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SELECTIVE STOCK MANAGEMENT IN THE CASE OF A FOREST SERVICES ENTERPRISE

SELEKTYWNE ZARZĄDZANIE ZAPASAMI W PRZEDSIĘBIORSTWIE USŁUG LEŚNYCH

Key words: stocks, management, ABC method, forest services enterprise

Słowa kluczowe: zapasy, zarządzanie, metoda ABC, zakład usług leśnych

Abstract. The work presents a practical use of the ABC method for selective stock management in the case of the forest services enterprise. All purchased materials and spare parts were divided into 14 groups within which further analysis were performed. Value of the purchased products was estimated and further classification of products was carried out with the ABC method. Products which require consideration on account of a high participation in the total material costs as well as their regular purchase were selected. Increase in efficiency of work through decreasing work-stoppages caused by failures of machines as well as considerable savings in material economy through change of suppliers and single purchase of products were a notable effect of the performed analysis.

Introduction

Stock management in farms is a challenge and usually it is related to selection of a particular strategy from among the whole scope of possible solutions [Kuboń, Tabor 2010, Kuboń 2011]. Efficient operation of productive enterprises or service enterprises depends among others on proper formation and maintaining stocks. Necessity of maintaining stocks is mainly connected with ensuring continuity of productive processes, continuity of sale, protection against changes of prices as well as maintaining technical readiness of the owned machines and devices [Kowalski, Tabor 2003, Kuboń 2008, Baran 2009]. It also results from the influence of a random factor on logistic processes in the enterprise. Stocks allow decreasing a risk connected with uncertainty and meeting the deadline of delivery of goods, especially fluctuations of deliveries time. Stocks help to counteract a changeable and uncertain situation on the market. Aspiring to obtain a lower price of a product, to reduce transport costs, to produce and store products due to lower prices of a purchase as well as due to discounts from suppliers are an essential reasons for storing [Skowronek et al. 2003].

Forming and maintaining stocks encounters numerous difficulties and limitations mainly connected with bearing many types of costs. Stocking up requires considerable financial outlays. On the other hand, an excessive aspiration to minimize stocks means a bigger threat for operation of the enterprise in view of changing economic situation. In order to work up a rational proceeding, various logistic strategies concerning stock management, which allow for optimization of stocks level, are introduced. Therefore, it is significant to decide what to buy, when and in what amount to maintain a technical readiness and production continuity at minimal costs. The purpose of the article was to present a practical ABC method for selective stock management in the case of the forest services enterprise.

Materials and methods

The forest services enterprise reported the need to analyse stock management in the company within cooperation with the Institute of Agricultural Engineering and Informatics. The company is mainly occupied with obtaining wood and logging. Moreover, it delivers services connected with planting and cultivating plants, forest protection, renewing felling sites, cutting out over-bushes and over-trees, renovating forest tracks and tourist development of forest areas. The enterprise possesses a very modern equipment. It owns the following machines: Valmet 911 Harvester, two Forwarders – Valmet 860 and Timberjack 11010, a thinning processor Niab, few tractors adjusted for works in a forest, line winches Inter Forst, a light sidecar with a crane More Maskiner, few passenger cars and few off-road vehicles and a ropeway Savall 1500. Financial reports, informations from the guided interview questionnaire as well as

data from the company's documents of 2010 constituted a source material for research. A documentation method and a questionnaire method were used for collecting data. Statistical methods, the ABC method, as well as a case study were used for working out the results. There are many ways of stock management in relation to a type, a structure, and specificity of functioning of a company. The most important and the most frequently used method of management are: the ABC method, the XYZ method, a model of optimal seize of an order – EOQ, stock controlling models, systems of planning material needs – MRP as well as the JIT system. The ABC method was used in the article. It classifies goods based on their diverse participation in the value of the purchased products. With the use of an analytic procedure a division of materials into three groups (A, B, C) was carried out and a branch algorithm was based on a statistical material consisting in the record of the purchased products.

