

## THE STUDY OF THE SENSITIVITY OF RESOURCE POTENTIAL MANAGEMENT TO CHANGES IN UNCONTROLLED PRODUCTION PARAMETERS

## ДОСЛІДЖЕННЯ ЧУТЛИВОСТІ УПРАВЛІННЯ РЕСУРСНИМ ПОТЕНЦІАЛОМ ДО ЗМІНИ НЕРЕГУЛЮВАНИХ ПАРАМЕТРІВ ВИРОБНИЦТВА

*The sensitivity of the economic model of the optimal resource potential management plan to changes in the regulated parameters of the economic model of the agricultural enterprise was analyzed; significant of which are considered to be the direct production costs as an indicator of management responsibility to changes in the cost of process parameters; and the indicator of technological rigidity, as an indicator of management adaptation initiatives in the course of technological processes planning and adaptation to natural conditions. It is established that predicting probable changes makes it possible to program the measures for support of the accepted mode of resource use with the help of investment conditions creation to support the economic model of the agrarian enterprise. Moreover, using the model of effective changes dynamic programming in the course of resource potential management allows us to assess both quantitative and qualitative changes. It is substantiated that the system of resource potential management should be based on the principles of adaptive technological solutions taking into account the extensive financial stability, and the main tool for ensuring constant performance should be technological policy. The conditions for the basic performance maintenance as well as the stability of the model in macroeconomic conditions are determined. It is proposed to use the sensitivity analysis of the economic model of the optimal plan to determine the effectiveness of the resource potential management system.*

**Keywords:** management, resource potential, sensitivity analysis, economic model, controlled parameters, resource use mode.

*Проаналізовано чутливість економічної моделі плану управління оптимальним ресурсним потенціалом до зміни регламентованих параметрів економічної моделі сільськогосподарського підприємства; суттєвими з яких вважаються прямі виробничі витрати як показник реагування менеджменту зміну вартісних параметрів процесу; показник жорсткості технології як показник управлінської адаптаційної ініціативи при плануванні технологічних процесів та адаптації до природних умов. Встановлено, що прогнозування можливих змін дозволяє запрограмувати заходи щодо підтримки ухваленого режиму використання ресурсів за допомогою створення інвестиційних умов для підтримки економічної моделі аграрного підприємства. Понад те, використання моделі динамічного програмування ефективних змін у процесі управління ресурсним потенціалом дозволяє оцінити як кількісні, і якісні зміни. Обґрунтовано, що система управління ресурсним потенціалом має будуватися на принципах адаптивних технологічних рішень з урахуванням екстенсивної фінансової стійкості, а основним інструментом забезпечення постійної результативності має бути технологічна політика. Визначено умови підтримки базової працездатності та стійкості моделі в макроекономічних умовах. Пропонується використовувати аналіз чутливості економічної моделі оптимального плану визначення ефективності системи управління ресурсним потенціалом.*

**Ключові слова:** управління, ресурсний потенціал, аналіз чутливості, економічна модель, контрольовані параметри, режим використання ресурсів.

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**The setting of the problem in general.** An agricultural enterprise does not operate in a static environment. The processes that take place both outside and inside of the enterprise in a system of consistent interaction have a significant impact on the final result. In this case, the essential task of management is to identify the overt and covert influences to predict the actual performance in order to plan the sustainable development of the production system. One of the popular methods of systems research is an experiment, which considering the conditions of the economic system and long-term production cycle, is too expensive a research method. A good alternative, in this case, is modeling that helps determine the sensitivity of the economic model.

The idea of modeling is to replace the object under study with its analog. The mathematical models formalize the patterns of object dynamics in the form of numerical relations. Reasonable decisions are formed based on the model. The sensitivity analysis of models is a process implemented after obtaining

the optimal solution. This analysis reveals the sensitivity of the optimal solution to certain changes in the original model.

To ensure the effectiveness of resource potential management, it is important to determine the threshold of sustainability of the optimal plan and the critical conditions for making changes in the financial and economic model of the project.

