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Features of the Decision-Making Process in Agribusiness Management in the Condition of Russian Military Aggression in Ukraine

Abstract

Full-scale Russian military aggression in Ukraine, which began in February 2022, significantly affected the conditions for conducting domestic business and agribusiness in particular. This article presents the results of a study of how the conditions of war affected the process of making managerial decisions at the level of domestic agribusiness enterprises. *The main objective* of the article is to study the features of making managerial decisions in wartime. *Methods* includes the combinations of primary research, including interviews with agribusiness managers and industry experts, with secondary research, such as industry reports, case studies, and academic literature. Also, the use of methods of justification of decisions under probabilistic certainty and uncertainty of conditions for the implementation of alternatives by using payment matrix. By incorporating these perspectives, we provide a comprehensive analysis of the decision-making process in Ukrainian agribusiness in wartime. *Results* of the survey showed the impact of war as an external environmental factor on decision-making by agribusiness enterprises in the areas of production technologies, conservation of production resources, changes in the direction of resource procurement and sales of manufactured products. The main factors that affected the agricultural sector are identified, including a reduction in sown areas, damage to buildings and equipment, rising prices for fertilizers and diesel fuel, labor shortages, blockade of Black Sea ports, and lack of electricity. The influence of the basic resources of an agribusiness enterprise (land, capital, labor, enterprise and information) on the formation of its profit is shown. On the example of the crop sector of agricultural enterprises, the main directions of increasing the productivity of agricultural land use in the war and post-war periods are indicated, where the main ones are: increasing the level of specialization of production in accordance with the conditions of the economy; increasing the productivity of the use of enterprise assets by introducing modern innovative technologies for the production of agricultural products; expanding irrigation. *Practical implications*. On the example of a dairy processing enterprise, the processes of making management decisions regarding the selection of effective products for sale on the market are demonstrated. For this purpose, the method of payment matrix with probabilistic certainty of the implementation conditions was used and the choice of the best alternative was justified. Since the conditions for the implementation of alternatives are also antipodes (alternatives), in reality there will be only one option for implementing the alternative from among those presented in the matrix. Therefore, in addition to the size of the expected result (profit), the final choice of the best alternative by the manager is significantly influenced by other factors, in particular: the presence of negative consequences of the alternative; probability of conditions with negative consequences; difference in consequences of implementing alternatives (scale of fluctuations); difference in expected consequences of implementing alternatives, etc. *Value / originality* is the proposed approaches to the development of management decisions by managers of agricultural and processing enterprises in conditions of uncertainty caused by the war.

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managerial decision-making, wartime conditions, agribusiness, payment matrix

JEL: Q10, Q12, M11, D81

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1 Introduction

Russian military aggression in Ukraine started in February 2022 significantly affected the conditions for domestic business. The purpose of this article is an attempt to investigate how the conditions of the war affected the process of making management decisions at the level of agribusiness enterprises. The war has a significant influence on the decision-making process. In this connection, there is a need to investigate certain specific aspects of decision-making by managers in agribusiness enterprises in wartime conditions. In particular, the article presents:

- the theoretical aspects of the decision-making under conditions of war;
- the impact of war on the process of making managerial decisions in agribusiness of Ukraine;
- decision-making in agribusiness enterprises through the prism of the use of basic resources: land; capital; labor; entrepreneurship, information;
- the justification of decisions regarding the choice of the direction of specialization in crop production of agrarian enterprises in the conditions of the wartime and the post-war period;
- the examples of a milk processing enterprise of selecting products for production and sale on the market under probabilistic certainty and uncertainty of conditions for the implementation of alternatives.

In general, the process of development and adoption of management decisions is the basis of the manager's activity. In a narrow sense, it is a process that begins with ascertaining and formulating a problem situation and ends with the choice of an action aimed to eliminate this problem situation. The decision-making process is a component of human mental activity and involves all aspects of this activity: psychological; the ability to take risks; perception of time; moral, value, behavioral, consciousness and subconsciousness, intuition, etc. It is clear that in the conditions of war, all these aspects acquire a slightly different color, have a slightly different focus. Based on the theoretical foundations of the management decision-making process and the factors affecting it, it can be unequivocally stated that the Russian military aggression in Ukraine, or the Russian-Ukrainian war, has a decisive influence on the management decision-making process in general, and agrarian management, in particular.

