COMPLEX BUSINESS SYSTEM MANAGEMENT IN AN AGRO-INDUSTRIAL COMPLEX[1]

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Abstract

Management of business functions in the business system also includes management in agricultural production. It indicates that the production process, other company operations (procurement, sales, and finance), and the work, means of production, products of production, and technology are all harmonized. Production management's primary objective is to maximize the economic benefits; all other secondary goals (technological, social, and production) must serve this primary objective. When achieving goals, it should also take care of ecology. The management model of a complex business system connected to the agro-industrial complex, which will comprise independent variables and constraint matrices, will be the main topic of the study.

Key words: *Agricultural management, business system, economic objective, independent variables, constraint matrices.*

Introduction

Specificity in the sphere of production management manifests itself in all phases, as well as at all levels. The complexity and specificity of agricultural management are conditions by the existence of production dependence by the need to make the most of the potential synergy hidden in them. (Novković & Šomođi, 1999). The skill of agricultural production management lies precisely in the fact that the potential production synergy is maximally used and valorized through the economic efficiency and effectiveness of the business system as a whole (enterprise, cooperative, or peasant farm. Based on the above, the requirement arises that the integrity and hierarchy of management are the char-

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acteristics of management business systems in agriculture and agro-industry. Integrality, management, as a feature implies that the subject is the business system as a whole (with respect and use of the specificities of individual subsystems) to achieve maximum overall economic effectiveness at defined (satisfactory) levels of efficiency. (Šomođi et al., 2006) The integrality of agricultural production management implies the maximum synchronization of production factors and the achievement of the optimal synergy of horizontal and vertical production structure, i.e., the integration of the optimal level of intensity of individual production lines and the optimal production structure to achieve maximum economic effectiveness (Novković et al., 2015). Integrality implies the complete management of functional and development production processes to realize the economic effects of the production process in a rather short period, for which it is necessary to ensure continuous growth of production capacity and production results through development processes. Hierarchy, as a characteristic of production management, implies that individual management decisions are not equally significant or equally inclusive. In other words, the hierarchy of agricultural production management means the necessity of the division of decision-making (Novković & Šomođi, 2016) In the case of large business systems in the agro-industry, all strategic share of tactical decisions at the headquarters levels and the other part of tactical and operational management decisions are brought at the level of individual subsystems, i.e., organizational units. Production management implies the temporal and essential synchronization of strategic, tactical, and operational management decisions and activities at each of the mentioned management levels which is necessary to harmonize the four head phases of the management process - planning, organization, management, and control. (Drinić & Ceranić, 2018). An essential element of successful management, i.e., achieving maximum economic results under certain conditions for production, is the choice of adequate management methods for solving specific problems. Methods are a tool used to solve a problem. Therefore, it is necessary to adapt the method to solve every problem with the same method. (Simonović, 2014). Operational management means direct management of work operations that make up the production process. That deals with the formation of operational production plans, their specific organization, and the management of their realization and control as a basis for the upcoming operation plane. The specificity of this management level of production in agriculture (especially in plant production) is in the planning, organization, management, and control of campaign works. Campaigns in agriculture differed from each other, in terms of duration, implementation

time, size of engagement of production workers and means of mechanization, necessary materials, etc. (for example, autumn and spring sowing campaigns, harvesting, pruning...). Network planning is an effective method for this level of production process management.

Traits of sophisticated business systems

The characteristics of complex business systems in the agro-industry are (Novković, 2018): very high value of engaged capital, the volume of production and number of employees, diversified production program and business activity (from primary agricultural production through primary and secondary processing of agricultural products, to traffic and other services (tertiary) activities), a large number of owners (shareholders), the development of all business functions, a complex and developed organizational structure and a complex and developed hierarchy of leadership and control. Complex business systems in the agro-industrial complex consist of a large number, of organizational units. Those units characterize a relatively large scope of independent business decision-making. Most often, a complex business system is composed of a large number of economic entities- businesses that have a special legal and economic status (giro account). (Djukic & Ilic, 2021). What connects these companies in a complex business system is the ownership, i.e., the interests of the majority shareholders in these companies, by establishing new organizational entities - companies (Simonović et al., 2017). Complex business systems in the agro-industry were also created by the integration of separate companies, or by the purchase of company shares on the capital market. Individual companies, within the framework of complex business systems in agro-industry with common majority owners (shareholders), are most often connected and production-technologically. That means that some companies within the business system produce raw materials and semi-finished products for the needs of other companies within the same business system, which market their products and services. If there is this type of production-technological dependence within complex business systems, then they are usually organized according to the principle of strategic business units, i.e., profit centers (Simonović et al., 2011). At the same time, due to the unique capital at the level of the complex business system as a whole, the profits of individual companies do not represent a priority goal. The priority goal is the maximum total profit at the level of the complex business system. Profit, as a rule, does not represent a simple sum of the maximized profits of