**Analysis of recent research and publications.** The problem of forming the ways to manage the resources of the enterprise in the process of economic activity organization effectively has been studied by such well-known economists as Andriichuk V.H., Haidutskyi P.I., Krystalnyi O.V., Mesel-Veseliak V.Ya., Paskhaver B.Y., Sabluk P.T., Stelmashchuk A.M., Trehobchuk V.M., and others.

The influence of the system of factors on the efficiency of resource potential management and efficiency of economic management was investigated by Vyshnevskya O.M. [12], Yermakov O.Yu. [13], Pidlisetskyi H.M. [4], Piniaha N.O. [5], Sakun A.Zh. [7], Tarasiuk H.M. [11], Shebanin V.S. [9], Shchyhol T.P.

[8]. However, the quantitative calculation of this impact remains unresearched due to the multifaceted process of factors changing.

**The purpose of the article.** The article aims to study the sensitivity of the optimal resource potential management plan to changes in controlled production parameters.

**The presentation of the primary material.** Given the conclusions on the presence of regulated and unregulated factors in forming the agricultural resources use efficiency, it will be appropriate to model the behavior of these factors to predict the sustainability of optimal models for implementation of the resource potential of agricultural land in the current economic management.

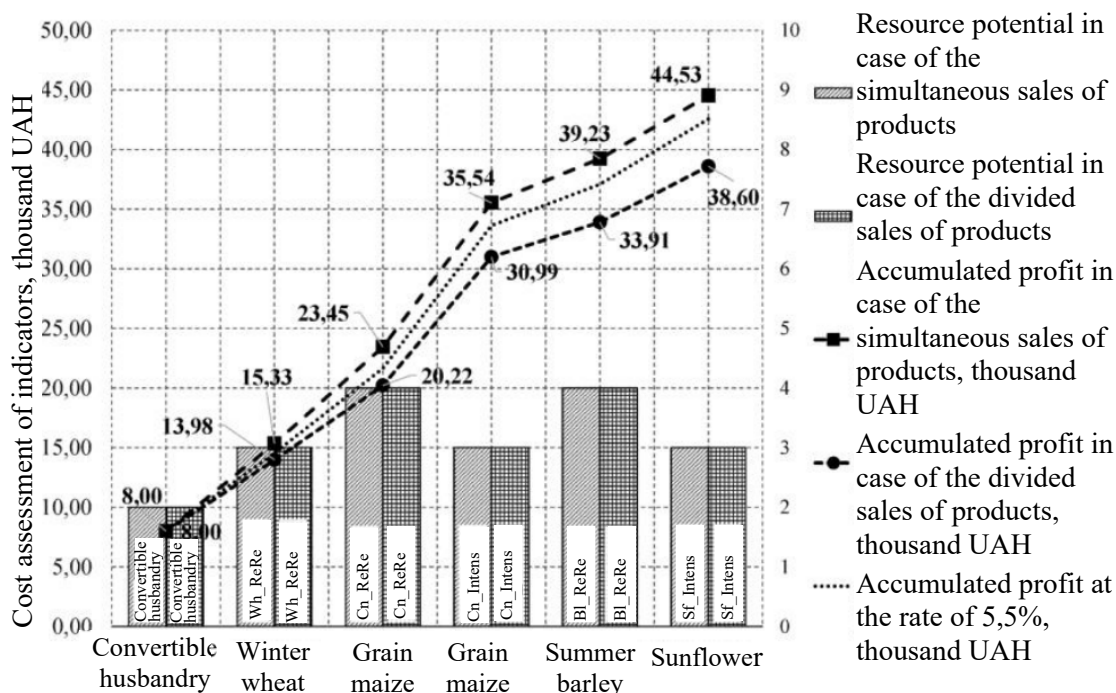
The basis makes up the availability of circumstances within the influence of agricultural enterprises, i.e., the study of performance factors will be considered both favorable and unfavorable trends of microeconomic conditions. We will pay attention to the change of the factors which can be influenced under counteraction. For example, developing an unfortunate trend and increasing direct production costs will obviously lead to losses in the agricultural enterprise. The issue is only in the severity of the damage. In contrast, the research on the possibility of costs decreasing in case of an unfavorable trend is more useful because it determines the impact of technological policy on agricultural enterprises' sustainability of resource use. Therefore, the assessment of the vehicle of change in the optimal land-use plan in counteraction is expedient.