Decision-making theory describes the steps involved in making any decision, based on understanding the goals a person hopes to achieve, making a list of possible alternatives, determining the consequences for each alternative, both positive and negative, determining the desirability of each consequence, evaluating probabilities of each outcome and integration of all information. The whole process takes place in the context of a certain situation, which can affect the available decision options and their consequences. Decision-making theory provides a general descriptive

framework for explaining how people actually make decisions, what they actually do to make the best decision under existing circumstances.

In real life, people often make choices based on habit or tradition, without using the stages of decision-making described by the theory. Decisions can be made under social pressure and time constraints (for example, in war conditions), which prevents careful consideration of decision options and their consequences (Reason, 1990). When people lack sufficient information or skills, they may make sub-optimal decisions (Fischhoff, Broomell, 2020). Even when people have time and information, they often have a poor understanding of the probabilities of the consequences of the decisions made and rely more on personal experience and intuition than on information about the possible consequences of the decisions made (Calabretta, Gemser, Wijnberg, 2017; Gígalová, 2017).

The process of making managerial decisions is influenced by many different factors. The most important of them include risk and uncertainty factors, which imply that there is always a possibility of making the wrong decision, which can adversely affect the organization. Therefore, one of the most difficult stages of the decision-making process is the generation of alternatives. The main goal of this stage is to obtain a significant number of alternatives. The wider the range of alternatives worked out, the higher the probability that this set contains the best option. In order to facilitate and streamline this activity, special methods of generating alternatives are used, which have become widely used in the practice of managers, in particular, methods of justifying management decisions under the conditions of probabilistic certainty or uncertainty of generating alternative solutions (Dervishi, Kadriu, 2014; Fischhoff, Broomell, 2020; Marchau, Bloemen, Walker, Popper, 2019; McCann, 2020; Taghavifard, Khalili Damghani, Tavakkoli Moghaddam, 2009).

In the conditions of war, information about the implementation of alternatives lacks unequivocal certainty, and their reliability is limited to probabilistic indicators. In this case, statistical methods and mathematical programming methods can be used to make management decisions. Statistical methods are a type of quantitative methods for justifying management decisions based on the known consequences of the implementation of all alternatives and the probabilistic conditions for their implementation. The following are common in management practice: the payment matrix method; the "decision tree" method; correlation-regression analysis; dispersion analysis; factor analysis; cluster analysis; methods of statistical quality control.

Based on the theoretical foundations of the management decision-making process and the factors affecting it, it can be unequivocally stated that the Russian-Ukrainian war, has a decisive influence on the management decision-making process in general, and in agrarian management, in particular (Makaliuk,

Kashpurenko, Barannikov, 2023; Demianenko, Sas, 2023; Raiter, Matskiv, 2023).

Based on the above-described review of literature on the problems raised in this article, we can draw conclusions about insufficiently researched aspects of solving these problems. In particular, this concerns the implementation of alternative options for management decisions in the absence of unambiguous certainty and reliability of the initial information for the decision-making process, which is limited by probabilistic indicators in war conditions using statistical methods and mathematical programming methods. The payment matrix method used in the study belongs to such methods

The main objective of the article is to study the features of making managerial decisions in wartime. Any management decision is always based on the main contradiction of the economy – the contradiction between limited resources and unlimited needs of society in goods and services. At the enterprise level, it is a contradiction between the limited resources of the enterprise and the desire of its owners (managers) to maximize profit. And although profit maximization remains the main criterion of the company's activity even in wartime, the crisis situation in the economy requires other, intermediate goals of the company's activity. Such goals include the preservation or restoration of the company's resources – personnel, land, machinery, equipment, farm animals, logistical connections for the purchase of resources and the sale of manufactured products.

So, because of the war, the usual operational decisions of Ukrainian agricultural companies are undergoing changes. Such changes consist, first of all, with limiting use of such agricultural resources as land, capital, labor, information, diversifying business and changing sales markets. There have also been changes in the agri-food chain of added value.

