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MODEL OF EFFICIENCY IMPROVEMENT IN PURCHASING STRATEGIC RAW MATERIAL IN A METALLURGICAL COMPANY

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The present paper focuses on the efficiency improvement of the strategic raw material (iron ore) purchase process in a metallurgical company and its management with the aim to minimize costs. The authors have come up with the proposals for an efficiency improvement and cost reduction model on the basis of the identification of significant dependencies between individual purchase functions while considering media contained in the technological process.

Key words: raw material, iron ore, purchase, stock level

INTRODUCTION

The average worldwide production of pig iron is about 1,4 billion tons. In the pre-production purchase phase this production depends on:

- The reliability of a business partner,
- The smooth supply of strategic raw materials (transport),
- Quality of the technological treatment of iron ore (homogenization) [1].

For these reasons, the purchase of strategic raw materials, being the genuine source of savings at the input of the production process, has been playing one of the most important roles in metallurgical companies [2]. The aforementioned issues are directly related to U. S. Steel Košice, (hereinafter referred to as USSK), due to its character and activities.

The analysis has been performed in the section of Purchase of strategic raw materials. The Financial 2000 (IS F2000) information system is used in individual purchasing processes. The modules and functionalities that are most closely related to the object of the purchase are as follows:

- The Business Partners Module provides a central register of all suppliers and clients within the information system as well as within individual companies that can use this system.
- The Purchase Module is a management tool for handling purchase and order requirements and the entire supplying process in the company. The Purchase module is directly related to the Inventory module. These modules are designed on the basis of the integrated database of the F2000 system.
- The Inventory Module is a management tool for handling the supplying processes in the company. This module is closely interconnected with the Purchase module [3].

In terms of accounting, the functionalities of these modules are closely linked with the following modules: General Ledger, Liabilities, Receivables and Assets. No IS F2000 module designed predominantly for accounting and stock management provides preparation of daily reports [4]. The situation is similar in the area of monthly analyses, various types of reports or balance sheets.

Another support system in the process of purchasing strategic raw materials is the Cognos ReportNet management system that offers more comprehensive outputs in the area of purchasing [5]. Its disadvantage is that the user must have expert knowledge in programming and defining the sets connected to the IS F2000 Oracle database.

THE NATURE AND METHODS OF IRON ORE PROVISION

The Department of iron ore (Fe ore) purchase has exactly defined stock levels, i.e. separately for agglomerated ore, concentrates and pellets. The optimum stock level for summer and winter seasons is in Table 1.

Agglomerated ores and concentrates imported in winter start freezing during their transportation when exposed to frost for the time period between two and three hours, and within 24 hours the entire volume of the truck freezes completely. It is conditioned by the fact that agglomerated ores contain 4 % of water and concentrates contain as much as 10 % of water. In winter months trucks with frozen material pass through defrosting plants that consist of 10 defrosting tunnels with the length of about 330 m. Each tunnel can accommo-

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Table 1 **The optimum stock level for the summer and winter seasons**

Season	Agglomerated ore	Concentrate	Pellets
Summer / t	90 000	100 000	130 000
Winter / t	120 000	140 000	180 000
The optimum stock level / day	More than 20 days		

Source: Own compilation

date up to 24 trucks. Defrosting time depends on the temperature (agglomerated ore – 10 hours, concentrates – 24 hours, pellets – 4 hours). The average number of defrosting days / year: 100 days. Natural gas is used as a heating medium.

The average delivery time of agglomerated ore is 4 days (deliveries from Ukraine); in case of concentrates it is from 4 to 5 days (4 days from Ukraine and 5 days from Russia), and in case of pellets it is from 4 to 5 days (4 days from Ukraine and 5 days from Russia). Private siding is char ged from the time of taking trucks from ŽSR (Slovak Rails). From the above it results that both defrosting and private siding have an adverse ef fect on the cost of purchased raw materials in USSK.

Fe ores supplied to USSK have various chemical compositions even though they come from the same deposit. The iron content varies between 6 to 10 % (the lowest Fe content is 59 %, whereas the highest content reaches 69 %). The processing of ores with variable chemical composition in the blast furnace results in changes of the chemical composition of the blast fur - nace slag, changes in blast furnace temperature conditions, uneven furnace operation and subsequent fluctuation of the pig iron quality. The purpose of the homogenization process is to ensure minimal fluctuation of Fe and SiO2 contents in the charge.