The optimal plan developed by the dynamic modeling method has a significant advantage compared to other approaches, considering the ability to adapt to changing conditions. So as the next step, we will pay attention to the possibility of the financial and economic result predicting as an indicator of the effectiveness of the resource potential implementation. This target is to be fulfilled by means of the two-parameter analysis of the optimal plan sensitivity of the agricultural resource potential management model.

The main parameter for the simulation of conditions changes experiment, which is proposed to be researched to observe the time specificity of the activity, is the principle of implementation, namely one-stage (i.e., implementation "from the field") and divided (implementation in time lag). The second parameter will be changed during the performance of the experiment.

Intensive farmery is largely dependent on a significant number of resources involved, resulting from other enterprises' activities. Therefore, an essential factor for the effective implementation of the resource potential is the ability to create the appropriate technological conditions to implement the production process with the appropriate cost to ensure the appropriate efficiency. Therefore, the first parameter of the simulation experiment is the direct production costs, the change of which within 10% is proposed to be analyzed.

Figure 1 demonstrates the results of a two-parameter sensitivity analysis of the resource potential



**Figure 1. Diagram of the change modeling of the optimal plan for managing the resource potential of the agricultural enterprise in terms of direct production costs increasing by 10%**

Source: developed by the author

management model with a probable increase of direct production costs by 10%.

Thus, the basic optimal plan for the use of technological solutions will be consistent with the increase of direct production costs by 10%, both in the case of simultaneous and in the case of divided sales of products. However, these changes lead to a loss of financial and economic performance as an indicator of the potential implementation effectiveness. Thus, an increase of direct production costs by 10% will reduce profits by 8.17% in case of simultaneous sales of products and by 9.24% – in case of the divided sales.

We would also like to add that, guided by indicators of financial and economic performance with a divided sale of products, it is possible to maintain the efficiency of resource management by reducing the discount rate to 5.5%, which is 2.5% less than the current (8%). This indicator is a kind of rate that helps to maintain the effectiveness of the basic plan.

In case of production expenses increase by 10%, the profitability preservation of the accepted plan of resource potential management is possible, providing the reduction of a discount rate by 2,5%, or by 5,5%.

Figure 2 demonstrates the results of a two-parameter sensitivity analysis of the resource potential management model with a probable reduction of direct production costs by 10%.

Summarizing the obtained data on the optimal plan for resource potential management in terms of direct production costs reduced by 10%, we would like to note that in case of simultaneous as well as

in case of divided sales of products, there should be some restructuring for the plan to remain optimal. The main changes in the simultaneous principle of sales of products occur: at the stage of the second cultivation of grain maize, there is a replacement of the intensive type of resource use to resource-saving one and at the stage of summer barley growing, there is a replacement of resource-restoration practice to resource-saving. Reducing costs makes it possible to find an opportunity to increase the resource potential to the highest level and maintain it at an earlier stage, reducing the contribution of other crops. These changes lead to an increase in financial and economic performance as an indicator of capacity effectiveness. Thus, reducing direct production costs by 10% will increase the profits by 8.29% in case of simultaneous sales of products and by 9.33% – in case of the divided principle.

We would also like to note that, guided by indicators of financial and economic performance in case of a divided sales of products, these conditions can be considered as basic for increasing the financial stability of the optimal plan, i.e., in terms of production costs reducing by 10%, the optimal strategy (its effectiveness) can comprise a discount rate of 2.55%, or up to 10.55%. In this case, the rate of maintaining the effectiveness of the basic plan is 10.55%.