2 Method

Methods includes the combinations of primary research, including interviews with agribusiness managers and industry experts, with secondary research, such as industry reports, case studies, and academic literature. Also, the use of methods of justification of decisions under probabilistic certainty and uncertainty of conditions for the implementation of alternatives by using payment matrix. By incorporating these perspectives, we provide a comprehensive analysis of the decision-making process in Ukrainian agribusiness in wartime.

In our study, we apply the payment matrix method as such, which can be used in the practice of agribusiness enterprises and show its application on the example of a milk processing enterprise. The payment matrix method allows you to choose the best alternative by comparing each of them as a function

of its consequences under different implementation conditions and the probability of these conditions occurring. The scope of application of the payment matrix – situations characterized by:

- availability of a limited number of alternatives;
- the presence of several distinct conditions under which each of the alternatives can be implemented;
- quantitative measurability of the consequences of implementing alternatives and the probability of conditions for their implementation.

The algorithm for using the payment matrix method is based on the concept of "expected result", which means the sum of the possible consequences of the implementation of a certain alternative, weighted by the probability of occurrence of conditions. For this, the following formula is used:

$$OP_i = \sum_{j=1}^n (P_j \times p_j),$$

where,

OP_i is the expected result of the i -th alternative ($i = 1, 2, \dots, m$);

P_j is the result of the implementation of the i -th alternative under the j -th conditions of its implementation ($j = 1, 2, \dots, n$);

p_j is the probability of occurrence of the j -th conditions for the implementation of the i -th alternative.

According to the results of the calculations, the alternative is chosen, the expected result of which will be the best.

3 War Influence on Ukrainian Agribusiness

The main factors affecting the war on the Ukrainian agricultural sector were the reduction of cultivated areas (by 20% compared to 2021), damage to buildings and equipment, rising prices for fertilizer and diesel fuel, and the blockade of Black Sea ports. All these factors significantly reduced the incomes of Ukrainian farmers and agricultural companies (DLF Attorneys-at-Law, 5). Table 1 shows the main problems, their impact on the activities of agribusiness enterprises, and possible management solutions to address these problems.

In the agribusiness of Ukraine an important role belongs to the field of crop production as such, which provides more than 70% of gross agricultural production and 60% of its export revenues. Therefore, the adoption of management decisions regarding the organizational restructuring of agricultural enterprises specializing in the production of plant products in the conditions of the war and the post-war period are extremely relevant. The main such solutions include the following: increasing the level of specialization of production in accordance with the conditions of the economy; increasing the productivity of the use of enterprise assets through the introduction of

TABLE 1 Wartime factors and corresponding managerial responses

Wartime factor	Impact	Managerial response
Common Wartime Factors		
The disruption of logistics chains	Sharp decline in export volumes, especially grain through seaports, and purchase prices for products	The creation of alternative routes helped increase grain exports to 1.2 million tons in April and 2.7 million tons in June 2022.
The termination of the work of buyers of agricultural products, their inability to purchase pre-war volumes or offer acceptable prices.	Inability to carry out pre-war volumes of purchases of agricultural products by wholesalers and traders	Selling the products of agricultural enterprises to processing enterprises
Mobilization, migration	Shortage of labor force	Automation; flexible work organization; attracting migrants from other countries
Crop production		
Mine-explosion contamination of land. The environmental disaster that occurred as a result of Russians blowing up the Kakhovka hydroelectric plant in Kherson region	Reduction of cultivated area, . increased content of heavy metals (arsenic, lead, copper, zinc) and residues of explosives in the soils. Reduction of irrigated land	Using crop rotation, which will ensure a combination of crops that have a beneficial effect on each other. Such an organizational system will make it possible to make the best use of the advantages of crop rotation - to reduce the amount of use of fertilizers, chemicals and fuel, to provide environmental benefits and increase economic efficiency
Low efficiency of crop production	The principle of self-sufficiency when the enterprise sought to have the entire set of crops for the purpose of self-sufficiency and diversification of production	Specialization of production creates conditions for the introduction of highly specialized innovative technologies. For examples, miniaturization of tillage operations provided the greatest economic benefit. This greatest economic benefit is achieved when the marginal cost of cultivating a hectare of crops is approximately equal to the marginal cost of production obtained from this hectare
Livestock sector		
Destruction of production facilities and infrastructure	Damage to farms, warehouses, equipment and livestock facilities	Restoration of critical facilities; relocation; diversification of production sites

