THE INFLUENCE OF SPECIFIC FORMS OF COOPERATION IN SUPPLY CHAIN ON INVENTORY

BRANSKA Lenka, PECINOVA Zuzana, VAVRA Jan

Univerzity of Pardubice, Faculty of Chemical Technology, Pardubice, Czech Republic, EU
lenka.branska@upce.cz,zuzana.pecinova@upce.cz, jan.vavra@upce.cz

Abstract

Stock is generally considered to be a sign of incomplete material flow control in logistics and supply chains. However, it often cannot be eliminated, because the specific conditions in the link do not allow doing so for a variety of reasons. It is not possible to achieve full coordination of material flows based on the implementation of modern methods of material flow management, such as the CPFR method (Collaborative planning, forecasting and replenishment). The paper presents results of two primary researches carried out in metallurgy wholesale and an engineering company that uses metallurgical materials as input. It evaluates the research results and makes comparisons between inventory management approaches of the two companies. It also shows how the inventory management approaches in these companies affect the specific conditions prevailing among their suppliers of metallurgical materials, i.e. the specific conditions associated with metallurgical production.

Keywords: Stock, supply chain, logistics, CPFR, metallurgy

1. INTRODUCTION

In today's globalized and highly competitive business era the manufacturing organizations have begun to realize that in order to gain and sustain the competitive advantage they have to deliver the best customer value at the lowest possible cost [1]. The need to better anticipate changes in the market environment and quickly adapt to them, however, requires multilateral cooperation among all those involved in the creation and delivery of value. It is from the uniqueness of the network of partners, their activities and relationships that much of the competitive advantage currently stems [2]. It is already quite obvious that successful businesses are those that can develop cooperation with their business partners and build supply chains of various lengths with them. Increasingly in the past three decades several companies have established collaborations with other supply chain (SC) partners [3]. According to literature [4], SC collaboration will be beneficial to the parties only when all members in SC cooperate. What seems to be ideal is a total coordination of material flows based on the implementation of modern methods of material flow management, such as the CPFR method (Collaborative Planning, Forecasting and Replenishment). The lack of collaborative forecasting leads to formation of independent forecasts performed at several places of the supply chain and leading to incorrect coordination of company activities and to disproportional amount of stock along the whole material flow [5]. However, the CPFR method it is not fully recoverable in all chains. For example in metallurgical supply chain, cooperation is still at a low level, in relation to other areas [6]. In that case, it is desirable to develop cooperation between at least two immediate links, i.e. between the supplier and his customer.

Regarding the possibilities of developing cooperation between the manufacturer of metallurgical products and other parts of the supply chain, they are affected not only by which part of the chain the direct purchaser is in, what function it performs and how it uses the products, but also by what customers it serves (what their needs and requirements are) and how it has decided to satisfy them. At the same time, the possibilities of cooperation are greatly affected by the size of bargaining power that it can apply towards its business partners. The final form of cooperation is then determined by the necessity to respect the needs, wishes and requirements of customers, but also the necessity to respect its own limitations (given especially by the nature of metallurgical

production) and specific conditions prevalent in the chain. It can be noted that the final form of cooperation is the result of a compromise reached between the supplier and the customer. This compromise then affects the form of material flow in that part of the chain and, at the same time, also the location of stock and the amount thereof by individual items sold to the customer.

The form of cooperation between the manufacturer of metallurgical products and its direct customers, including the impact of this cooperation on stock management in that part of the chain, became a subject of the research performed. When choosing enterprises where to perform the research, the authors proceeded from the fact that the metallurgical enterprises are located in different places of the supply chain and their customers can be divided into three basic categories [6]:

- direct customers (process metallurgical material in their own production processes),
- distribution and service centres (taking over both non-technological and certain technological operations of the manufacturers),
- wholesalers of metallurgical products (sell products in small quantities for final consumption and small businesses).