The research on the means of technologies adapting to the existing agroclimatic conditions has a significant potential to increase the efficiency of resource management of agricultural enterprises by increasing the financial and economic efficiency while

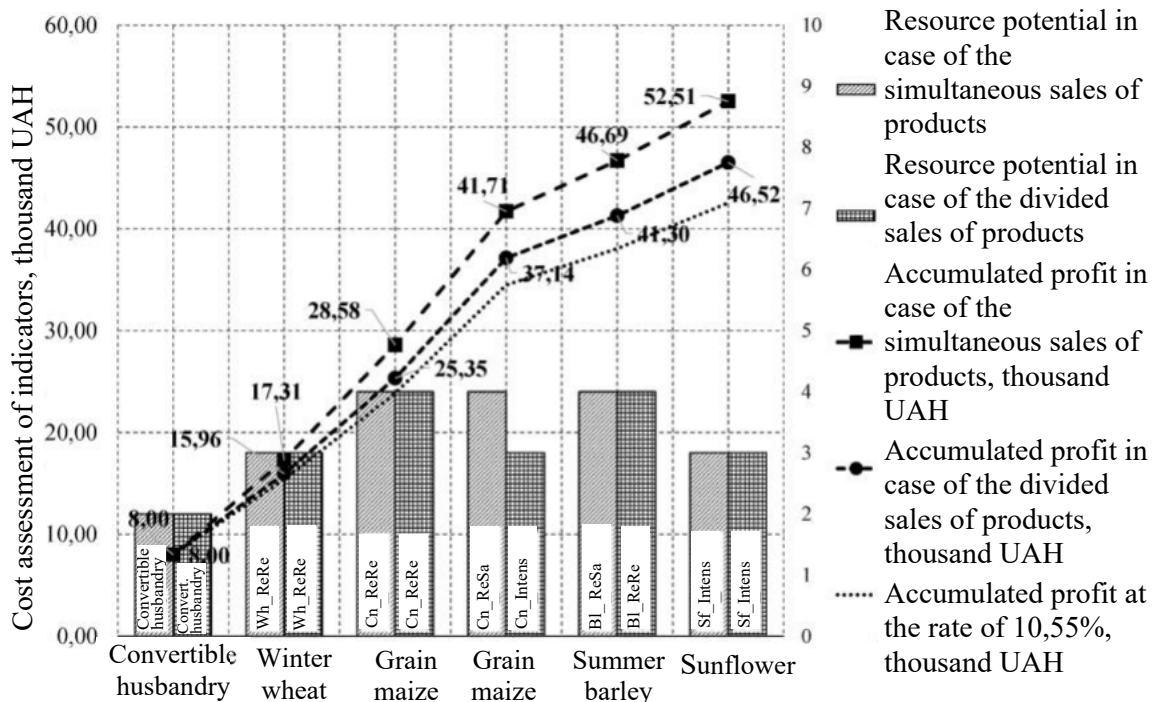


Figure 2. Diagram of the change modeling of the optimal plan for managing the resource potential of the agricultural enterprise in terms of direct production costs decreasing by 10%

Source: developed by the author

maintaining an acceptable level of resource use. For example, long-term climate predictions indicate an increase in agroclimatic resources in the Luhansk region, which will significantly affect the performance of agricultural enterprises. We change the technological load to obtain a given volume of agricultural products. Therefore, the following parameter of the simulation experiment is the level of technological pressure, the change of which is proposed to be analyzed within one level.

Figure 3 demonstrates the results of a two-parameter sensitivity analysis of the resource potential management model with a probable decrease of the technology pressure intensity by 1 point.

According to the modeling results of the conditions for a decrease of the technology pressure intensity by 1 point, i.e., providing the conditions to increase the contribution to support the resource potential, other conditions being equal, ensure the acceptability of intensive resource use at all stages of crop rotation. The only exception is the cultivation of winter wheat, which is carried out with the help of the resource-restoration type of technology necessary to raise the resource potential to the highest level.