Source: Author's own development

modern innovative technologies for the production of agricultural products; and expansion of irrigation. The high natural potential of Ukrainian soils in combination with modern soil cultivation technologies can ensure a high yield of agricultural crops. However, neither modern technologies in crop production (latest hybrids, varieties, equipment), nor high natural soil fertility will be able to provide an effective result in the absence of one of the main factors for obtaining high yields – the necessary amount of moisture. Based on the analysis carried out (Demianenko, Sas, Fomichov, 2024) it can be stated that the gradual climate change during the last decades (increase in average daily temperature) worsens the situation temperature regime of the soil, and a decrease in the amount of precipitation leads to a deterioration of the state of the water regime.

The best solution for eliminating the moisture deficit is the construction of an irrigation system by agricultural enterprises, which will allow not only to supply the necessary moisture, but also fertilizers dissolved in water, which will flow directly to the root system of plants.

The question of the expediency of using irrigation systems as the main technical and technological technique for reducing the risks of insufficient moisture when growing agricultural crops requires economic justifications and appropriate decisions by

managers and business owners (Demianenko, Sas, Fomichov, 2024).

Thus, economic and ecological expediency will be the main factors that will determine the directions of organizational restructuring in crop production of agrarian enterprises of Ukraine in the post-war period and will ensure the recovery and development of the domestic agricultural industry.

As for the livestock sector, a balanced approach to support the basic production of livestock products and their processing is needed here. For example, an increase in added value in Ukrainian agricultural production and export is relevant for Ukraine. After all, instead of exporting raw products (cereals and oil crops), it is better to develop, for example, livestock breeding on this basis and export dairy and meat products with high added value.

4 Main Resources Use in Agribusiness

In general, the company's profit is formed by its resources: natural (land, water, forest); capital; labor; entrepreneurship; information (Fig. 1). In turn, each resource generates its own sources of profit, which are directly related to the ownership of the corresponding resources. Thus, land resources generate income at the expense of land rent. For example, if agricultural land is

owned by a farmer, then profit is generated in the form of land rent. If a farmer rents land, he pays rent to its owner. The source that creates land rent is the natural fertility of the land (part of the humus content in it).

Capital generates profit in the form of interest for its use, and the possibility of interest is provided by the change in the value of money over time, which is affected by inflation.

Labor, as a production resource, generates profit due to the difference between the actual and potentially possible wages of employees working in the enterprise. An entrepreneur always has the opportunity to differentiate the wages of employees working for him. In turn, the source of the wage level is a person's physical and mental abilities, depending on the type of work (physical or mental). It is believed that physical labor generates a salary in the form of production costs, and mental labor – increases the company's assets. Accordingly, the salary level depends on the level of competence of the employee, which takes into account education, work experience, professional skills, abilities, etc.

The profit generated by the resource "Entrepreneurship" is associated with risk, and with risk that is not insured. The insured risk generates corresponding costs (income, in the case of an insured event). Only non-insurable risk is a source of profit from entrepreneurial activity. In addition to risk, there is another source that brings profit for this resource, and this is monopoly power. If the entrepreneur is a monopolist in a certain market, then he receives the corresponding profit from it.