One primary research was carried out with the direct customer - in an engineering company that processes metallurgical material, the other one took place in a metallurgical material wholesaler. Both of these businesses are characterized by a difficult-to-predict demand for their products, which needs to be promptly satisfied to keep the market position, but each of the enterprises is in a different point of the chain (at a different distance with respect to final customers) and also they both have different bargaining power in relation to the supplier of the metallurgical material.

The main goals of the primary researches were to explore how suppliers of the metallurgical material are chosen, how contacts are made with them, what level and what specific form the cooperation between the customer and the supplier of the metallurgical material has and how the cooperation translates into the stock management. At the same time, the authors explored the impact of commercial transactions on the economic situation of the customer.

Both primary researches were conducted through personal interviews according to a survey scenario, which contained questions designed to fulfil the primary objective (and partial objectives of the research derived therefrom). The respondent in a manufacturing company was the Logistics Director; respondents in the metallurgical wholesalers were a worker responsible for the execution of business operations and the chief economist of the company. The research was conducted in the period December 2014 - February 2015. Information obtained was processed using a content analysis.

2. THEORETICAL BACKGROUND - INVENTORIES AS A RESULT OF SPECIFIC CONDITIONS IN THE CHAIN, INCLUDING A LACK OF COOPERATION

As mentioned above, the form of cooperation in the particular chain is given partly by objective factors arising from limitations of the business partners and partly by specific factors, arising from the conditions of the particular chain and the chosen customer service strategy. Metallurgical supply chains are specific, especially thanks to the nature of the production systems that are contained in them [6]. The following factors appear to be restrictive with regard to the metallurgical enterprise in these chains:

- The nature of its own metallurgical production entailing limitation of flexibility.
  The production equipment of metallurgical companies is often designed to process relatively large quantities of products within one cycle, i.e. production has the character of mass and batch production [7]. The problem is that increasing demand of customers for decrease in order volume and the growth of assortment range [8, 9] lead to a significant increase of conversion and setup times of equipment [7].
- The necessity to produce in large volumes allowing it to achieve acceptable economy of the manufacturing processes.

Only mass or batch production allows maximizing the capacity exploitation of the capital-intensive production facilities [7]. If frequent setups necessary for small orders of wide assortment range are accepted it can make production uneconomic [8].

- The nature of the metallurgical production outputs and the scope of production.
  While the metallurgical products are apparently simple, their quantity is enormous [7]. These are products often entailing large volumes and large weight. They need to be produced in a wide range, so that diverse requirements of a wide range of customers can be met. It is the type "V", i.e. large numbers of finished products is produced from small number of input raw materials [10]. The combinations of grades, shapes, sizes, heat treatments and surface treatments create up to tens of thousands of items of rolled products [7, 11].
- The necessity to move large mass volumes (which results from the nature of the products manufactured) and the associated limitations in terms of types of transport that can realistically be used, either for technical and economic reasons.
- The storage capacity, the size of which needs to be proportionate to the nature, quantity and range of the manufactured products.

Metallurgical companies are characterized by their large extent given by their great space requirements for each technology and storage of raw materials, semi-finished and finished products [7]. The above factors also show that the metallurgical companies keep relatively high amounts of raw materials, materials, intermediate products and finished products in stock [7].

These objective reasons create an enormous pressure on the formation of inventory in the chain, in which the manufacturer of metallurgical products is involved. The task of inventory management in an industrial company is to keep the inventory at such a level that enables high-quality performance of its functions, which include especially levelling of the geographical, time and quantitative discrepancies between the processes of suppliers and customers and also absorbing or completely eliminating random fluctuations during the follow-up processes, so as to maintain the continuity of the material flows in the supply chain [12]. However, stocks of metallurgical products not only present a huge mass contained in the chain, but also a tremendous value expressed in monetary terms, which usually means an enormous economic burden for selected links of the chain and reduction of the economic success of the whole chain. The only way to resist this fact is to cooperate in the chain with business partners, integrate corporate logistics systems into higher units - supply chain systems and continuously improve material flow throughout these chains by implementing modern methods such as Quick Response, VMI, CRP, CPFR.