For the purpose of a more careful analysis, the materials and spare parts purchased by the forest services enterprise were divided into fourteen groups:

- 1) included the electric system parts (batteries, disconnectors, glow plugs, regulators, switches, bulbs, transmitters and switchers of signal lights),
- 2) consisted in the braking systems elements (brake belts, brake cylinders, bands, brake cables, brake forks),
- 3) included parts of an engine (seals, piston rings, a compressor head, compressor pistons HS 1145, valve rods, piston rings etc.),
- 4) consisted in the power transmission system parts (springs, a flywheel gear, a milled shaft, a lever, power transmission wheel, a hydraulic jack, a clutch plate, a clutch reel, a V-belt, a hinged bearing),
- 5) included elements of the hydraulic system (hydraulic pipes, actuators, solenoid valves, pumps, a booster pump with a compressor, terminals and sleeves for hoses, hose couplings, hydraulics casing),
- 6) consisted in the feed system parts (sprayers, heaters inductor, conduits, a petcock, petrol and oil hoses, a petrol sedimentation tank),
- 7) included operational materials (liquids, oils, grease and oil, air and petrol filters),
- 8) consisted in operational materials (lines, chains for Harvester, for logging, cutting chains, chain links, chain guides, slide buckles, electromagnets, electrodes, coupling pins, waterproof sheets, metal sheets screws),
- 9) fuel (diesel oil),
- 10) consisted in tools (keys, heads, screw taps, dies, drills, screwdrivers, blades, pliers, hammers, a wheel key, working lamps),
- 11) included the suspension system elements (bearings, knobs, tyres, tubes),
- 12) elements of machines accessories (slideslip, handles, a striker hook, pins, cotter pins, a silencer, a silencer support, stop arms, a stop telescope, screens, a cab fan),
- 13) included parts of the cooling system (water hoses, pipes, thermostats),
- 14) consisted in the remaining operational materials (cables, rolls, washers, seals, screws, pegs, toolboxes, flat bars, rings, engage sleeves, throw-outs, abrasive wheels, abrasive cloths, seals, silicones, dilutents, as well as isolating bands).

In order to perform a more careful analysis of the structure and the size of the purchased materials and spare parts every purchased item was assigned to a particular machine or a device.

Results

In the forest service enterprise, the purchases are carried out systematically, what concerns mainly basic operational materials. The purchase takes place in the points of sale, which are located the nearest to the working areas. Short-term stocks are formed mainly from fuels and selected machines spare parts stored in the so-called movable workshop. Some of small repairs are carried out independently (e.g. exchange of hoses in the hydraulic system of a machine), the remaining are performed in the surrounding workshops or service points. Whereas, more complicated faults require the service team to come to the place. It mainly concerns harvester machines.

Table 1 presents the value of the purchased products in the particular months of 2010. On the basis of the data values presented in the table, one may notice that a monthly value of the products purchased by the enterprise was between PLN 17.5 thousand and PLN 33.3 thousand. The highest value was reported in September and the lowest in August. From among the purchased goods in every month, the purchase of fuel was the highest (diesel oil), which constituted 20-88% of the total value of the purchased products. An average value of the purchased fuel in the researched year was PLN 13.6 thousand. Except for fuel, products from group no. 7 were purchased regularly with an average value of PLN 1.6 thousand as well as material from group no. 14 with an average value of PLN 0.8 thousand. The remaining materials were purchased systematically without storing – 4-8 times a year.

Table 1. Amount of the purchased products in particular months divided into groups
 Tabela 1. Wielkość zakupionych towarów w poszczególnych miesiącach z podziałem na grupy

Months/ Miesiące	Groups of products/Grupy towarów [PLN]														Sum/ Suma
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
I	26.2	209.9	404.1	2724.9	12873.5	258.2	301.2	1836.0	6059.9	1301.9	401.4	230.3	-	2616.5	17469.9
II	45.6	41.5	118.4	2144.4	540.4	70.0	3015.7	728.1	10077.5	121.5	56.6	4.0	-	506.2	11044.4
III	72.0	-	31.6	96.0	135.0	-	445.8	452.6	9732.8	-	-	-	-	78.6	13523.8
IV	6.1	4.0	2366.3	1004.2	475.8	312.2	967.2	68.3	7541.7	195.0	25.1	24.4	9.0	524.5	8116.7
V	-	-	5.0	28.4	98.2	-	1366.8	940.9	5417.1	-	-	-	116.8	143.5	20720.7
VI	114.6	-	17.5	4395.0	1089.3	62.8	579.4	1856.4	9062.4	348.0	1449.0	950.4	-	795.9	12990.4
VII	-	-	-	200.0	81.5	-	706.4	1146.2	10046.0	221.3	-	136.0	-	453.0	28733
VIII	337.2	325.0	23.0	2135.3	4283.3	338.4	3157.3	-	9904.9	991.0	200.0	4016.6	4.5	3016.5	17548
IX	-	-	4.9	-	2973.5	-	1205.9	-	9955.7	466.1	-	-	-	2941.9	33285.5
X	712.1	-	-	288.4	4059.4	-	1972.1	1703.4	22816.8	108.5	362.8	980.0	16.0	266.0	41220
XI	-	-	-	29.7	2681.6	111.6	3321.9	4313.1	30333.4	171.6	-	-	139.8	117.3	31384.4
XII	65.0	-	-	704.3	-	1057.5	1271.5	2049.6	24955.3	762.2	244.2	119.0	-	155.8	17469.9
Average/Średnia	193.2	123.5	366.7	1102.6	1641.8	325.4	1637.3	1473.2	13622.1	376.1	389.6	890.1	57.2	818.1	196.6
1st half year/I półrocze	264.5	255.4	2942.9	10392.9	15212.2	703.2	6676.1	5882.3	47891.4	1966.4	1932.1	1209.1	125.8	4665.2	4929.7
2nd half year/II półrocze	1114.3	325	27.9	3357.7	14079.3	1507.5	11635.1	9212.3	108012.1	2720.7	807	5251.6	160.3	6950.5	8064.8
Total / Razem	1378.8	580.4	2970.8	13750.6	29291.5	2210.7	18311.2	15094.6	155903.5	4687.1	2739.1	6460.7	286.1	11615.7	12994.5

