Model for assessing personnel security of enterprises in the agro-industrial complex

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Abstract. The article briefly examines the models and methods for assessing personnel security, highlighting their shortcomings. For enterprises of the agro-industrial complex, an additive-multiplicative assessment model has been developed. The factors influencing the personnel security of the agro-industrial complex enterprises, as well as the indicators of their assessment, are revealed. Distribution of factors is carried out according to two components of the model - additive and multiplicative.

1. Introduction

The agro-industrial complex (AIC) plays a particularly important social role, solving food supply issues, providing employment and incomes for the population of agricultural regions, preserving the settlement system. Enterprises employed in the agro-industrial complex are backbone and ensure the economic security of the territories. One of the key socio-economic problems of such enterprises is their sustainable operation [1], which is largely due to the existing level of economic security. Sustainable development of enterprises is recognized as a priority by the entire world community [2].

One of the main elements of economic security can be considered personnel security [3], closely related to the subsystem of personnel management. Currently, there is an increase in the number of economic crimes, most of which are committed by employees of enterprises. That is why the issue of forming an effective mechanism for ensuring personnel security that can optimize the management of corporate resources and ensure stable operation is urgent for enterprise managers [4-5].

It should be noted that the development of an effective mechanism for ensuring personnel security is impossible without a preliminary assessment of its current level. At the same time, a universal and adaptive methodology for assessing personnel security by specialists has not yet been developed [6-8].

The purpose of the study is to develop a model for assessing the personnel security of enterprises in the agro-industrial complex based on an additive-multiplicative model.

2. Materials and methods

The methodological basis for writing an article is a set of methods and techniques of scientific knowledge - a systemic and integrated approach, as well as a scientific analysis and method of groupings (in the study of the composition of factors that affect personnel security); quantitative and qualitative analysis (when interpreting the empirical assessment of the influence of factors on the level of personnel security); method of expert assessments (when determining the composition of factors and their weight).
The sources of information were the works of domestic and foreign scientists, materials from periodicals, Internet resources, as well as the results of their own research.

3. Results

HR security is a state of the internal environment of the enterprise, in which all negative impacts from the employees of the enterprise are minimized.

In our opinion, when assessing the level of personnel security, one should take into account not only certain results, but also the factors of its formation and development. Thus, in the developed model for assessing personnel security, it is necessary to provide for the calculation of an integral indicator, as well as reflect the influence of factors that determined a particular level of security.

In the modern scientific world, a number of researchers offer various models and methods for assessing personnel security, and each of them has certain disadvantages [9]. Thus, additive models are designed for the meaningful homogeneity of factors, which is unacceptable for heterogeneous factors that affect the level of personnel security. Comparative models involve the mandatory assessment of competing enterprises or the derivation of some benchmark result. Qualitative methods require a very large amount of information, which is often unavailable under conditions of uncertainty in the external environment [10]. Indicator approaches require clear justification of threshold values [11]. It is believed that the most accurate assessment is given by statistical research methods, but they can only be used if there is complete and reliable information [12].

Thus, taking into account the shortcomings of existing methods for assessing personnel security, the authors presented an additive-multiplicative model that allows taking into account the nature of the influence of personnel security elements - additive or multiplicative. In principle, the model can be used by enterprises in any field of activity. A necessary condition for this will be the correction of influencing factors, taking into account the state of the external and internal environment of the enterprise.

Multilevel sets of personnel security factors (indicators, criteria, indicators) are sufficiently represented in the studies of domestic and foreign scientists. For agro-industrial complex enterprises, the choice of personnel security factors was made by the method of expert assessments based on the analysis of existing approaches.

All significant factors of personnel security of agricultural enterprises should be reflected in different ways in the assessment model. Some of the factors are included in the additive component of the model, taking into account the weighting factors. It should be noted that the use of weighting factors for factors of the multiplicative part is incorrect. And the factors influencing the additive elements are included in the multiplicative component of the model.

A certain difficulty is the distribution of personnel security factors by the components of the model, as well as the selection of the indicator for assessing each factor. A prerequisite for the correctness of the proposed model is a single simulative or de-simulative character of the indicators. To comply with this condition, a certain transformation of indicators may be required, which will exclude the likelihood of deformation of the model and the value of the integral indicator of personnel security.

The difficulty of quantifying some indicators can also present a problem that can be solved by resorting to the method of expert judgment.

Table 1 shows the factors of influence on the personnel security of agricultural enterprises, which are proposed to be included in the multiplicative component of the assessment model. For the multiplicative component of the model, it is advisable to use a single-level set of factors.

For the additive component of the personnel security assessment model, a two-level set of factors is proposed (table 2).

Thus, all the selected factors of influence on the personnel security of agricultural enterprises are stimulants and ensure the correct functioning of the additive-multiplicative assessment model.

Obviously, the proposed factors are not the only possible ones; the correction of their composition is carried out at each specific enterprise and depends on a number of conditions (resources, opportunities, activities, industry, personnel characteristics, etc.) [13]. To assess the influence of those
factors where certain quantitative analytical indicators cannot be used, a point scale of measurement should be used. The influence of such factors can be assessed by the scoring method of range or qualitative comparison or by the expert method.