Implementation of these methods in the final form, however, is likely to be precluded by the specifics of metallurgical productions and products based thereon. However, this means that it is not possible to completely eliminate the stock of the chain and the costs associated therewith, but both can be substantially reduced through cooperation. The selection of the right system of inventory management is a strategic decision that will fundamentally affect the operation of the whole industrial company [12]. The characteristics that affect the choice of the inventory management system are mainly the purpose of the inventory in a concrete plant, the character of needs/demand, the economic conditions of company, the quality of information sources and the system of material flows within the supply chain [13].

3. PRACTICAL RESEARCH - METHOD OF COOPERATION BETWEEN CUSTOMERS AND SUPPLIERS OF METALLURGICAL MATERIAL INCLUDING EFFECTS ON INVENTORY

The primary research was conducted in two companies (referred to as Company A and Company B) that represent a group of industrial manufacturers, who purchase metallurgical outputs to manufacture their own products (Company A) as well as a group of metallurgical wholesalers selling in small quantities to end-users and small businesses (Company B).

3.1. Results of Research - Company A (Industrial Manufacturer)

Engineering company A is a major direct purchaser of metallurgical industry products (annually it processes more than 100 thousand tons of metallurgical material). It is one of the production units of a large multinational company. The production unit is supposed to produce products at the required time and in the required quality at reasonable costs as required by the pattern company and send them to the logistics centre, which will fulfil a marketing strategy specified by the centre. The products are mainly intended for further processing. Sales including any additional services are provided by specialized sales unit, which ultimately means that the company, except in exceptional cases, does not know its customers (not only end customers, but not even direct ones).

The company's products are divided by the purpose of usage into five relatively independent groups, distinguished only by the metallurgical material and the method for processing thereof (shaping, finishing). In these groups, by a wide range of products is produced that are intended for different uses, they also differ in the way and size of packaging.

The production is relatively simple with a reasonable degree of flexibility. Framework production plans are based on the plans of the sales units. Operational production plans are made on the basis of current requirements of the centre (a make-to-order system, with delivery in a very short time, often within 24 hours). Individual requirements are assigned identification codes that uniquely identify the product, including the packaging, the required quantity and delivery date and subsequently the required production time. This approach to orders allows the company to meet requirements flexibly while contributing to reducing the locked-up working capital.

Given that the technical parameters of the input metallurgical material and its price significantly affect the costs of the company (material costs account for about 80% of the cost of products), the company has a relatively large discretion in choosing suppliers, even though the purchase of strategically important items is controlled by the centre. There are a lot of possible suppliers of the input metallurgical material. With regard to the specific quality requirements for purchased materials, the company cannot buy from unverified suppliers and, for the same reason, neither simply change the supplier. In addition, quality requirements for inputs are so specific that adaptation of the supplier to the company’s quality requirements is a long-term affair. Long-term relationships with suppliers are therefore important to the company. It is therefore quality and its stability and reasonable price (assessed 10 at a 10-point scale), the speed of response to the demands (assessed 9) and variability and adaptation of the packaging and supplier reliability (assessed 8) that are considered to be the most important criteria when choosing a supplier.

The company purchases directly from manufacturers. For a given item/group of items of the metallurgical material it usually has one main supplier that covers up to 80 per cent of needs and one add-in supplier. Large purchases from one supplier allow the company to achieve better prices while contributing to establishing deeper cooperation and strengthening relationships. The company has signed contracts for consignment storage with almost all suppliers; the consignment does not include only small-volume and low-turnover items. Consignment stores are set up directly at the customer’s place of business. All activities associated with consignment storage are provided and funded by the customer, the cost of capital locked-up in inventory are borne by the supplier. Since business plans are not shared, the customer also determines stock replenishment. The company considers the system to be optimal.