individual companies due to the synergistic connections that pass between them and based on production-technological dependencies. Owners of complex business systems in agribusiness invest excess free financial resources (according to the principle of maximum effectiveness) in companies that are not technologically compatible with the existing production program, that are not even in the same industry, but are attractive because they potentially bring high profits. (Ilic, 2023). There are two underlying forms of organizing complex business systems in the sense of organization, management, and leadership. These are corporation and holding. In the corporate organization of complex business systems, there is a higher degree of integration of the management functions. At the corporate level, there is one board of directors, which, appoints managers and decides on all strategic issues in subsidiaries (subsidiary companies). This means that with the corporate form of organizing complex business systems, the majority of owners are the same in all subsidiary companies and that the degree of their business decision-making is limited (dependent) by the framework set by the parent company. (Stojanović et al., 2017). Board of directors managed corporation appointed by the shareholders' meeting. The chairman of the board of directors is usually the majority shareholder. The board of directors appoints the general director (manager) by the corporation's functional directors of individual business functions and directors of subsidiaries. Shared business functions of the corporation (financial, development, marketing, personnel, legal, etc.) are united within the parent company. (Ilić & Nikolić 2019). They coordinate the work of analogous business functions in subsidiaries. With the organization of complex business systems according to the holding principle, the degree of integration of management at the level of the whole system is lower. It means that at the level of subsidiary companies, there are opportunities for them to make business decisions independently. The basis for establishing a holding is also the interests of capital owners and the establishment of production and technological dependencies between individual companies. However, in the case of holdings, in companies - companies that join the holding, there are different dominant capital owners. (Ilić et al., 2019). In this case, the organizational connection in the holding is not based on the unity of the capital but on the economic interests of several different owners of companies. The organization system of a holding is similar to that of a corporation, with the difference that management boards are formed in individual companies by the ownership structure of the capital and that a smaller number of management responsibilities from the delegates at the level whole of the holding. (Cer-

anić et. al, 2013) The primary goal of managing a complex business system in an agro-industrial complex is to ensure integral optimal functioning and development. The business system combines primarily agricultural productions as a raw material base (cost business unit) and the processing industry as a strategic business unit, i.e., profit center. (Đekić & Jovanović, 2010). In development management, the primary economic goal is maximizing effectiveness, i.e., the need of the business system in the agro complex to deal with the actual productions in the future, i.e., products that bring maximum profit. In the management of functioning, the primary economic goal is maximizing efficiency, that is, the need of the business system in the agro complex to produce what it produces in the right way, whereby the maximum value of the relations of economic effects and economic efforts (income and costs) by achieved. (Praća et al., 2017). In both cases, the linear programming method can be implemented to the needs of production management, more precisely, at the planning of the production structure. In planning the overall development of a complex system, a development policy and long-term and medium-term development plans are adopted, based on which individual investment programs and projects are further elaborated (Ilić et. al., 2017). The plan, the functioning of the complex system as a whole, and a business policy for a specific year be adopted, as complex production and financial.