The principle of homogenization is that individual types or lots of ores and concentrates are stored in 20 – 30 cm horizontal layers (in a homogenization pile). The material is taken from piles vertically , and this procedure ensures a complete mixing of individual substrates. The ratio is as follows : 1 (agglomerated ore) : 1,12 (concentrate) + other additives, under the condition that the Fe content is higher , whereas in case of a lower Fe content, the agglomerate ratio must be higher, namely 1 (agglomerated ore) : 1,3 (concentrate).

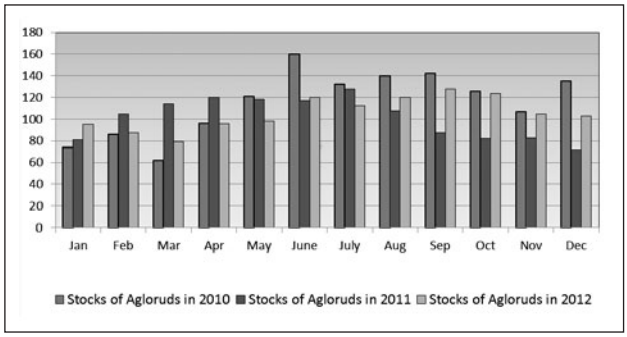

Figure 1 Stock levels of agglomerated ores during the period of 2010 – 2012

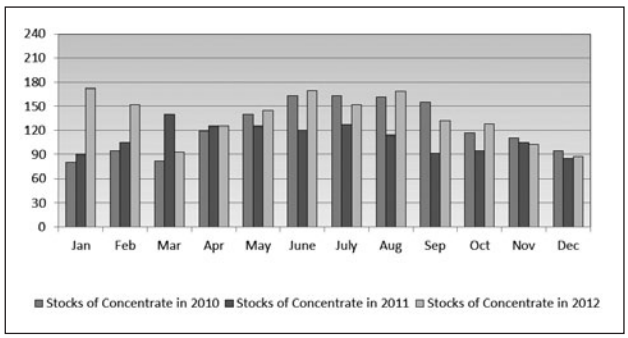

Figure 2 Stock levels of concentrates during the period of 2010 – 2012

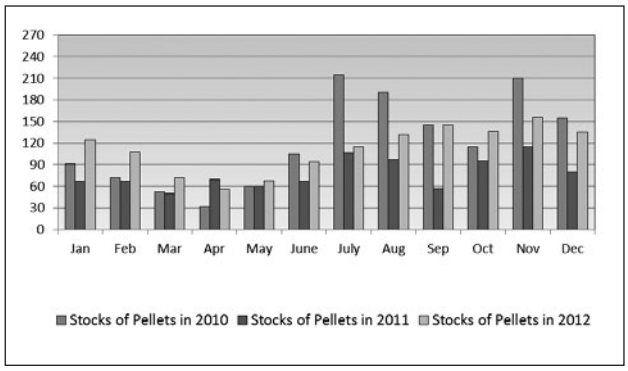

Figure 3 Stock levels of pellets during the period of 2010 – 2012

The development of supplies according to individual commodities for individual periods between 2010 and 2012 are shown in Figures 1, 2 and 3.

Significantly uneven supplies are typical for all commodities.

THE PROJECT OF SUPPLYING Fe ORES FOCUSING ON THE COST REDUCTION

With regard to the supply of Fe ores, there are cer - tain persistent problems associated with the increased costs resulting from private siding and defrosting in case in purchasing ores from Russia and Ukraine. The supply is uneven, it fl uctuates throughout the year, and it is not linked to the stock levels defi ned for summer and winter seasons. In Figures 4 we suggest the optimum stock level of Fe ores.

Two types of modes have been proposed on the basis of the aforementioned analysis, namely:

The summer mode supplies between April and August, when the supplies are maintained at the minimal technological level, which is related to the foundation of homogenization piles.

The summer mode piles – in the summer system three piles would be used (the first pile would be founded, the second pile would age due to homogenization, and ore would be taken from the third pile).