3.2. Results of Research - Company B (Metallurgical Wholesaler)

Company B is a wholesaler of metallurgical material, but it also provides retail activities. Its annual sales are about CZK 250 million (EUR 10 million). The company focuses on a wide range of common metallurgical material for engineering and construction purposes. It is one of the leading firms in the field in our country. Its customers are mainly local metalwork, engineering and construction companies (60 %), smaller retailers

(30 %) and consumers (10 %). Competition in the sector is growing, which creates pressure on prices. Customer loyalty is declining, they often buy based on the current lowest price offered. Differences in selling prices among customers are mainly due to quantity rebates.

The company considers speed, quality, reasonable prices and a wide range of metallurgical material offered in stock to be its strengths. Other advantages include storage capacity and sufficient financial resources. The company is thus able to compensate for the gap between series production in the metallurgical industry and a relatively balanced demand for its products. Smaller companies find it difficult, either for financial or storage reasons, to buy one-off large amounts.

The basic criteria for selecting suppliers are quality and price. As for basic items, the company cooperates with a long-term one supplier from the Czech Republic, only in case of problems it purchases from other suppliers. As for other materials, it chooses according to the current price. It makes use of the total of 6-7 stable suppliers, for a half of which it is a key customer in each commodity. Purchase plans are compiled monthly being primarily based on an analysis of sales for the last three months, while manufacturing capabilities and plans of suppliers are taken into account.

Mainly due to the demands for the quality of purchased items, stable long-term relationships with suppliers are preferred. The current level of cooperation with suppliers is evaluated as good, but it is in accordance with normal business relations. The main reason is a required commercial freedom, which is more valuable than the potential benefits of linking information systems and sharing information on stocks, automatic stock replenishment with the supplier, sharing plans, etc. The current system of supply and the stock levels meet to the needs and goals of the company.

3.3. Evaluation of the Results of Research

The enterprises examined are located in different parts of the supply chain and they also differ in fields of activities, yet common factors can still be specified that influence their approach to inventory management of inputs. A common feature is the general effort to accommodate customers. Both companies seek an immediate or almost immediate satisfaction of customer demands, which contributes to the fulfilment of the chosen marketing strategy. Both companies are significantly determined by the specific conditions of metallurgical production and the nature of its outputs.

Their approach to stock and management thereof, however, is quite different. The main reasons, in addition to different business focus and the ensuing different character of their customers' requirements, can be seen in the differences in bargaining power and the size of the interest in deepening cooperation. The different approaches to stock management also have different economic impacts, especially a different impact on the size of the necessary working capital.

The basic problem, which affects the approach to inventory management in the manufacturing enterprise, is low flexibility of the supplier in relation to the needs of the customer. The supplier is not objectively able to achieve the desired flexibility. The different nature of production of the supplier and that of the customer leads to a certain level of stocks, but the question is where in the chain they are to be placed. Given the bargaining power of the customer, the stock is held by the supplier, with regard to the specifics of material flow and efforts of both parties to establish long-term cooperation, under these conditions consignment storage is a reasonable compromise. The cost of locked-up working capital is borne in this case by the supplier.

The discrepancy in the necessary flexibility of the customer and the limited flexibility of the supplier as well as the specifics of metallurgical material flow are also dealt with by the wholesaler with creation of stock. Creation of stock in the customer's place, however, arises from the nature of the business (concentration of supply of a wide range of metallurgical materials and resolving of the discrepancy between the necessary purchase in bulk and sale in small quantities). Although the difference in bargaining power between the supplier and the customer is not as large as in the previous case, nevertheless the wholesaler is advantaged due to the excess

supply. Neither party, however, has a deeper interest in cooperation. For the supplier, the company is not a key customer; the wholesaler sees no significant benefits in closer cooperation. Relationships in the chain are highly competitive and trust between partners is minimal. Information sharing and other forms of cooperation are therefore perceived as factors that could jeopardize the implementation of marketing and business strategies, especially those of the metallurgical material wholesaler.