These conditions provide the highest dynamics of financial and economic results formation: a decrease of the technology pressure intensity by 1 point will increase profits by 57.39% in terms of simultaneous sales of products and by 62.87% – in the case of the divided sales.

These conditions can be considered basic for increasing the financial stability of the optimal plan, i.e.,

in terms of decreasing the technology pressure intensity by 1 point, the optimal strategy (its effectiveness) can comprise an increase in the discount rate by 13.93%. That is, in this case, the rate of maintaining the effectiveness of the basic plan is 21.93%.

Figure 4 demonstrates the results of a two-parameter sensitivity analysis of the resource potential management model with a probable increase of the technology pressure intensity by 1 point.

Summarizing the results, we would like to note that an increase in the technological load of the resource potential of the agricultural enterprise for various reasons will lead to a crisis situation.

These circumstances lead to a loss of financial and economic performance as an indicator of the potential implementation effectiveness: an increase in the negative impact of technology pressure intensity by 1 point will lead to a critical decrease in profit by 70.26% in terms of simultaneous sales of products, and by 73.18% – in case of the divided sales.

These circumstances make it impossible for the basic model of resource management to maintain the basic level of financial and economic performance. The marginal profitability of the model at a discount rate of 0% is 14.42 thousand UAH, which is 66.11% less than the profit of the basic optimal plan.

To improve the situation regarding the technological structure of the optimal plan, it is proposed to prioritize the use of resource-restoration technologies to maintain an acceptable level of resource potential. However, they are insufficient, so the proposed planning algorithm focuses on at least minimal

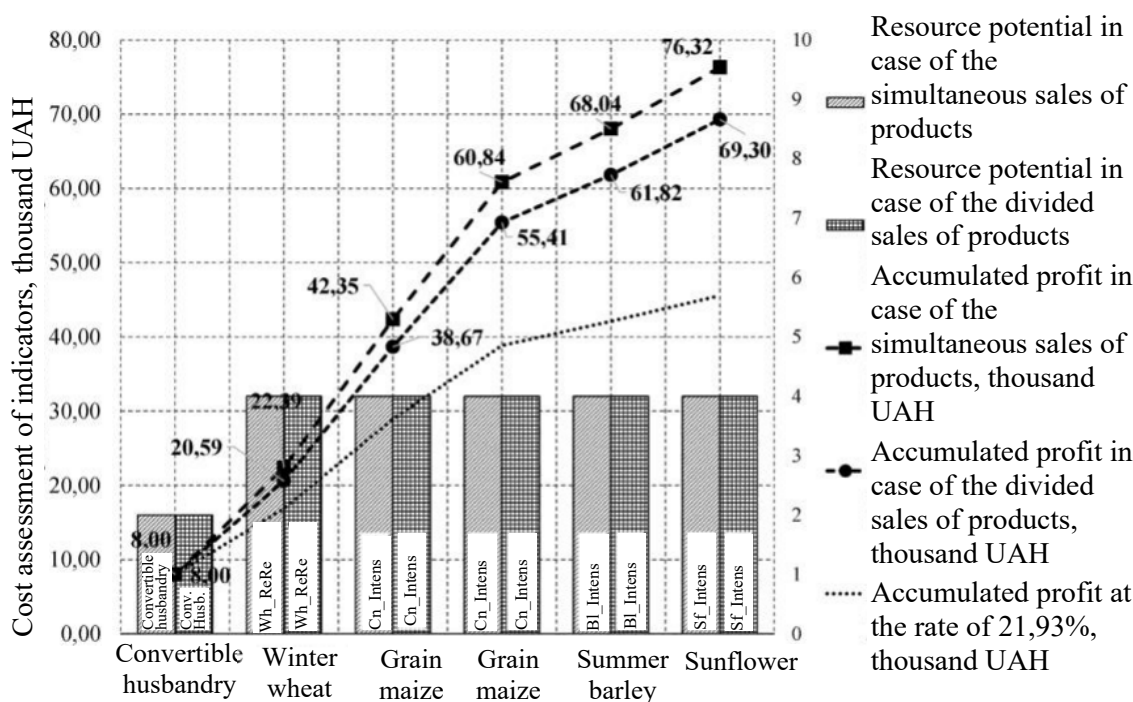


Figure 3. Diagram of the change modeling of the optimal plan for managing the resource potential of the agricultural enterprise in terms of decrease of the technology pressure intensity by 1 point

