Optimization of Management Decision by Network Method used for Chipboards Manufacturing

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Abstract. *The paper presents a method of an economic analyses through which the bases of the management decision may be set in order to optimize the chipboards manufacturing activity. The method is focused on the national and efficient capitalization of raw materials, as network rate assortments, and depending on the stocks situation within the store, to establish momently the optimal recipe to be implemented according to the manufacturing expenses and the profit implicitely, this recipe being variable in time depending on the supply possibilities.*

Key words: management decision; efficient caiptalization of raw materials; manufacturing expenses; profit.

1. General elements

Chipboards manufacturing represented and represents the technical and technological solution for wood recovery – generally wood with no industrial uses as timber or veneers – related to the low quality small-sized wood, neglected by industry and set as fuel for combustion – source of thermal energy.

The design and introduction within the economic area of the chipboards manufacturing technology mainly ensured the wood recovery from branches, splitwoods, slabs, sawdust, etc., randomly rated, but sometimes influencing the boards quality (example: excessive use of small-sized branches with high bark content or sawdust).

The recipes applied in industry refer to the simultaneously use of many raw material assortments as rates, with no influence upon the product quality and the manufacturing costs, and thus the profit to be reduced under the company expected limits.

Under these conditions, a real analyses of the recipes applied by other chipboards manufacturing companies is imposed, in order to design other possible recipes that can represent the base of the management decision optimization, after performing some attentive economic tests.

2. Study of case - a chipboards manufacturing company

The analyses of the industrial activity for chipboards manufacturing was performed at PAMOF Company – Curtea de Arges for 8 months. The output and assortments are presented in Table 1.

Output and assortments at PAMOF Company

Table 1

Thickness / Month	8 mm	12 mm	16 mm	18 mm	22 mm	25 mm	28 mm	Total
January	18	128	823	276	61	9	29	1344
February	46	77	817	277	66	0	52	1335
March	19	186	1135	450	184	0	0	1974
April	0	52	402	298	68	21	24	865
May	111	240	912	288	0	0	23	1574
June	0	199	800	415	88	0	83	1585
July	127	158	781	358	0	24	64	1512
August	32	52	1021	466	0	0	0	1571
I-VIII	353	1092	6691	2828	467	54	275	11760

The achievement of this production, both quantitative and qualitative, was performed by using different raw material assortments.

When analysing the situation of assortments recovery within an aleatory system, depending on the „current store amount" during 8 months, the following situation presented in Table 2 resulted.

The situation of wood assortments recovery for chipboards manufacturing at PAMOF Company

Table 2

Nr	Month	Consumed wood mass m^3	Beech splitwood (%)	Softwood splitwoods (%)	Diverse splitwood (%)	Beech wastewood (%)	Softwood wastewood (%)	Beech sawdust (%)	Cost/m^3 wood mass (lei)
1	January	2198,80	28	8	2	56	-	6	37,40
2	February	2230,80	20	2	-	62	7	9	33,82
3	March	3220,00	73	-	25	20	-	5	47,85
4	April	1422,00	-	-	-	90	-	10	27,91
5	May	2650,50	47	-	-	42	-	11	40,27
6	June	2580,00	41	-	5	50	-	4	43,25
7	July	2522,00	44	7	35	38	-	8	43,46
8	August	2566,00	47	-	-	43	-	10	43,57
9	Average	2423,77	41,5	2	8,37	46,4	0,8	7,7	40,84
10	Total units (m^3)	19390,16	8043,44	397,05	313,94	8993,25	156,15	1486,33	

Table 2 pointed out that the raw material assortments were used as high rates within the networks, as follows:

- Beech splitwoods – 20 ÷ 73%
- Softwood splitwoods – 2 ÷ 8 %
- Diverse species splitwoods – 2 ÷ 35%
- Beech wastewoods – 20 ÷ 90%
- Softwood wastewoods – max. 7%
- Beech sawdust – 4 ÷ 10%.

