# MODERN APPROACHES TO PRODUCTION MANAGEMENT IN TUBES PRODUCING COMPANY

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**Abstract**

This article, using the example of tube producing company, defines how we can find economically optimal delivery term, level of inventories and location of logistic decoupling point. Furthermore this article tries to explain that for successful fulfilling of these tasks is advisable to split products into logical groups and for these groups define indicators separately.

**Keywords:** Delivery term, decoupling point, storage costs, logistics

## 1. INTRODUCTION

Metallurgy is one of the traditional industries in which the use of modern methods of production management spreads slower than in sectors that utilize the most advanced manufacturing technologies such as car production. This is partly due to the manufacturing process which remains unchanged for decades and partly also due to the very nature of this type of production which restricts the use of modern methods.

Production of tubes combines both the "hot" metallurgical part and the "cold" engineering part when the tubes gain their final shape required by the customer. The input raw material is steel in various forms (billets, ingots, etc.) This material is heated in a rotary furnace and the raw tube is drawn down using the Stiefel technology. During subsequent steps, the tube obtains the desired diameter, wall thickness and length. The resulting tube is further subjected to processes of surface smoothing and straightening. At this stage, in a cooling bank, the "hot" part is completed, and the tube is then processed in engineering procedures which treat its end (cut-off, taper, thread). Furthermore, specially designed tubes are used to manufacture sleeves that serve for connecting tubes intended for wells. It is appropriate to apply different management approaches for each of these two production parts.

## 2. BASIC PRODUCTION OPTIMIZATION

Changeovers of two types have to be performed on the rolling mill - for different tube diameters (this takes several hours) and, within one diameter, for different widths of tube walls (this takes about 1 hour). From an economic and logistics point of view, it is therefore appropriate to group individual orders into campaigns (according to the diameter) and rolling parameters (according to the quality of input material and wall thickness). Here we are looking for an optimum between the time lost due to changeovers and costs for their implementation on one hand and shortened delivery terms on the other hand. In order to find the optimum, these two conflicting criteria must be evaluated on a comparable basis. Downtime and costs for changeovers can be simply financially evaluated as a loss of profit from lost orders. Regarding the delivery terms, it is clear that this will affect the number of orders that the company gains because too lengthy periods will make the customer switch to a rival company. [1] Even here, the evaluation can be based on the loss of profit from lost orders. The problem, however, lies in determining the volume of orders lost. The company has this information just in a small number of cases. In most cases, the only way is to use an expert appraisal and extrapolate the known cases to the total estimated amount using a coefficient. In practice, companies usually solve this optimization problem by determining the target average length of delivery terms for individual products according to the required level in the market (for commodities) or the standard level in competitive firms (for less conventional products). [2] This is then adopted by plans of rolling campaigns.

Engineering part of the production is characterized by the fact that the individual production steps are already being implemented according to the requirements of specific business contracts. There is a gross production plan that determines which orders have to be produced on the given shift or day. Within certain production steps, e.g. non-destructive testing of the tube quality, the detailed orders are grouped according to the type of testing to increase the productivity of the respective device. The same logic then applies, for example, also to the heat treatment centre, where the heat treatment is carried out according to the requirements of specific orders but the orders are grouped within a certain period according to tube diameters to minimize the number of necessary changeovers.

## 3. DEFINITION OF DECOUPLING POINT

When trying to define the logistic decoupling point in this industry, we do not find a one answer. The decoupling point depends on the type of products made by a specific tube manufacturer. [3] Part of the assortment is composed of commodity products which are produced by companies in larger and time-stable amounts. In this range of products, the decoupling point is located behind the hot part; the crude tube is produced and the basic quality controls are made, and the tube then waits for a specific order when any additional processing steps are performed according to customer requirements. Location of the decoupling point for commodity products further downstream the production would shorten the delivery times even more but with a considerable increase in stocks because customer requirements in such a point tend to be very individual (required testing, treatment of tube ends, tube marking, etc.). [4]

In other standard products, all the production takes place depending on a specific order and the decoupling point is therefore located in the raw material warehouse. This group constitutes the majority of the manufactured products.

However, there are also rare, highly specific products, where even the input material is purchased according to a specific order and the decoupling point is then located at the supplier of this input material.

On the contrary, there is a small group of products which are highly standardized, and the company can afford to produce finished tubes to the warehouse because the respective demand is stable and the required tube treatment is always the same. In this case, the decoupling point is located in the warehouse of finished products and we talk about the so-called free stock.

