

### **SUMMARY**

**Saykevich Marina Ivanovna**, Ph.D., assistant professor of economics. Zhytomyr National Agroecological University. Evaluation of Raw Materials Supply and General Economic Effect Of Functioning of the Processing Plant. The paper highlights the results of the simulation of the processing cooperation with raw material suppliers. Dependence justified the purchase price, which may offer a processing plant from the cost of raw materials and the processing unit loading level of processing capacity. Factors that affect the overall economic effect of cluster companies, the prospect of a return on investment in specific assets, as well as the possible manifestations of opportunistic behavior in the form of extortion have been identified.

*Keywords:* loading of capacities, the minimum offer price, the maximum purchase price, break-even, transportation, economic development of the area, the transport network.

Evaluation of Raw Materials Supply and General Economic Effect  
Of Functioning of the Processing Plant

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## I. Introduction.

Economic activity in the real economic segment needs investments in specific assets. First of all, these are the means of production, the effective use of which is only possible within a certain area. Due to the low liquidity of specific assets there is a need to predict economic outcomes of business entity functioning to assess the prospects of payback on such investments.

The problem of economic outcome prediction is of particular relevance in the conditions of interaction of several independent business entities in the same area. For instance, the subject A produces the products, which are the raw materials for the subject B – processing plant. Herewith, the first subject and the second one are investing in the specific assets, the use of which is limited to a defined area. The level of the load processing facilities of die subject B and the period of its payback depends on the volume of the raw materials supply by the subject A. Lack of the necessary production facilities in the subject A creates a risk of insufficient processing facilities loading of die subject B. The last one, in its turn, will be unable to offer an attractive price for the raw materials. Thus, the productive assets of the subjects A and B, and also some components of infrastructure in the region re the complementary conditions of successful economic activity of independent subjects. Modeling the interaction of commodity producers and processors is an actual problem. It will allow estimating the prospects of a positive outcome of their cooperation, and providing die necessary conditions to achieve it.

Review of recent research and publications sources. Methodological basis of research of interaction between producers of agricultural products and its customers, due to the spatial location of farms, laid by German scientists J. von Thunen [5], W. Launhardt [1], A. Weber [2]. The expansion of industry markets due to their density and economies of scale, investigated G. J. Stigler [7]. Current studies the problem of the ensuring processing enterprises with raw materials developing in line with supply logistics [3,4,6,8].

## II. Problem statement.

Summary of achievements of these studies will allow formulating the estimated model for quantifying the performance of the processing enterprise. The purpose of this paper is to highlight results of modeling the interaction of processing enterprises and farms that cultivate the appropriate plants. The target of the model is to determine the purchase price of raw materials, which depends on the level of loading of facilities of the processing enterprise and offer price of raw materials, which is caused, by the distance of transportation.

## III. Core material and results.

Assume for illustrative purposes that the subjects A are agricultural enterprises, which cultivate flax, and the subject B is flax plant, which performs recycling flax

straw. Let's consider the depending on which it is possible to model interaction between the subjects A and B:

- 1) the larger are the amounts of flax sowing in the region, the farther from the flax plant should be located flax-sowing enterprises;
- 2) the farther from the plant is located farm property, the purchase price of flax straw should be higher (due to other equal conditions), so that to cover transport expenses for the delivery of the raw materials to the processing plant;
- 3) the larger are the volumes of flax straw processing, the lower are the costs of processing plant, per unit of finished product, and the higher purchasing price can be offered by the flax plant, so that to encourage more agricultural enterprises for flax sowing.

1) Distance dependence between flax sowing enterprise and flax plant is determined by the level of plowed area ( $c$ ), rate of crop rotation (0,2 – flax can be sown in the same place 1 time in 5 years), and also by the density of transport network. Let's designate  $R$  – distance in a straight line from A to B,  $l$  – real distance along the roads, than  $h=l/R$  – characteristics of road density of the region,  $h$  is evaluated empirically for a particular region. The area of agricultural holdings, occupied by flax sowing:  $s = 0,2 (l/h)^2 c$ . Multiplying term of sowing area by the average flax yield  $q$  we obtain dependence of the raw materials supply  $x$  on the distance of transportation  $l$ :

$$x = 0,2 cql^2/h^2 \quad (1)$$

2) Let  $P_{min}$  – is a minimum unit price for the raw materials, it meets the requirements of agricultural enterprise profitability, which is fully equipped with the necessary aggregates for cultivation of flax and harvesting. And the enterprise is located at zero distance from flax plant. Than the price, which meets the requirements of the enterprise, is located at the distance  $l$  from the flax plant is defined as  $P=P_{min}+lt$ , where  $t$  – is transport rate of 1 ton-km.

$$P = P_{min} + ht \frac{\sqrt{x}}{\sqrt{0,2\pi c q}}$$

Taking into account (1), we may write This is function of

raw materials supply  $P^s=f(x)$ .