Source: own study

Źródło: opracowanie własne

Table 2 presents the value of the purchased goods divided into 5 basic machines and forest devices, that is: a forwarder, a harvester, tractors, forest sidecars for logging and a thinning processor. The results of calculations were presented in a monthly, half-annual and annual view.

It was found that the costs of the purchased products in relation to different machines show a considerable diversity both between themselves as well as between particular months. The highest value of the purchased products was in November and December and most of them was designed for harvester machines. Whereas, the lowest costs were connected with the purchase of parts and materials for a thinning processor (PLN 1.2 thousand) and forest sidecars for logging (PLN 0.08 thousand). It resulted from the fact that these were new machines for which only operational materials were bought. In the annual balance sheet, materials and parts to the harvester constituted the biggest participation in the purchases where the purchase costs were on the level of PLN 118.9 thousand.

Assigning particular groups of products to a particular group A,B or C depending on the seize of their percentage participation for the total number of the purchased materials was the basic part of the ABC purchase analysis method. For this purpose, all groups were organized from the highest to the lowest participation in the total value, then subsequent percentage shares were summed up, and cumulated values were obtained. According to the accepted methodology, groups of products of a joint participation in the purchase value below 80% were qualified to the A group. While products, the participation of which was cumulated along with the previous group was below 95%, were qualified to the B group and the remaining products to the C group. Results of calculations and qualification of particular products to the A, B and C group was presented in table 3.

Table 2. Value of the purchased products with division into selected machines
Tabela 2. Wartość zakupowanych towarów z podziałem na poszczególne maszyny

Months/ <i>Miesiące</i>	Groups of machines/ <i>Grupy maszyn</i>					
	forwarder	harvesters/ <i>kombajny</i>	farm tractors/ <i>ciągniki rolnicze</i>	forest sidcars for logging/ <i>leśne przyczepy do zrywki nasiębiejnej</i>	thinning processor/ <i>procesor trzebiezowy</i>	average/ <i>średnia</i>
I	-	16 911.8	12 332.3	-	-	5 848.8
II.	-	8 675.5	8 843.9	-	-	3 503.9
III.	792.5	4 818.3	5 433.7	-	-	2 208.9
IV	4 878.8	2 737.0	5 511.2	-	-	2 625.4
V	1 056.8	4 122.0	2 927.1	-	-	1 621.2
VI	3 108.1	7 719.8	11 575.5	-	27.4	4 486.2
VII	3 187.3	3 467.5	5 076.8	80.0	-	2 362.3
VIII	11 130.0	10 544.4	7 053.5	-	-	5 745.6
IX	4 287.9	8 052.1	5 897.8	-	-	3 647.5
X	6 808.1	9 542.2	13 664.3	-	147.6	6 032.4
XI	10 554.4	22 289.9	7 453.7	-	1071.3	8 273.9
XII	6 055.0	20 027.7	5 301.8	-	-	6 276.9
Total/ <i>Razem</i>	51 858.9	118 908.1	91 071.5	80.0	1246.2	52 632.9
Average/ <i>Średnia</i>	4321.6	9909.0	7 589.3	6.7	103.9	-