As can be seen, it is not always possible and appropriate to define only one decoupling point. If the company produces a wide range of products whose nature differs to the extent that the determination of only one decoupling point would not be cost-effective, it is appropriate to divide the products into several groups and apply different logistics management techniques. [5]

## 4. OPTIMIZATION OF DELIVERY TERM AND STORAGE COST

It is obvious that the loss of profit from lost orders grows with increasing delivery terms. Graphically, this relationship can be represented using **Fig. 1**.

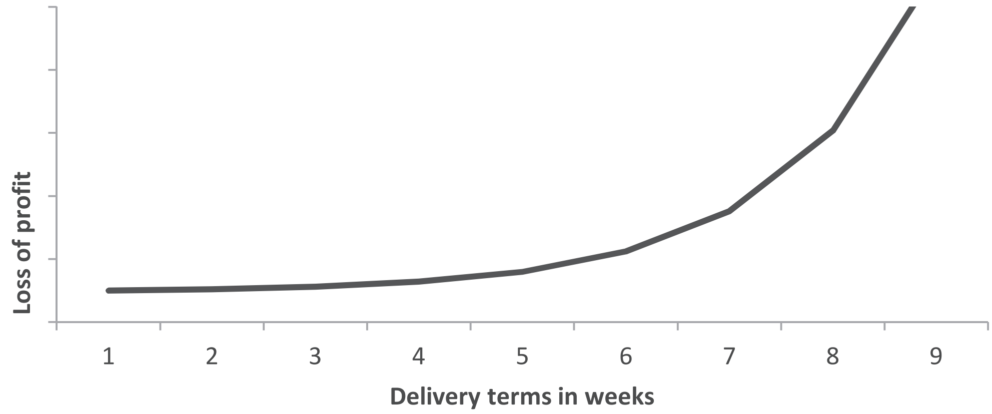


**Fig. 1** Loss of profit from lost orders

The vertical axis represents the loss of profit from lost orders and the horizontal axis shows the length of delivery time in weeks. The graph presents a situation where the customer does not make a big difference between delivery times of 1-5 weeks because such delivery terms are common in the marketplace. For delivery times longer than 5 weeks, the number of lost orders as well as the amount of lost profit starts to increase.

The opposite situation occurs when we try to show the development in storage costs and their dependence on the target delivery date. As can be seen from the graph below, the company has maximum storage costs in a situation when wanting to meet very short delivery times. In this case, the company is forced to keep high inventory levels which negatively affect the overall costs of storage (see **Fig. 2**).


**Fig. 2** Costs of storage

In practice, the curve of storage costs will vary according to the type of products. At the same target delivery term, the costs of storage will be higher for specific products because the company is forced to keep a wide range of input materials, semi-finished products or finished products in order to respond quickly to any customer requirement. In contrast, regarding conventional repetitive products, short delivery times can be achieved with keeping relatively low levels of homogeneous stocks. If using the product groups defined in chapter 3, the resulting graph is shown in **Fig. 3**.