3) Determining the purchase price of raw materials by the flax plant  $P^d$ , will consider the condition of its profitability. Let  $TFC$  – are the total fixed costs of the flax plant for the year, the value of which does not depend on  $x$ ,  $VC$  – direct costs for processing of 1 ton of raw materials, and  $Z$  – are the revenue from the products sale, obtained by processing of 1 ton of raw materials. Then the maximum purchase price of 1 ton of raw materials will be  $P^d = Z - TFC/x - VC$ . It is obvious that while increasing  $x$ , the maximum purchase price will increase.

Positive cooperation between flax sowing enterprises and flax plant is possible if

$x$ , which ensures the fulfillment of condition  $P^d > P^s$ , where – is a set of production capacities of flax plant. Let's check the possibility of fulfillment of condition  $P^d - P^s > 0$  with the example of functioning Novograd-Volynskiy flax plant (Zhitomir Region, Ukraine).

According to the technology of cultivation of flax, which is recommended by Polissya Agriculture Institute on the territory of Novograd-Volynskiy District, expected crop yields  $q$  is projected at 3 tons of flax (equivalent of 1 ton of flax fiber) from 1 ha of crops. Tariff of transport costs  $t$ , which was relevant at the time of payment, was 5 UAH/t-km. The calculated lowest price  $P_{min} = 763,2$  UAH/t. The level of cultivated lands of Novograd-Volynskiy Districts  $c = 0,33$ . The calculations showed that in the District the distance between two points of the roads is at 1,325 times exceeds the distance in the straight line, namely  $h=1,325$ .

According to the data of the company «Linen of Desna», which is a leading regional producer of linen in northeastern Ukraine, after flax processing the outcome of long fiber is 10-12 %, 18-20 % of short fiber from the total amount of flax straw. Considering the average world prices for long and short fiber, also the exchange rate, we define that the sale of products of 1 t of flax straw provides the marginal revenue for the flax plant in the amount of 3077,6 UAH, namely  $Z = 3077,6$  UAH. The annual costs of maintaining the functioning of the flax plant, regardless of the amount of flax straw processing are 2,5 millions UAH, The costs for processing of 1 t of raw materials  $VC = 640$  UAH/t. In the table 1 there are given calculations, which indicate the possibility of breakeven cooperation between flax sowing enterprises and flax plant at different levels of capacity utilization.

Thereby, due to each given level of capacity utilization the maximum purchase price of the flax raw materials exceeds the minimum price of the offer, which indicates the potential possibility of positive cooperation between the enterprises. But we need to note, that in die example it was considered a simplified situation, when the agricultural enterprises are fully equipped with their own equipment and do not need credits for working capital funds. Besides, there were not taken into account tax payments, which are charged on the wage-fund, on the added value, and payments for land use.

**Table 1 Simulation of Different Levels of Capacity Utilization of the Flax Plant**

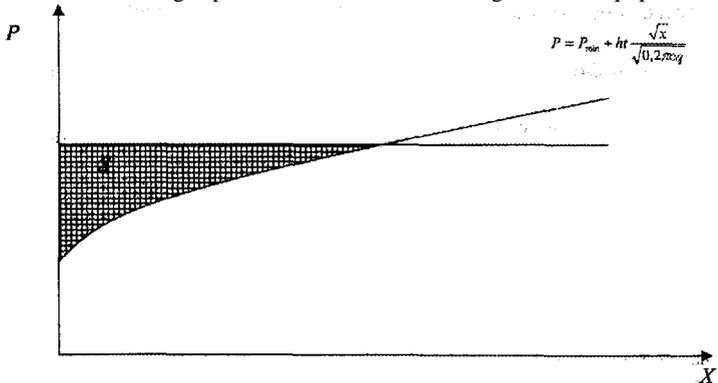
The level of capacity utilization of the plant, %	20	40	60	80	100
Annual purchase amount of the flax straw, t	2000	4000	6000	8000	10000
The maximum purchase price of the flax straw in the enterprise, UAH/t	1187,6	1812,6	2020,9	2125,1	2187,6
The area of agricultural holdings (arable lands), which should be sown with flax for providing the given level of capacity utilization of the flax plant, ha (based on the regulatory yields 31 of the flax straw from 1 ha)	666,67	1333,33	2000,00	2666,67	3333,33
The greatest distance from the agricultural enterprise to the flax plant, km	23,8	33,6	41,2	47,5	53,1
The minimum price for flax straw .of the farther enterprise from the flax plant, UAH/t	881,99	931,20	968,96	1000,79	1028,83

