, there are two broad categories of the policy:

1. Make to Stock (MTS)
2. Make to Order (MTO)

In the MTS policy, finished goods are produced based on forecast and the customer buys from the finished goods inventory. In the MTO policy, the finished good is not produced until the customer has placed an order. \cite{2}

Taking into account all manufacturing supply chain activities including design, sourcing, manufacturing, assembly, packaging, labelling and distribution we can define eight detailed production and inventory planning and control policies \cite{3}:

1. Engineering to Order (ETO)
2. Source to Order (STO)
3. Make to Order (MTO)
4. Assemble to Order (ATO)
5. Package to Order (PTO)
6. Label to Order (LTO)
7. Deliver to Order (DTO)
8. Make to Stock (MTS)

The objective of the article is to determine the possible utilizations of MTS policy in metallurgical industry.
2. MTS POLICY IN METALLURGICAL INDUSTRY

In MTS policy, the manufacturer pushes the product into markets without direct regard for the customer orders. Forecasting is a crucial step in such an approach [1]. According Walace and Stahl, the MTS policy has one major advantage and some serious shortcomings. The advantage is that it is quick; the time to fill orders is limited to picking and shipping. The disadvantages include the need to maintain a finished goods inventory with its costs and its consumption of working capital, the need to forecast at the end item level, the risk of stock-outs and backorders when the forecast is too low, and the risk of obsolescence when the forecast is too high. [4]

From a process and capacity analysis perspective, MTS policy is suitable for mass production systems (production of narrow assortment in large quantity). Therefore, the relevant questions for process and capacity analysis are [5]:

- What is the productive capacity of the production process per shift or per day?
- Where is the bottleneck for this process?
- How to increase productive capacity of this process?

Thanks to its specific character, metallurgical production is considered to be a typical representative using MTO policy. The main problem of application of MTS policy in metallurgical companies is the wide range of produced assortment and high value of the final products. Combinations of grades, shapes, sizes, heat treatments and surface treatments make up as many as tens of thousands of items of metallurgical products. Keeping the entire assortment in stock was connected with enormous costs.

Strengthening competition and increasing requirements of customers however, especially in the periods of recession, force metallurgical companies to consider more and more often whether to transfer to MTS policy for selected assortment. When the assortment for MTS policy and the volume of stock are being determined, the following factors must be taken into consideration:

- Delivery time
- Production lead time
- Product price
- Demand quantity
- Variation of demand
- Volume of production batches
- Time needed to conversion of equipment
- Degree of product finalization

In general, MTS policy should be considered in case of assortment where the requirement is for shorter delivery time than the production lead time is. As far as the costs are concerned, the inventory costs affected by product price, quantity and fluctuation of demand and volume of production batches must be taken into account. Negative impact of keeping final products in stock is reduced by decreasing costs for conversion of equipment and transfer of finalizing operations into distribution.

MTS policy usually requires in-house company distribution networks. In case of metallurgical companies, this requirement is met by a relatively high spectrum of options, starting from company store, your own distribution warehouses, and specialized trade companies up to service centres built in places with optimal location from the point of view of customers.

The options for establishing a distribution network may vary as well. Metallurgical companies build distribution networks as their exclusive investment activity or in cooperation with other manufacturers or trade companies, for example in the form of joint ventures. Another option is to use capital interconnection with already existing trade companies, i.e. sales by means of companies with capital participation of steel manufacturers.
MTS policy is used mainly in order to satisfy large number of medium and small customers requesting lower quantity of regular assortment. For these customers it is not profitable to purchase directly from the manufacturers. High level of customer service is expected in assembly of more types of metallurgical materials, including those which are not manufactured by the company itself (also including non-metallic materials), instantaneous withdrawal or just-in-time delivery or material modification (cutting or bending according to customer’s request is common).

Current trends lead to expansion of activities towards demanding, often manufacturing, financially demanding operations such as staining or metal coating. It becomes evident that the service centres are more capable of conducting these activities than the manufacturing companies themselves. Increased finalization reduces the quantity of assortment kept as inventory only to basic ranges of metallurgical material sizes. Other savings of costs connected with keeping wide assortment range are brought by efficient utilization of information and prognostic systems which enable efficient reduction of risk connected with lack of merchantability and obsolescence of inventory.

The decision regarding the selection of suitable production and inventory policy belongs to basic strategic logistics decision making in any manufacturing company [6]. In order to reduce the risk of making wrong decision it is suitable to use decision support systems (DSS). With regard to the number of factors influencing the decision-making process important for the selection of MTS policy in metallurgical production and the complex nature of supply chain activities in metallurgical industry, dynamic simulation can be seen as adequate DSS in this area [7, 8, 9].

3. CASE STUDY

The decision-making process of MTS policy and the possibility of supporting it by means of dynamic simulation can be demonstrated using an example of metal cloth production. The producer has already been using MTS policy with one of its products with regular demand. Maximum inventory level of this product in the warehouse is set to 20 000 m². Production planning and control is carried out on the basis of the above mentioned maximum inventory level, current inventory level, incoming orders and capacity of the bottleneck, which is represented two annealing furnaces.

With regards to the ever growing demands of customers to cut the delivery time, the producer will lose mainly those customers expecting immediate withdrawal. That is why the producer is considering increasing maximum inventory level of the final product in stock up to 50 000 m², which corresponds with the maximum available storage space. A simulation model created to serve this purpose is illustrated in figure 1.
Fig. 1 Simulation model of metal cloth production

The model covers the entire material flow linked with metal cloth production: input material (wire) warehouse, transport of material to annealing furnaces, annealing treatment in the furnaces, material cooling, transport of material to coil winding (only half of the material, the other half goes directly to weaving), coil winding on one machine, transport of coils to weaving, weaving on three machines, transport of produced metal cloth to finished stock room and delivery to a customer.

The input material is ordered once a month in quantity which is withdrawn from the warehouse a month ago (the model uses sufficient material stock for production launch in the first month). Production continues only to the moment when maximum inventory level is reached in the finished stock room. Acquisition of new orders from customers in quantity corresponding to the capacity of annealing furnaces is the impulse for next production launch. Annealing treatment is carried out in three-shift operation, coil winding and weaving according to the ordered volume, either in single or double-shift operation.

The following parameters are, above all, monitored so as to make a decision regarding the maximum inventory level of the final product:

- Average inventory value (EUR-month⁻¹)
- Average delivery time (days-month⁻¹) and its probability distribution

During the experimenting process, maximum inventory level of the finished products was changing between 20 000 and 50 000 m² for the set order structure. The simulated period of time was one year. The experiments have shown rather small effect of increased maximum inventory level of finished product on average inventory value, but significant effect on shortening the average delivery time. At maximum inventory level of 50 000 m² (increase by 150%), there is only 6.26% increase in average monthly inventory value, but there is 84.26% decrease of average delivery time.

4. CONCLUSION

Strengthening competition and increasing requirements of customers force metallurgical companies to consider more and more often whether to transfer from traditional MTO to MTS policy for selected assortment. This trend causes that new tools which would reduce the risk of making wrong strategic decisions in this area are looked for.
The case study results proved that dynamic simulation belongs to these tools. It can be recommended especially in case of complex metallurgical processes where a great number of factors influencing MTS decision making must be taken into consideration. Its implementation also brings detailed analysis of the studied production process which makes it possible to improve the efficiency of production planning and control system. In case of metal cloth production, for example, new rules for planning single and double-shift operation for coil winding and weaving have been defined, which lead to savings in operational costs.

REFERENCES


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