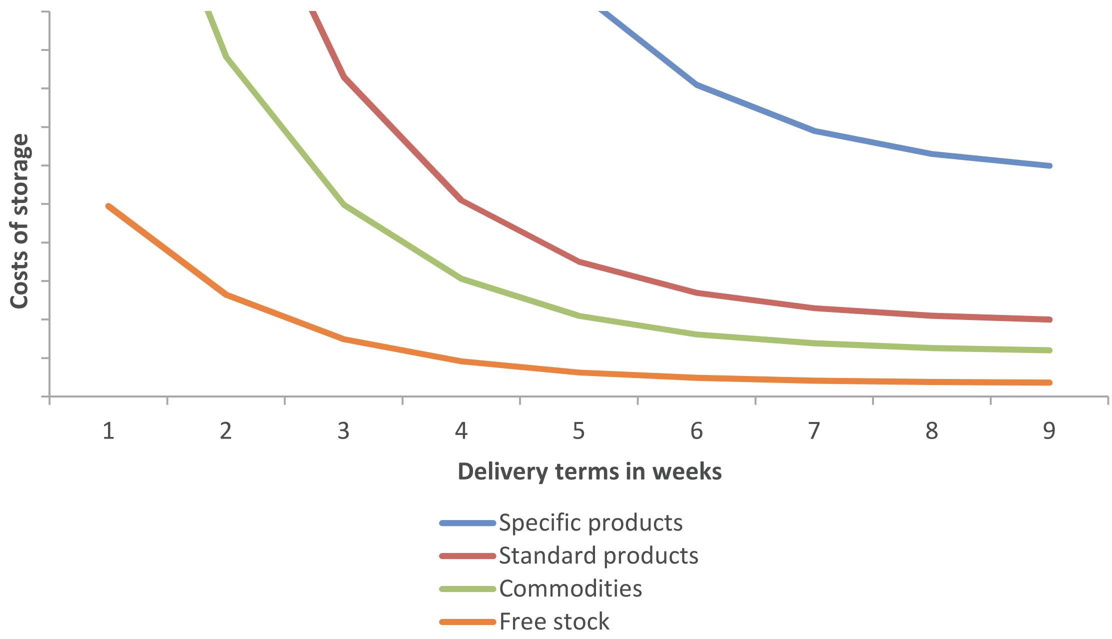


**Fig. 3** Costs of storage according to product groups

The presented graphs of the loss of profit from lost orders and the graphs of costs of storage can be combined; for each product group, we can thus graphically find the optimum length of delivery term which is defined by the intersection of the curve for the loss of profit and curves for the costs of storage (see **Fig. 4**).

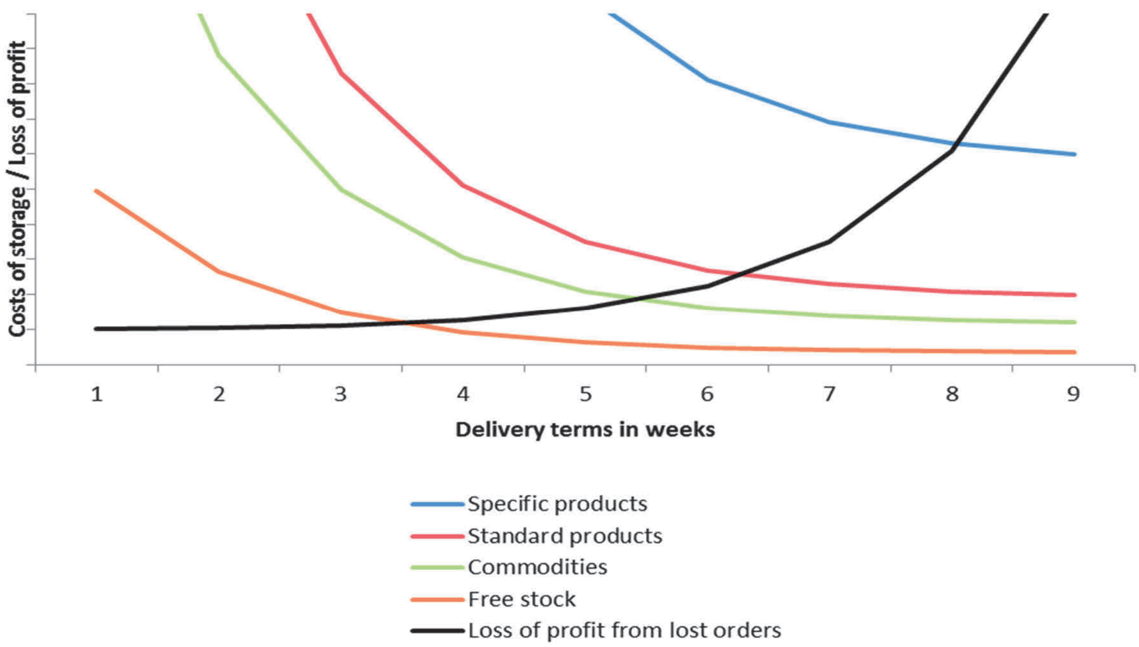


**Fig. 4** Optimal length of delivery terms

In this model case, the optimal delivery time for specific orders is around 8 weeks. Conversely, regarding the standardized products in the so-called free stock, the optimal delivery time is 3.5 weeks.