Source: own study

Źródło: opracowanie własne

Table 3. Classification of the groups of products with the ABC method

Tabela 3. Klasyfikacja grup towarów metodą ABC

Number of a group/ <i>Numer grupy</i>	Name of the group of products/ <i>Nazwa grupy produktów</i>	Purchase value [zł rok]/ <i>Wartość zakupu [PLN/year]</i>	Percentage share in the total value/ <i>Udział procentowy w wartości całkowitej</i>	Sum of the value/ <i>Suma wartości [%]</i>	Group/ <i>Grupa</i>
9	Fuel/ <i>Paliwo</i>	155 903.4	58.8	58.8	A
5	Hydraulic system/ <i>Układ hydrauliczny</i>	29 291.5	11.0	69.8	A
7	Operational materials – oils, grease, liquids, filters/ <i>Materiały eksploatacyjne – oleje, smary, płyny, filtry</i>	18 311.2	6.9	76.7	A
8	Operational materials – lines, chains, guidebars, chain links/ <i>Materiały eksploatacyjne – liny, łańcuchy, prowadnice, ogniwa do łańcucha</i>	15 094.5	5.7	82.4	B
4	Power transmission system/ <i>Układ napędowy</i>	13 750.5	5.2	87.6	B
14	Operational materials –remaining/ <i>Materiały eksploatacyjne – pozostałe</i>	11 615.9	4.4	92.0	B
12	Accessories of the machines/ <i>Osprzęt maszyn</i>	6 460.7	2.4	94.4	B
10	Tools/ <i>Narzędzia</i>	4 687.1	1.8	96.2	C
3	Engine/ <i>Silnik</i>	2 970.8	1.1	97.3	C
11	Suspension system/ <i>Układ zawieszenia</i>	2 738.8	1.0	98.3	C
6	Feed system/ <i>Układ zasilania</i>	2 210.6	0.8	99.2	C
1	Electric system/ <i>Układ elektryczny</i>	1 378.8	0.5	99.7	C
2	Braking system/ <i>Układ hamulcowy</i>	580.4	0.2	99.9	C
13	Cooling system/ <i>Układ chłodzenia</i>	286.1	0.1	100.0	C

Source: own study

Źródło: opracowanie własne

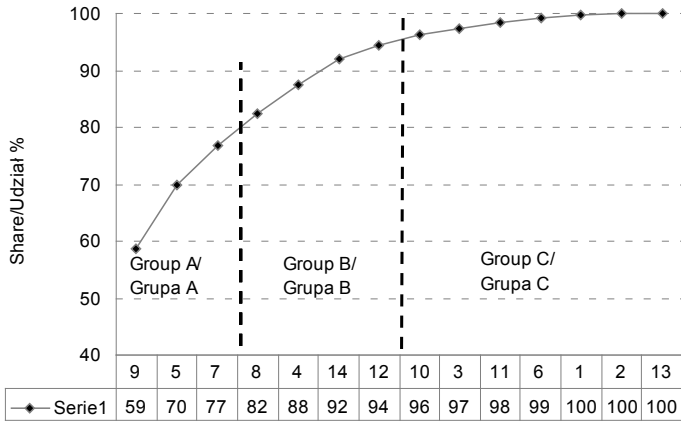


Figure 1. Pareto curve for purchases in the analysed forest services enterprise

Rysunek 1. Krzywa Pareto dla zakupów w analizowanym zakładzie usług leśnych

Source: own study

Źródło: opracowanie własne

Three groups of products: fuel (group 9), parts of the hydraulic system (group 5) and operational materials, such as oils, grease, liquids and filters (group 7) had the biggest value share in the total purchases made by the enterprise. The total value of the purchase of the above product groups, which formed the A group, was 76.7% of the total sum spent by the enterprise on the purchase. The B Group consists in the next four groups of products, that is operational materials such as lines, chains, guidebars, chain links (group 8), parts of the power transmission system (group 4), remaining operational materials (group 14) as well as accessories of the working machines (group 12). The above-mentioned groups constituted 17.7% of the total sum of the total purchase.

The remaining participation (5.6%) belongs to the Group C products. This group includes tools (group 10), engine parts (group 3), parts of the suspension system (group 11), parts of the power transmission system (group 6), parts of the electric system (group 1), parts of the braking system (group 2) as well as parts of the cooling system (group 13). A diagram called Pareto curve was worked out due to the information on the percentage value share of the particular groups of products.