4. CONCLUSION

The described modern supply systems are not applicable under the existing conditions in the surveyed enterprises. The main reasons are:

- on the demand side - the lack of accurate demand forecasting (with respect to the contract management system of the parent company and the nature of the demand for products of the trade organization),
- on the supply side - metallurgical productions are mass productions, it is necessary to order sufficient quantities in advance, because it is not possible to solve the lack operatively - suppliers are unable (due to technological and economic reasons) to respond flexibly to changing manufacturing requirements, nor do they usually have storage facilities for the creation of adequate stock,
- nature of the material flow - for economic reasons it is not possible to transport small quantities, nor is it realistic in terms of deadlines.

Stocks are generally considered to be a sign of imperfect control of material flow in supply chains. As is apparent from the results of the research, they often cannot be removed, because they are the result of specific conditions in the chain. Then, the location and the amount of stock are results of a compromise between the supplier and the customer. If the compromise is satisfactory to both parties, it may constitute a basis for cooperation.

REFERENCES

[1] CHAKRABORTY S., BHATTACHARYA S., DOBRZYKOWSKI D.D. Impact of Supply Chain Collaboration on Value Co-creation and Firm Performance: A Healthcare Service Sector Perspective. Procedia Economics and Finance, Vol. 11, 2014, pp. 676-694.

[2] PECINOVA Z., LOSTAKOVA H., BRANSKA L. Barriers to the Development of Cooperation in Value Networks with a Low Level of Cooperation. In Metal 2013: 22nd International Conference on Metallurgy and Materials. Ostrava: TANGER: 2013, pp. 2006-2012.

[3] RAMANATHAN U., GUNASEKARAN A. Supply Chain Collaboration: Impact of Success in Long-term Partnerships. International Journal of Production Economics, Vol. 147, Part B, 2014, pp.252-259.

[4] CAO M., ZHANG Q. Supply Chain Collaboration: Impact on Collaborative Advantage and Firm Performance. Journal of Operations Management, Vol. 29, 2011, pp. 163-180.

[5] PATAK, M., VLCKOVA, V.: Demand Planning Specifics in Food Industry Enterprises. In Business and Management 2012: 7th International Scientific Conference, Selected papers. Vilnius: Vilnius Gediminas Technical University: 2012, pp.1168-1175.

[6] WICHER P., LENORT R., KRAUSOVÁ E. Possible Applications of Resilience Concept in Metallurgical Supply Chains. In METAL 2012: 21st International Conference on Metallurgy and Materials. Ostrava: TANGER, 2012, pp. 1904-1913.

[7] SAMOLEJOVÁ R., LENORT M., LAMPA M., SIKOROVA A. Specifics of Metallurgical Industry for Implementation of Lean Principles. METABK, Vol. 51, No. 3, 2011, pp. 373-376.

[8] LENORT R., FELIKS J., TVRDON L. Production Logistics Concepts and Systems in Metallurgical Companies. In Metal 2013: 22nd International Conference on Metallurgy and Materials. Ostrava: TANGER: 2013, pp. 1867-1872.

[9] LENORT R. Production Logistics Concepts and Systems: Potential for Use in Metallurgical and Waste Processing Companies. AGH University of Science and Technology Press: Krakow, 2010.

[10] MIEMCZYK J., HOWARD M. Supply Strategies for Build-to-Order: Managing Global Auto Operations, Supply Chain Management: An International Journal, Vol. 13, No.1, 2008, pp. 3 - 8.

[11] BRANSKÁ L., LENORT R. Identification of Main Problems of Supply Chain Management in Companies of Chemical and Metallurgical Industry. Sci. Pap. Univ. Pardubice, Ser. A, Vol. 17, 2011, pp. 381-402.

[12] WICHER P., LENORT R. Inventory Planning and Control of Electrodes for Electric Arc Furnace. In METAL 2013: 22nd International Conference on Metallurgy and Materials. Ostrava: TANGER, 2013, pp. 2050-2056.

[13] STUSEK, J. Operation management in logistic chains. C. H. Beck: Prague, 2007.