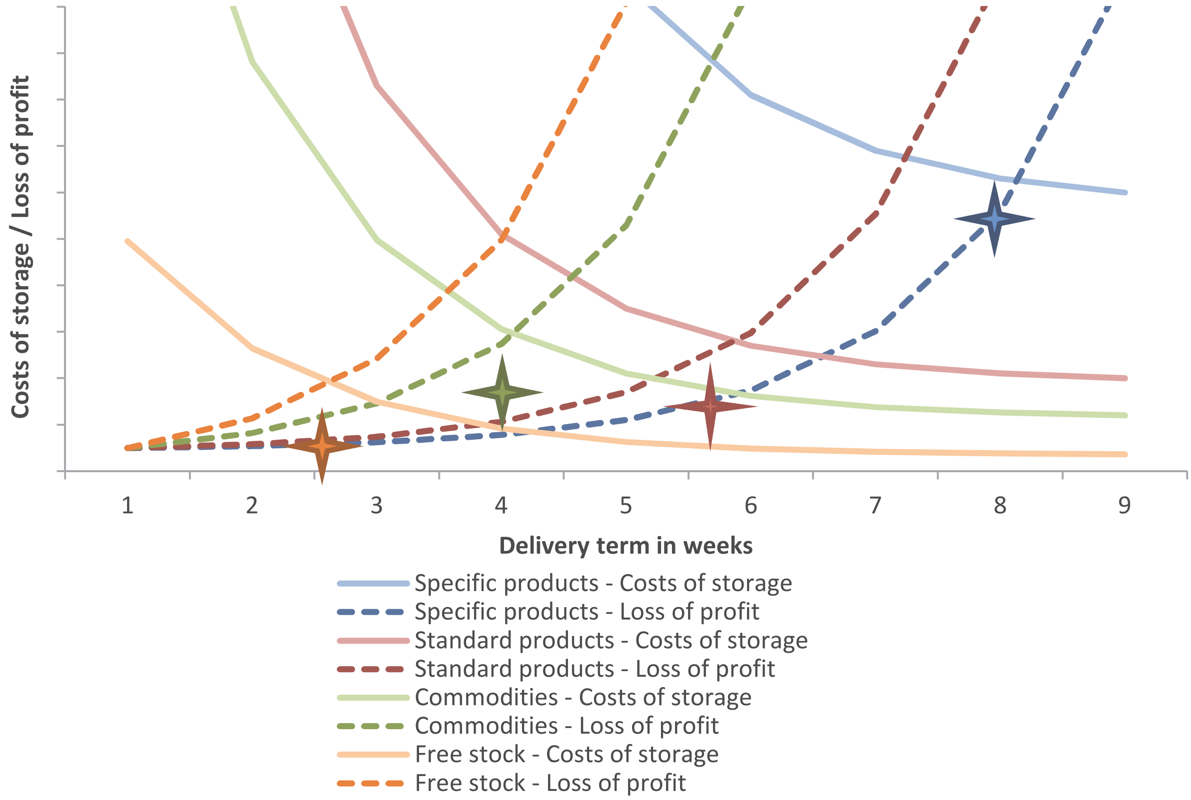


**Fig. 5** Optimal length of delivery terms according to product groups

For simplicity, we have assumed that the amount of the loss of profit from lost orders for the given delivery term is the same for all product groups. In practice, this value is lower for specific orders when the customer accepts longer delivery times. By contrast, regarding the free stock, the customer expects immediate fulfilment of its demand because short delivery times are standard in the market. When adapting the curve of costs for lost orders according to these assumptions, the graph shown in **Fig. 5** can be obtained.

Regarding our model situation, this graph already provides final optimal decoupling points: 2.5 weeks for the free sock, 4 weeks for commodities, 6 weeks for standard products and 8 weeks for highly specific products.

## 5. CONCLUSION

Defining the logistic decoupling point and target delivery terms belongs among the most widespread methods for optimizing logistics costs and managing the supply chain. According to the nature of manufactured products, the decoupling point moves along or against the flow of production so that the company finds the best balance between the loss of profit from lost orders due to the length of delivery times and costs of inventory storage. The costs of inventory storage enabling to meet the given delivery term vary for individual product groups as well as the loss of profit from lost orders for the given delivery term. It is therefore appropriate to consider this different logic when defining product groups and determining their target delivery terms, optimal amount of stocks held and location of the decoupling point.

## ACKNOWLEDGEMENTS

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## REFERENCE

[1] STADTLER H., KILGER C. Supply Chain Management and Advanced Planning: Concepts, Models, Software, and Case Studies. Berlin: Springer, 2008.

[2] VILAMOVA S., JANOVSKA K., VOZNAKOVA I., KOZEL R. Selected specific aspects of marketing analyses and management in the conditions of metalurgy firms. In METAL 2011: 20th Anniversary International Conference on Metallurgy and Materials. Ostrava: Tanger, 2011, pp. 1279-1285.

[3] VOLLMANN T. et al. Manufacturing Planning & Control Systems for Supply Chain Management. McGraw-Hill, 2005.

[4] MENTZER J., MOON M. Sales Forecasting Management - A Demand Management Approach. USA: Sage publication, 2005.

[5] ASFAQUE A. Profitable-to-Promise: A New Exciting Era. Technology Evaluation Centers [online]. [cit. 2008-12-1]. Available from: <http://www.technologyevaluation.com/research/article/Profitable-to-promise-A-New-Exciting-Era.html>.