Conclusion on the possibility to load the processing capacities for the specified level, yes/no	yes	yes	yes	yes	yes
Number of agricultural enterprises closely located territories, which should be involved in ensuring the plant with raw materials, um.	3	5	7	10	13

On the other side, it was not taken into account the rent of the agricultural enterprises, which are located straight close to the flax plant, compared with more distant producers. In the conditions of equal purchase price for all the enterprises it is obvious availability of savings on transport costs for the nearest farm properties. Due to the specified amount of flax straw processing  $x$ , the amount of savings can be estimated by using the integral:

$$S = x(P_{\min} + ht \frac{\sqrt{x}}{\sqrt{0,2\pi q}}) - \int (P_{\min} + ht \frac{\sqrt{x}}{\sqrt{0,2\pi q}}) dx = \frac{htx\sqrt{x}}{3\sqrt{0,2\pi q}}$$

The agricultural enterprises, which will transport the raw materials to the pitot independently, will have the possibility to assign specified differential rent. In case of purchasing the raw material by the flax plant on the EXW terms, it can use the price discrimination and reallocate differential rent in its favor. The exact mechanism of purchase may be determined on a personal level between the Heads of the enterprises. It is therefore advisable to focus on forecasts' of economic benefit from functioning of the flax «cluster» generally, to estimate the possibility of attraction of credit resources for financial needs in working capital and rent of the needed agricultural equipment.



**Fig. 1. Diagram of Differential Rent of the Agricultural Enterprises, Which are Located Near to the Flax Plant**

Mass profit of the flax cluster is defined by the difference between maximum possible purchase price and lowest possible offer price for raw materials unit, also it includes differential rent:

$$M = (Z - VC - P_{\min})x - TFC - \frac{2htx\sqrt{x}}{3\sqrt{0,2\pi c q}}$$

Note that the given mandatory payments the lowest offer price of the raw materials  $P_{\min}$  increases at 123 UAH/t comparing with the previous calculations. Considering the equipment rental costs and involvement credits for the needs of turnover, due to the standards established by Polissya Agriculture Institute, positive value of profit mass of cluster is achieved only while downloading of processing capacities of the flax plant more than 40 %. Note that the value of the fixed costs of the analyzed processing enterprise in the absolute measurements exceeds final mass of profit almost in 5 times, this allows us to consider the projects of processing enterprises portioning, as perspective.

Profit mass increases with increasing of world price and the amount of raw materials processing and decreases with an increase of fixed expenses and transport tariff costs increasing. The improvement of transport network decreases  $h$ , thus it slows down the reduction of profit mass. The similar effect on the profit mass has the increasing of crop capacity and increasing of the plowed area level.

#### IV. Conclusions.

The flax equipment of the agricultural enterprises and processing capacities of the flax plant are cospecialized, or bounded assets, which generates so-called «hold-up problem». One of the sides (the one, which has alternative options of behavior), using monopoly power, redistributes cluster mass profit in its favor, thereby preventing the development of the other side. Practice shows that flax sowing enterprises have monopoly power. Their flax sowing equipment has the shortest wearing out terms comparing with the basic means of production of the flax plant. The main holdings assets - lands - allow alternative directions of their use. Decreasing the sowing of flax, the enterprises increase the price of the offer, thereby decreasing loading capacities level of the flax plant and making processing on unprofitable activities. Solving the problem of exaction should be in the plane of pricing. The purchase price of the raw materials should not only ensure profitability of the agricultures, but also to generate income, compared with the income from alternative annual crops. Than flax sowing will be considered as the way to generate rents, but as the way of crop diversification and optimization of crop rotation with cereal crops, potatoes and sun flower.

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