Management of an agro-industrial complex's growth of a complex business system

Considering that in the business systems in the agro-industrial complex production is much diversified, the independent variables in the linear programming model for optimizing production development can be grouped, according to the authors Novković and Vukelic to independents variables in plant production, independent variables in animal husbandry, and independent variables in primary processing. (Novković & Vukelić, 2020). Secondary goals of development, which lead to the realization of the primary goal determined by planning: effective production technology, the optimal level of production intensity, the optimal structure of crop production, the optimal livestock production, the optimal primary processing, and the optimal relationship between crop production, livestock, and primarily processing. These maximum goals must be realized under the conditions of several limiting factors and available conditions for production. The most important groups of constraints in the linear programming model can be defined, as land constraints, biotechnical and zoo-technical constraints, productive labor force con-

straints, mechanization resource constraints, stable capacity constraints, processing capacity constraints, constraints connecting crop production, animal husbandry and primary processing, constraints investment funds, and market restrictions. Maximizing the total net income of the business system is taken as an optimality criterion. (Šomođi et al., 2004). Based on the above, the general linear model programming for planning the development of the agro-industrial business system can be formulated as follows. (Novković & Vukelić, 2020)

- Independent variables in crop production (condition a)

$$B\,a\,b\,c\,d \geq 0 \qquad \text{a)}$$

Babcd is the area (in hectares) of the crop "a", produced by technology "b", on the land of type "c", in the sowing structure "d",

where:
a = 1(1) m; m = the number of crops taken into the model
b = 1(1) n; n = the number of technologies for the production of certain crops
c = 1(1) o; o = the number of types of land
d = 1(1)2; 2 = number of sowings per year (1 = regular sowing; 2 = subsequent sowing)

- Independent variables in livestock farming (condition b)

$$S\,e\,f \geq 0 \qquad \text{b)}$$

where:
Sef is the average annual number of "structural" heads of livestock "e", which are bred according to the production technology (keeping method)
"F" e=1(1) p; p = the number of majors produced in livestock
f=1(1) q, q = the number of production technologies of individual lines of production in livestock farming

- Independent variables in the primary treatment (condition c)

$$P\,g\,h \geq 0 \qquad \text{c)}$$

where:
Pgh - annual volume of production of food product "g", produced according to production technology "h", in appropriate units of measurement (t, hl,)
g=1(1) r; r = number of food products
h=1(1) s, s = number of processing technologies of certain products

Constraint matrix

- Land restrictions
- Regular sowing (formula d)

$$\sum_{a=1}^{m} * \sum_{b=1}^{n} B_{abc1} = A_c \qquad d)$$

A_c = land area type "c"

- Subsequent sowing (formula e)

$$\sum_{a=1}^{m} * \sum_{b=1}^{n} * B_{abc1} - \sum_{a=1}^{m} * \sum_{b=1}^{n} B_{abc2} \geq 0 \qquad e)$$

1. Agro technical restrictions (formula f)

$$\sum_{b=1}^{n} B_{abcd} \leq k_a A_c \qquad f)$$

ka = coefficient of maximum participation of crop "a" in the sowing structure

2. Manpower limitations (formula g)

$$\sum_{a=1}^{m} * \sum_{b=1}^{n} * \sum_{c=1}^{0} * \sum_{d=1}^{\angle} R^i{}_{abcd} B_{abcd} + \sum_{e=1}^{p} * \sum_{f=1}^{q} * R^i_{ef} S_{ef} \sum_{g=1}^{r} * \sum_{h=1}^{s} * R^i_{gh} P_{gh} \leq R^i_u \qquad g)$$

where:
– technical coefficient, which represents the required number of working hours of production workers per unit of activity in period "I"
– total available food of working hours of production workers in the period "*u*".

In addition to the mentioned limitations, according to the same author, the following stand out:

- Limitations of mechanization
- Stall capacity limitations
- Limitations of processing capacity
- Self-sufficiency in fodder needs
- Raw material security for processing

Considering the limitation of the research on these factors, we only mentioned them in the paper and did not process the formulas that show their limitedness.

Conclusion

By solving the linear programming model of the optimal development of the business system in the agro-industry, a series of information has been obtained that make up the essential elements of the development program. These are the optimal structure of the total production of the business system, the optimal sowing structure, the production technologies that are the most effective in cattle production, the optimal structure of livestock production, the directions and technologies of livestock production that are the most effective, the optimal of processing, the most effective processing technologies, the balance of animal feed needs by types, degree of provision of own raw materials for processing needs, total needs of the production workforce and their distribution by activities, total needs for mechanical work by types, production bottlenecks (minimum factors), real restrictions on product placement, we need and distribution of investment funds by activities and total planned net income (profit) of the business system.

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