The wide use domain of different assortments within the networks had as a result a high profit fluctuation, as resulted from Table 3.

When simultaneously analysing table 2 and 3, it resulted that the influence of the used recipe upon the profit can not be concluded. As pointed out from February, some looses and a profit are recorded, although the rate of beech splitwoods is about 20% and that one of beech wastewoods is about 62%, comparing to March, when a profit is achieved, but the rate of beech splitwoods is about 73% and that one of beech wastewoods is of about 20%, knowing that the price of beech splitwoods is almost double than that one of beech wastewoods.

Recipe-profit situation achieved at PAMOF Company

Table 3

Month	January	February	March	April	May	June	July	August
Total incomes (lei)	381695,51	387537,46	582556,97	254178,82	497552,49	476463,58	477301,18	454992,42
Total expenses (lei)	365440,43	389977,33	574566,73	253674,47	448086,81	465772,17	438862,89	445568,53
Profit (lei)	16255,08	-2439,87	7990,25	504,35	49465,68	10691,41	38438,29	9432,89

Under these conditions, with respect to the recipes practiced by PAMOF Company during 8 months and knowing that no definite interaction between recipe and profit can be achieved, the idea of networks optimization depending on the profit was followed out, in order to apply the recipe for maximum profit shifted with any store situation.

3. Recipe-profit correlation

After the previously mentioned conclusions, the design of some rate assortment recipes was pursued and the cost of raw material integrated within the final product unit (m^3) was established as well.

Table 4 presents a recipe structure, proposed within the paper, with the estimate elements that finally define the cost of integrated raw material.

Economic analyses under comparativ system for different types of composites with synthetic and mineral binder.

Similarly with recipe 1 already presented in Table 4, other recipes were synthetically presented in Table 5.

Chipboard with hardwood exclusively used – Recipe 1

Table 4

Used wood assortment	Partici-pation rate (%)	Wood amount integrated within the product (m^3)	Medium efficiency m^3 wood/m^3 product	Wood volume integrated within the product (m^3)	Unit price of raw material integrated within the product (lei/m^3)	Cost of raw material integrated within the product (lei/m^3)
0	1	2	3	4	5	6
Round wood	30	0,3		0,492	150	73,8
Splitwoods	20	0,2		0,328	200	65,6
Slabs and techno-logical wastes	40	0,4	1,64	0,656	120	78,72
Sawdust	10	0,1		0,164	100	16,4
TOTAL	100	1		1,64		234,52

Structural synthesis of the proposed recipes

Table 5

Recipe	R1	R2	R3	R4	R5	R6	R7
Round wood (%)	30	20	10	30	30	20	20
Splitwoods (%)	20	20	20	30	40	30	40
Slabs and technological wastes (%)	40	50	60	30	20	40	30
Sawdust (%)	10	10	10	10	10	10	10
Cost of raw material integrated within the product (lei/m^3)	243,52	229,6	224,68	247,64	260,76	242,72	255,84

When analysing data from Table 5, it results that the cost level of raw material integrated within the product unit depends on the recipe, ranging from 224,68 lei/m^3 to 260,76 lei/m^3.

In order to achieve an efficient and positive action, a complex analyses was performed, resulting the wood use factor for each recipe, depending on the chipboard market prices and according to the boards thickness, as resulted from Table 6.

It is noticed from Table 6 that the wood use factor (as ratio between the market product price and the raw material price) distinctly depends on the boards thickness and the used recipe.

Within the industrial reality, the thicknesses are produced based on orders of different rates from one month to another and, consequently, these may not set as base for the decision optimization, but the recipe may be the element used for establishing the management decision related to the manufacturing optimization.

Data recorded in Table 5 are graphically represented as shown in figure 1.