Source: developed by the author

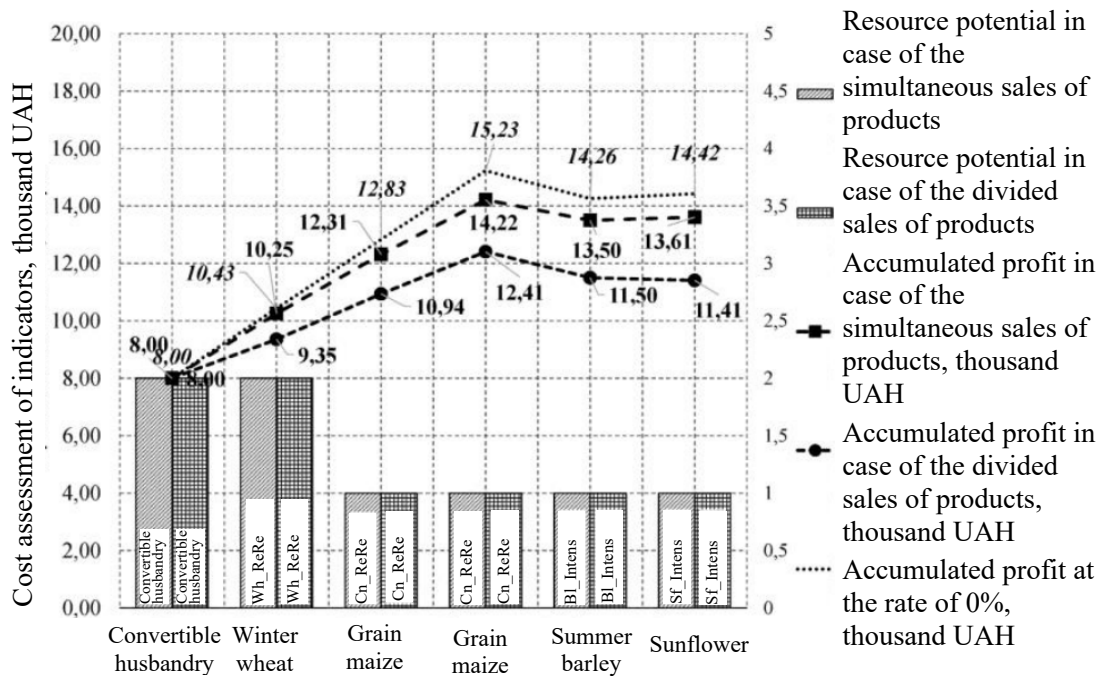


Figure 4. Diagram of the change modeling of the optimal plan for managing the resource potential of the agricultural enterprise in terms of increase of the negative impact of technology pressure intensity by 1 point

Source: developed by the author

profitability. Thus, the increase in technological load is a condition for developing the crisis in the resource potential management at the end of the period.

Thus, the internal leverages of the resource use intensity regulation have a significant impact on the effectiveness of resource management of agricultural enterprises.

**Conclusions and suggestions.** The sensitivity of the economic model of the optimal resource potential management plan to changes in the regulated parameters of the economic model of the agricultural enterprise was analyzed; significant of which are considered to be the direct production costs as an indicator of management responsivity to changes in the cost of process parameters; and the indicator of technology rigidity, as an indicator of management adaptation initiatives in the course of technological processes planning and adaptation to natural conditions.

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It is substantiated that the system of resource potential management should be based on the principles of adaptive technological solutions taking

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The conditions for the basic performance maintenance as well as the stability of the model in macroeconomic conditions are determined.

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