The winter mode supplies – between August and November, i.e. these months would be used to create and increase supplies of Fe ores. During the season between December and March the supplies of these ores

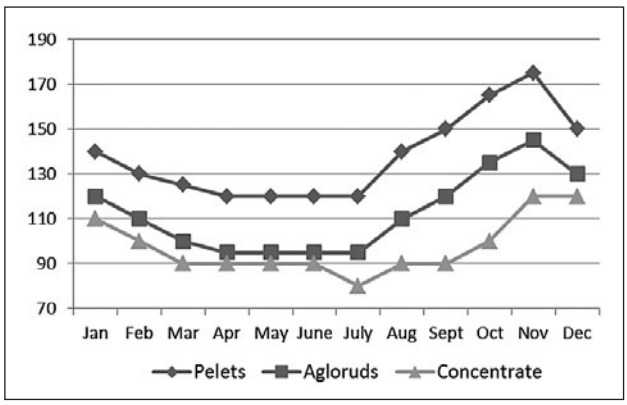

Figure 4 Proposal of the optimum stock level of Fe ores in thousand tons

would be reduced, especially in case of agglomerated ores and concentrates.

The winter mode piles – a similar system would be used in the winter mode, however with four piles:

- The 1st option: two piles would be founded, one would age due to homogenization and ore would be taken from one pile,
- The 2nd option: one pile would be founded, two would age due to homogenization and ore would be taken from one pile.

The savings resulting from the proposed model while considering the costs resulting from the provision of Fe ores in summer and winter modes are shown in Table 2.

Provided that the purchase project is launched, the supply limits throughout the year will be solved according to purchasing commodities, i.e.:

- The reduction of procurement costs related to the transshipment, especially in the winter season,
- The elimination of failures in mines for specifi c time periods,
- The possibility to gain space for lar ge-scale repairs,
- The reduction of the risk of railway closures,
- As for pellets, the supply would compensate for the lack of scrap iron,
- It would eliminate production failures of agglomeration,
- It would cover higher consumption in case of or - dering lesser amounts of material for next months.

September, October and November have been proposed as the beginning of the winter stocking up of raw materials. Thus we have eliminated costs that would incur as a result of the winter unloading. This would result in the saving of natural gas during defrosting and subsequent reduction of costs and demurrage chages related to the private siding [6]. The model considers an annual increase of prices at the beginning of a new calendar year.

The entire mode of the winter stocking up while considering the aforementioned effects in the area of the purchase of strategic raw materials enables to gain total cost savings of 475 thousand USD.

CONCLUSION

In our contribution we have pointed out the character of the purchase of strategic commodity in the metallurgical company and various purchase methods in individual periods that depend on the overall purchase philosophy. Our aim was to propose a model of the optimal method of purchasing iron ore, while focusing on the cost reduction. This particular area has been chosen due to the fact that the costs related to the purchase of iron ore in the metallurgical company represent 30 % - 45 % of the total costs of strategic raw materials. At present, the total amount of purchased strategic raw materials in the metallur gical company is about 1 1 million tons. The annual share of Fe ores purchase is over 5,8 million tons. The reasons determining the purchase of Fe ores from Ukraine and Russia (99 %) are logistic routes from these countries that are specially designed for this par - ticular metallurgical company.

The effective management of Fe ore purchasing depicted in our contribution, along with other possibilities (e.g. purchase of strategic raw materials, mainly ferrous alloys by means of E-auctions or implementation of the new module of purchasing Fe ores into the existing information system) can contribute to the efficient spending of funds in the metallurgical company, while focus-

Table 2 **Project of winter stocking up**

		Agglomerated ore		Concentrate		Pellets		Totally	
		ton	thousand USD	ton	thousand USD	ton	thousand USD	ton	thousand USD
Summer rise	SEP	10 000	1 030	10 000	1 200		0	20 000	2 230
	OCT	15 000	1 545	15 000	1 800	10 000	1 300	40 000	4 645
	NOV	10 000	1 030	10 000	1 200	10 000	1 300	30 000	3 530
	Totally	35 000	3 605	35 000	4 200	20 000	2 600	90 000	10 405
Winter drop	DEC	-15 000	-1 545	-25 000	-3 000		0	-40 000	-4 545
	JAN	-10 000	-1 030	-10 000	-1 200	-10 000	-1 300	-30 000	-3 530
	FEB	-10 000	-1 030	-10 000	-1 200	-10 000	-1 300	-30 000	-3 530
	MAR	-5 000	-515	-5 000	-600	-10 000	-1 300	-20 000	-2 415
	APR		0	-5 000	-600		0	-5 000	-600
	Totally	-40 000	-4 120	-55 000	-6 600	-30 000	-3 900	-125 000	-14 620

Source: Own compilation

ing on the main goal of ensuring the delivery of high-quality and affordable input raw materials for the production process.

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