Table 1. Factors of influence on personnel security included in the multiplicative component of the assessment model.

| Factors                        | Assessment method | Designations |
|--------------------------------|-------------------|--------------|
| Quality of management          | \( \frac{P_f}{P_p} \) | \( P_p \) – is the planned profit of the enterprise; \( P_f \) – the actual indicator of the company's profit; \( MC_p \) – is the planned value of management costs; \( MC_f \) – is the actual cost of management. |
| Compliance of personnel with the needs of the enterprise | \( 1 - \frac{q_f}{q_n} \) \( \sigma \) | \( q_f \) – is the actual number of employees in a particular position; \( q_n \) – is the estimated number of employees in a particular position; \( \sigma \) – is the standard deviation. |
| Loss of skilled workers        | \( \frac{W_e \times R_c}{W_e \times R_e} \) | \( W_e \) – is the average monthly salary of competitors in the labor market; \( R_c \) – coefficient of regularity of payment of wages by competitors; \( W_e \) – is the average monthly wage at the analyzed enterprise; \( R_e \) – coefficient of regularity of payment of wages at the analyzed enterprise. |

Table 2. Factors of influence on personnel security included in the additive component of the assessment model.

| Factors                        | Indicators                  | Method of assessment | Legend                                      |
|--------------------------------|-----------------------------|----------------------|---------------------------------------------|
| Staff composition and movement | Constancy coefficient       | \( \frac{P_y}{P_a} \) | \( P_y \) – is the number of employees who worked in full during the analyzed period; \( P_a \) – is the average number of the personal. |
| Qualification factor           |                             | \( \frac{Q_q}{Q_a} \) | \( Q_q \) – average work experience in the specialty; \( Q_a \) – the average level of the required work experience in the specialty. |
| Working conditions             | The rate of loss of working time due to injuries and morbidity | \( \frac{D - D_d}{D} \) | \( D \) – is the number of days worked by all employees per year; \( D_d \) – the number of days of incapacity for work of all personnel due to injury and illness. |
| Loyalty level of staff         |                             | \( \frac{P_p}{P_{ow}} \) | \( P_p \) – average number of personnel; \( P_{ow} \) – the number of those who quit voluntarily during the analyzed period. |
| Theft of material and information resources |                             | \( \frac{P}{T_c} \) | \( P \) – average number of personnel; \( T_c \) – the number of cases of theft of material and information resources. |
| Labor productivity            |                             | \( \frac{RFS}{WTF} \) | \( RFS \) – revenues from sales; \( WTF \) – staff working time fund. |
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Obviously, the proposed factors are not the only possible ones; the correction of their composition is carried out at each specific enterprise and depends on a number of conditions (resources, opportunities, activities, industry, personnel characteristics, etc.) [13]. To assess the influence of those factors where certain quantitative analytical indicators cannot be used, a point scale of measurement should be used. The influence of such factors can be assessed by the scoring method of range or qualitative comparison or by the expert method.

Formalized representation of an additive-multiplicative model for assessing the level of personnel security:

\[
IR = \prod_{r=1}^{n} f_r \times \sum_{j=1}^{t} f_i 
\]

Where IR – is the integral resulting indicator of the personnel security of the enterprise;

\( f \) – assessment of the factor's influence on personnel security;

\( n \) – is the number of factors that have a multiplicative effect on personnel security;

\( t \) – is the number of factors that have an additive effect on personnel security.

4. Discussion

Preliminarily, it is necessary to calculate the coefficients of the significance of the personnel security indicators included in the additive component of the model, resorting to the help of experts and using the method of pair wise comparison, which gives a more balanced result. It is advisable to determine the coefficient of significance in each specific case, since its values can undergo significant changes under the influence of factors of the internal and external environment of the enterprise.

One of the most difficult moments in the application of the additive-multiplicative model for assessing the personnel security of agro-industrial complex enterprises is the incomparability and different dimensions of the range of evaluated factors, which cannot be leveled even using the weighting factors. An important issue is the interpretation of the results obtained, which involves the study of the range of assessment of the intensity of the influence of each of the factors involved in the model. For this, it is proposed to determine the minimum (deterministic or reliable), maximum and average value of each of the indicators, and on this basis determine, respectively, the minimum, maximum and average value of the integral resulting indicator of the personnel security of the enterprise. The maximum and minimum values of the integral resulting indicator are calculated, respectively, based on similar values for each indicator included in the model.

As a result of the assessment, the relative range of the integral resulting indicator can be quite large, which is normal for multiplicative models. The traditional way to reduce the range of any indicator is logarithm, which makes it possible to move from the values of the indicator to the degree of the base of the logarithm and significantly reduce the range of variation.

5. Conclusion

Personnel security is one of the main elements of the economic security of enterprises. Various models and methods have been developed to assess the level of personnel security, but there is no universal methodology that can be adapted for use in most enterprises.

The authors have proposed an additive-multiplicative model for assessing the personnel security of agricultural enterprises, with the help of which it is possible to obtain a quantitative assessment of the existing level in the form of an integral resulting indicator. The result obtained in the assessment process can become the basis for making management decisions in the formation of a mechanism for ensuring personnel security at the enterprise.

On the basis of a survey of heads of agro-industrial complex enterprises, the factors influencing personnel security, as well as indicators of their assessment, were selected. For enterprises in this area,
only quantitative indicators have been selected, which increases the objectivity of the assessment. If it is impossible to use quantitative indicators (for example, for enterprises in the service sector), you can enter qualitative indicators into the model by setting the appropriate scales.

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