And, finally, such a resource as information is also a very important source of profit generation, especially in our time, the time of the information society. Information is needed to make adequate, correct decisions and is related to relevant information sources. Information in the conditions of war acquires special importance. This is related not only to the conditions of doing business, but in general to the possibility of physical survival, especially in the front-line zone, where agribusiness continues to function. In the theory of decision-making, risk does not mean the probability of receiving a negative result, but the

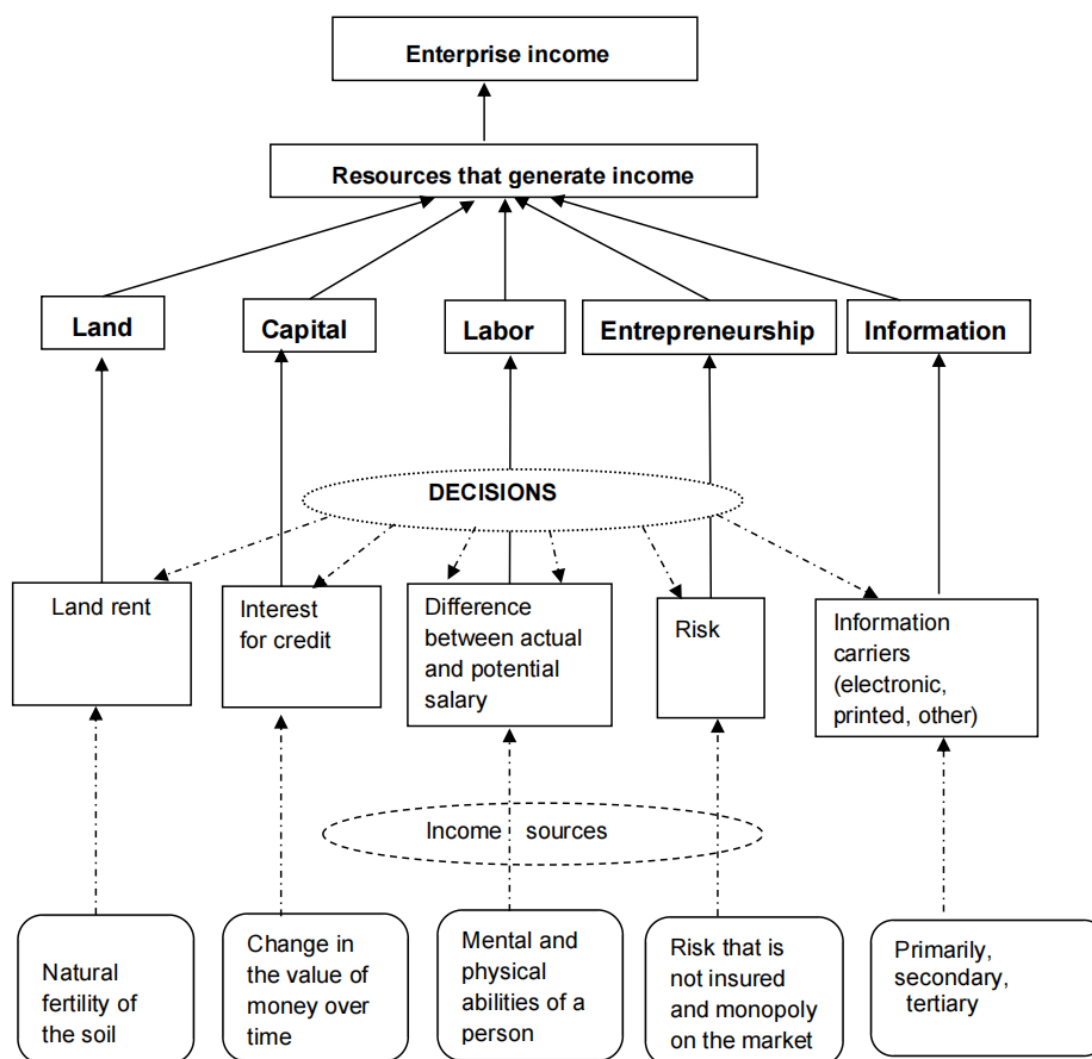


FIGURE 1 Decisions related to resource sources of enterprise income formation

Source: Author's own development

degree of awareness of the decision-maker about possible alternatives. And the greater the certainty of such information, the lower the risk when making a management decision.

5 Finding

In the decision-making process, it is important to set goals – in which direction to move. One of the tools for developing goals in management is compiling a list of goals as a means of achieving the company's strategic goals. In this regard, we will consider the use of the payment matrix in the justification of management decisions under probabilistic certainty of the conditions for the implementation of alternatives in the case of a milk processing enterprise located in the Kyiv region.