The ABC method was applied analogically for the analysis of the products purchased in particular months. Each group

Table 4. Classification of the groups of products with the ABC method in a monthly view

Tabela 4. Klasyfikacja grup towarów metodą ABC w ujęciu miesięcznym

Months/ Miesiące	Groups of products/Grupy produktów		
	A	B	C
I	5, 9, 4	14, 8, 10	3, 11, 7, 6, 12, 2, 1, 13
II	9, 7	4, 8, 5	14, 10, 3, 6, 11, 1, 2, 12, 13
III	-	9, 8	7, 5, 4, 14, 1, 3, 2, 6, 10, 11, 12, 13
IV	9, 3	4, 7, 14	5, 6, 10, 8, 11, 12, 13, 1, 2
V	9	7	8, 14, 13, 5, 4, 3, 1, 2, 6, 10, 11, 12
VI	9, 4, 8	11, 5, 12, 14	7, 10, 1, 6, 3, 2, 13
VII	9	8, 7	14, 10, 4, 12, 5, 1, 2, 3, 6, 11, 13
VIII	9, 5, 12, 7	14, 4	10, 6, 1, 2, 11, 3, 13, 8
IX	9, 5	14	7, 10, 3, 1, 2, 4, 6, 8, 11, 12, 13
X	9	5, 7, 8, 12	1, 11, 4, 14, 10, 13, 2, 3, 6
XI	9	8, 7	5, 10, 13, 14, 6, 4, 1, 2, 3, 11, 12
XII	9	8, 7, 6	10, 4, 11, 14, 12, 1, 2, 3, 5, 13

Source: own study

Źródło: opracowanie własne

was assigned one of three categories of the A-B-C groups in a particular month. The results were presented in table 4.

The above list indicates that the products from group 1, 2, 3 and 13 belonged to the group C in every month, that is to the group of the lowest value participation in the total purchase. Parts of the feed system (group 6), tools (group 10) as well as elements of the suspension system (group 11) constituted products of the C group for 11 months in a year, and one time per year they moved to the B group. Whereas, fuel in all months, except for March belonged to the A group, what proves a considerable value participation in the purchase. Four groups (4, 5, 7, 8) of the products had the most diverse participation in the purchase in the particular months. Parts of the power transmission system (group 4) belonged to the A group twice (in January and in June), three times to the B group (in February, April and August) and through the remaining months they belonged to the C group. Elements of the feed system (group 5) for three months (January, August and September) were among products, which constituted the highest value in the purchase (group A) and three times in the B group (in February, June and October). Operational

materials such as oils, grease, liquids and filters (group 7) altogether for half a year (April, May, July, October, November and December) belonged to the products of the B group and they belonged twice to the A group (in February and August). Operational materials such as lines, chains, guidebars, chain links (group 8) only for four months in a year (April, May, August and September) belonged to the C group. Whereas, they had a high share in the value of the purchase in July and they were in the A group and for the remaining seven months they were in the B group.

Summary

The conducted research and analysis of the research results confirmed a practical usefulness of the ABC method for selective stock management. From among the purchased goods, products which require consideration on account of a high participation in the material costs as well as their regular purchase were selected. On account of specificity of the company operation as well as the scope of performed activities, these were materials mainly connected with exploitation of forest machines (fuel, parts of the hydraulic system, grease, filters and liquids). The analysis, which was carried out in consequence led to purchasing a barrel (20001) for fuel with a pump as well as many hydraulic parts. As a result, the company changed its suppliers. Single purchase of a big number of products and better equipment of the mobile workshop with spare parts allowed to increase considerably the efficiency of work through decreasing work-stoppages caused by failures as well as to make considerable savings in the material economy.

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Streszczenie

Przedstawiono praktyczne wykorzystanie metody ABC do selektywnego zarządzania zapasami na przykładzie zakładu usług leśnych. Wszystkie zakupione materiały oraz części zamiennie podzielono na 14 grup w obrębie których dokonano dalszych analiz. Określono wartość zakupywanych towarów, a następnie dokonano klasyfikacji towarów metodą ABC. Wyloniono towary, na które należy zwrócić szczególną uwagę ze względu na bardzo duży udział w ogólnych kosztach materiałowych oraz ich regularne zakupy. Wymiernym efektem przeprowadzonej analizy był wzrost efektywności pracy, przez skrócenie postojów spowodowanych awariami maszyn, jak również znaczące oszczędności w gospodarce materiałowej poprzez zmianę dostawców i zakup większych jednorazowo partii towarów.

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