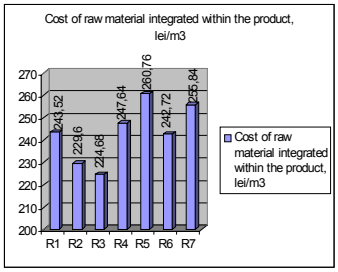

Figure 1. *Cost of raw material integrated within the product*

Use factors of wood recovery depending on the boards thickness

Table 6

PAL assortment mm	Porduct value		The value of wood material integrated and the recovery factor													
			Recipe 1		Recipe 2		Recipe 3		Recipe 4		Recipe 5		Recipe 6		Recipe 7	
	Euro/m^3	Lei/m^3	Value	Use factor	Value	Use factor	Value	Use factor	Value	Use factor	Value	Use factor	Value	Use factor	Value	Use factor
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
8	114	399		1,70		1,74		1,78		1,61		1,53		1,64		1,56
12	102	357		1,52		1,55		1,59		1,44		1,37		1,47		1,40
16	80	280	234,52	1,19	229,6	1,22	224,68	1,25	247,64	1,13	260,76	1,07	242,72	1,15	255,84	1,09
18	74	259		1,10		1,13		1,15		1,05		0,99		1,07		1,01
22	71	248,5		1,06		1,08		1,11		1,00		0,95		1,02		0,97
25	56	196		0,84		0,85		0,87		0,79		0,75		0,81		0,77

When analysing figure 1 and Table 5 it results that the recipe has direct, visible, and quantified influences upon the profit and it can be used as element for the economic optimization of the product manufacturing.

Certainly, the seven proposed recipes are not exclusive, an improved and meticulous study can be performed using a special software in order to define the best solution depending on:

- the situation from the store related to the raw material assortments;
- the supply prognosis;

- the period of activity on the operation line;
- assortment structure of the manufacturing according to the backing of orders;

2. Conclusions

The idea launched within the framework of the paper, to decide managerial the chipboards manufacturing recipe depending on the situation of the raw material stocks, under the terms of some minimum manufacturing costs and a maximum profit achieved, present a series of advantages such as:

- it can be processed through a permanent report on the situation of stocks into the store and with the recipes program introduced within the decisional block the manufacturing process can be checked, establishing rapidly and in real time an optimal manufacturing network for a given moment;
- it can be defined the recipe application time, depending on the stocks from the store and the consumption, according to the recipe;
- it can be anticipated the next recipe if no changes on stocks occur caused by the supply;
- it can be rapidly changed the recipe depending on the rhythm of supply with raw material and the change of stocks, thus the manufacturing remaining up to the maximum efficiency;
- it can be anticipated the supply with raw material depending on the optimal recipe to be practiced;
- it can be rapidly assessed the economic effect of a recipe use, achieving „active economic analyses", in real time, supporting managerial decisions;
- it can be rapidly calculated the profit and looses depending on the used recipes and it can be decided the maintenance in activity, the tehnological process restriction or stop, until the stocks are complete, in order to use efficient recipes;
- it can be established the store dimensions depending on the optimal manufacturing recipe;
- it can be established the current chapter size, monthly, for supply with raw material assortments, depending on the optimal manufacturing recipe;
- the software can be completed and extended (respecting the proposed method) in order to establish the effects of any recipe where the assortments combination is performed (with lower variation limits);
- optimization of the manufacturing recipe is achieved depending on the minimum stock (as recovery time) – for the raw material assortments under analyses and after the moment that one assortment from the recipe under study was finished.

The method proposed can be used by any company specialized in chipboard manufacturing, but connected to a computer system that must correlate data from:

- the raw material store, in order to supply the amount situation of stocks;
- the supply situation, with the schedule dynamics of assortments amount;

- the cost situation for the assortments supplied and introduced into the store.

The problem of supplied assortment costs is very important because these costs can be different and they can strongly influence the cost per product unit, depending on the recipe participation rate. It can be increased or decreased and thus it influences the product.

The permanent introduction of the supply costs for the raw material assortments arrange the recipes from the point of view of the manufacturing economic efficiency, and thus, mentioning the decision action under the uprightness area, the product and company under the maximum profitability (depending on the supply juncture complexity).

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