The enterprise specializes in the production of 9 types of food products and offers 39 types of dairy products on the market, in particular: sourdough – 4 items; yogurt – 7 items; kefir – 4 items; butter – 2 items; milk – 5 items; ryazhenka – 3 items; symbiomax – 5 items; sour milk cheese – 6 items; sour cream – 3 items.

In our example, the strategic task of the dairy plant is to expand the volume of production and reach new market niches. For this purpose, it was decided to increase the purchase of milk from private households. For this purpose, a corresponding list of operational goals is being developed.

Table 2 shows an example of a list of the formation of operational goals of a dairy plant with the aim of expanding the scale of production by increasing the volume of milk purchases from private households. The list of goals involves a list of specific actions to achieve the set goals, the determination of the necessary resources, and an outline of possible difficulties that may arise in the process of achieving the goals.

The enterprise decided to analyze the production of which of the three types of sour cream should be expanded:

- 21% fat sour cream packed in polystyrene cups weighing 450 g;
- 21% fat sour cream packed in polyethylene film weighing 350 g;
- 15% fat sour cream packed in polyethylene film weighing 350 g.

Each of the specified alternatives can be implemented under the following conditions:

- high level of consumer demand (the probability of the event is 0.4);
- low level of consumer demand (probability of the event is 0.6).

The expected profit levels for the month are as follows:

Sour cream with a fat content of 21% packed in polystyrene cups weighing 450 g:

- at a high level of consumer demand – profit in the amount of UAH 100,000;
- at a low level of consumer demand – profit in the amount of UAH 65,000.

Sour cream with a fat content of 21% packed in polyethylene film weighing 350 g:

- at a high level of consumer demand – profit in the amount of UAH 150,000;
- at a low level of consumer demand – profit in the amount of UAH 95,000;

Sour cream with a fat content of 15% packed in polyethylene film weighing 350;

- at a high level of consumer demand – profit in the amount of UAH 130,000;
- for low consumer demand – profit in the amount of UAH 85,000.

Using the payment matrix method, we justify the choice of the best alternative. Table 3 shows the initial conditions of the payment matrix.

The expected result for each alternative according to the entered formula is calculated as follows:

$$OP1 = 100 \times 0,4 + 65 \times 0,6 = 79 \text{ thousand UAH}$$
$$OP2 = 150 \times 0,4 + 95 \times 0,6 = 117 \text{ thousand UAH}$$
$$OP3 = 130 \times 0,4 + 85 \times 0,6 = 103 \text{ thousand UAH}$$

The expected results of the calculations are shown in Table 4. According to the results of the calculations, the

TABLE 2 Fragment of the list of goals of the dairy plant for the first quarter of 2024

No	Target	Date implementation	Amount
1	Increase the volume of milk purchases from private Companies households	15.03.2024	200 tons
	Actions:		
	1.1. Make agreements with households for the purchase of milk	10.01.2024	200 contracts
	1.2. Prepare an additional milk truck	12.01.2024	15 thousand UAH
	1.3. Organize milk collection points in populated areas	15.01.2024	50 thousand UAH
2	1.4. Open sub-accounts to pay for purchased milk	15.01.2024	200 Subcontracts
	Resources needed to achieve goals:		
	✓ additional time for staff to visit households, ✓ contract and open sub-accounts additional costs		500 man-hours 125 thousand UAH
2	Complications that may arise: Reluctance of households to sell milk at the set price		
	✓ Difficulties with organizing the opening of milk collection points		

second alternative is the best, namely the production of sour cream with a fat content of 21% packed in polyethylene film weighing 350 g, which provides the highest expected profit (117 thousand UAH).

It should be noted that the expected result will differ from the indicator that the company will actually achieve as a result of choosing one or another alternative. By weighing the consequences of alternatives according to the probabilities of the conditions under which they are achieved, a virtual (planned) result is obtained to a certain extent, which could be achieved only under circumstances when incompatible conditions for the implementation of alternatives simultaneously occur and coexist, namely, high and low levels of consumer demand.

Since the conditions for the implementation of alternatives are also antipodes (alternatives), in reality there will be only one alternative implementation option from among those presented in the matrix. Therefore, in addition to the size of the expected result, the manager's final choice of the best alternative is significantly influenced by other factors, in particular:

- the presence of negative consequences of the alternative;
- probability of conditions with negative consequences;
- difference in the consequences of implementation of alternatives (scale of fluctuations);
- difference of the expected consequences of implementation of alternatives, etc.

When choosing the degree of confidence in the results of the calculation of the expected result, the manager should remember that this is only a

mathematical compromise, which may not coincide with the real result. In this way, using the existing available means of decision-making, the managers of Ukrainian agribusiness enterprises in war conditions strive to continue and perhaps expand their business.

6 Conclusions

Decision theory is an important aspect of management science that focuses on how decisions can be made based on probabilities as well as quantitative and/or qualitative components that may impact the outcome. In the conditions of war, quick decisions based on the existing situation are often required. Along with this, decisions based on procedural reasoning and logic and computationally simulate decision-making processes also are needed. This is especially true for the justification of decisions regarding the choice of the direction of specialization in crop production and the selection of products for expanding the production of processing enterprises, investment and resource procurement in wartime.

Full-scale Russian military aggression in Ukraine significantly affected the decision-making process in agribusiness enterprises. Although profit maximization remains the main criterion of the company's activity even in wartime, the crisis situation in the economy requires other, intermediate goals of the company's activity. Such goals include: the preservation or restoration of the company's resources – personnel, land, machinery, equipment, farm animals, logistical connections for the purchase

TABLE 3 Initial conditions of the payment matrix

No	Alternatives	Expected profit at different levels of inflation (respectively, 8 and 12%), thousand hryvnias	
		The coefficient of the probable level of consumer demand	
		0,4	0,6
1	Sour cream with a fat content of 21% packed in polystyrene cups weighing 450 g	100	65
2	Sour cream with a fat content of 21%, packed in polyethylene film, weighing 350 g	150	95
3	Sour cream with a fat content of 15%, packaged in polyethylene film, weighing 350 g	130	85

TABLE 4 Expected results of possible solutions

No	Alternatives	Expected profit at Different levels of inflation(respectively, 8 and 12%) , thousand hryvnias		Expected result OPi, thousand hryvnias
		The coefficient of the probable level of consumer demand		
		0,4	0,6	
1	Sour cream with a fat content of 21% packed in polystyrene cups weighing 450 g	100	65	79
2	Sour cream with a fat content of 21%, packed in polyethylene film, weighing 350 g	150	95	117
3	Sour cream with a fat content of 15%, packaged in polyethylene film, weighing 350 g	130	85	103

of resources and the sale of manufactured products; operational decisions; organizational restructuring of agricultural enterprises.

In the decision-making process, it is important to set goals – in which direction to move. On the examples of a crop production industry and dairy plant the process of setting goals and justifying the decision regarding the choice of production of a certain type of product under probabilistic certainty and uncertainty are considered.

To substantiate effective decisions, the adoption of management decisions using a payment matrix is demonstrated using the example of a dairy plant, with the help of which the best solution is selected among possible alternatives. In our example, the production of sour cream with a fat content of 21% packed in polyethylene film weighing 350 g, will provide the highest expected profit.

The scientific novelty of the research is the proposed approaches to the development of management

decisions by managers of agricultural and processing enterprises in conditions of uncertainty caused by the war. One of such approaches is the use of a payment matrix to justify the choice of the best alternative from a possible list, which ensures the highest efficiency of the results of the adopted decision.

As for further research into managerial decision-making under conditions of war (uncertainty), a promising direction may be the use of quantitative methods of substantiating decisions under uncertain conditions of alternative implementation, in particular methods of statistical decision theory using the criteria of pessimism, optimism, Laplace, and others.

The considered processes of decision-making in agribusiness enterprises in the conditions of war are characteristic not only for enterprises of the agribusiness industry, but also for enterprises of other branches of the economy, taking into account the specifics of these branches and in this connection the are good perspectives for a further research.

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