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ARTIFICIAL INTELLIGENCE TOOLS FOR MANAGING THE BEHAVIOR OF ECONOMIC AGENTS AT MICRO LEVEL

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In modern business conditions, effective management of employee behavior is becoming a critical factor in ensuring competitive advantages and development of enterprises. AI tools, which are rapidly developing, provide new opportunities for managing the behavior of economic agents at the micro level and increasing the productivity of companies. To make the most effective use of AI in the outlined processes, there is a need to conduct research into the areas and possibilities of their application and impact on enterprise personnel.

The methodology and mathematical model developed in the article, based on the use of theories of fuzzy sets, neural networks and Lefebvre reflexive control, allow to study the potential and prospects for using AI tools (on an example of SAP SuccessFactors) in managing the behavior of economic agents at the micro level, in particular in predicting the efficiency of employees at enterprise.

It was concluded that the SAP SuccessFactors can evaluate the effectiveness of various personnel groups differently. This may occur due to insufficient adaptation of the models to the specifics of work and personal characteristics of employees of different productivity levels. Therefore, when using AI tools in the management of personnel behavior, it is important to consider such features and make individual settings for different groups of employee performance. This is a key aspect to avoid wrong management decisions that can affect the economic efficiency of the enterprise.

Keywords: *artificial intelligence, reflexive choice, employee behavior, managing the behavior, economic agent, micro level*

JEL Classification: C02, C45, C81, D01, D03

Introduction

Modern enterprises are being transformed in accordance with the rapid technological development within the framework of the formation of Industry 4.0 [1]. These changes transfer all aspects of business activity into the digital space, which not only adds value to products and services, but also requires intensive interactions between economic agents, such as enterprise personnel and counterparties at the micro and macro level [2].

The modern business landscape is becoming more dynamic and complex, which requires revision and improvement of personnel management mechanisms at enterprises. In this context, it is important to consider the growing popularity of systems that use the results of data analysis and intelligent technologies to form reflexive influences on agents in the digital space. They are designed to increase the productivity and adaptability of enterprises in the digital environment.

These innovative artificial intelligence (AI) systems not only help to manage effectively, but also contribute to stability in the digital landscape. At the same time, such systems are not direct tools of influence or manipulation but provide means for analyzing data and implementing reflexive approaches, contributing to improving the quality of management and achieving success in the era of digital transformation.

An important aspect in this context is considering the risks of the development of surveillance (digital) capitalism [3], which substantiates the relevance of studying the influence of the use of AI tools on the processes of human resource management in various socio-economic systems and, in particular, at enterprises [4].

In such conditions, effective management of human resources and analysis of employee behavior become critically important factors for achieving competitive advantages and ensuring sustainable development of enterprises. Improving the efficiency of personnel management and the ability to adapt to changes in the business environment are currently mandatory prerequisites for the successful operation of organizations in the modern world. Thus, in modern conditions, human resources management is becoming an increasingly

difficult task, for the solution of which enterprises are looking for innovative approaches.

According to a survey by Forbes Advisor [5], artificial intelligence is used or planned to be used in various aspects of business management. The survey results indicate that businesses are using artificial intelligence to solve customer service tasks, customer relationship management (CRM), improve the customer experience through personalized services, instant messaging and personalized advertising, improve internal business processes, and more. Although there are concerns such as dependence on technology and potential workforce reductions, most business owners foresee a positive impact from the adoption of AI. So, it is safe to say that modern systems in enterprises are becoming more intelligent thanks to the integration of artificial intelligence, which allows to significantly improve enterprise management, increase productivity and reduce costs [6].

The given statistical data reflect the fact that such systems have become an integral part of strategic planning and business management for many companies and enterprises, in particular, in human resources management. Such systems are gaining popularity due to their ability to automate and optimize operations, which leads to increased competitiveness and profits of enterprises.

Therefore, the study of the use of AI in solving personnel management tasks not only answers current questions, but also offers a new approach to solving a number of related tasks. In particular, it allows to find out how AI can contribute to improving the effectiveness of decisions on personnel management and employee development to increase their professional competence and promote development [7].

Therefore, consideration of the key aspects of the impact of AI on the field of personnel management is relevant and timely. In addition, an important task is to investigate the effectiveness of using AI-based tools for personnel management and forecasting relevant key indicators within the framework of the application of modern technology to ensure the strategic development of enterprises and increase competitiveness through the support and development of employees [8].

Literature review

In modern conditions, effective personnel management becomes a key factor for the success of the economic growth of the enterprise. For this reason, scientists, economists and business analysts are making efforts to develop modern tools that help to effectively manage the personnel of companies and optimize the work of employees. The digitization of all enterprise processes and the increase in the amount of data used actualize the integration of artificial intelligence into the relevant software, and scientists, in turn, investigate its effectiveness in the real conditions of using such tools at enterprises.

In particular, leading scientists such as Zuboff [3, 9], Crawford [10], Kidd and Birhane [11] etc. are actively investigating the impact of digitalization, including the use of AI tools, on the processes of managing the behavior of economic agents and the economic results of such influence. In their scientific works, they note the need to use artificial intelligence in the field of human resources management in order to improve its efficiency and quality.

Yawalkar [12], who is known for his work on labor in the digital economy, can be noted among scientists researching the topic of using artificial intelligence in personnel management. Cappelli, Tambe and Yakubovich [13] investigated the gap between perspectives and reality in the process of using artificial intelligence tools in human resource management.

Indeed, there are a number of different points of view regarding the use of artificial intelligence in HR. Some researchers criticize the use of employees' personal data by such systems. At the same time, there are studies outlining the prospects for the development of this technology, which are worth considering. In particular, the use of artificial intelligence tools allows enterprises to make more objective and quick decisions regarding personnel management, which helps to increase the efficiency of management and achieve strategic goals. Personalized employee experiences powered by AI can improve employee satisfaction and motivation and provide greater agility to changes in market conditions. Forecasting and planning the enterprise development strategies are becoming more accurate thanks to data

analysis using AI, which allows enterprises to manage their personnel and resources more effectively.

In the work [14], the authors Ledro, Nosella and Dalla Pozza investigate the ethical challenges associated with the use of artificial intelligence in CRM systems. The authors single out such aspects as discrimination, violation of privacy and unjustified interference in personal space as potential problems in the process of applying artificial intelligence in personnel management. Ethical issues related to possible unauthorized access to personal data in CRM and ERP-systems, which may cause the risk of fraud or illegal use, are also being investigated.

Despite a significant amount of research, scientists have not yet reached a consensus regarding the feasibility and effectiveness of using AI tools in the field of personnel management. This uncertainty is complicated by the large number of available AI tools, which is growing rapidly over time.

Indeed, on the modern market there is a wide range of IT tools for personnel management. In particular, Resume Matcher, Skillaz, TalentTech Sever.AI, Hurma System, Veriato 360, Workday, AIOps, SAP SuccessFactors and many others [4]. These tools provide opportunities from the selection of candidates to the analysis of the work of employees, which allows to optimize the work of the personnel of enterprises. They provide an opportunity to collect and analyze important data about employees, such as professional competence, the quality and volume of work performed, make estimates and calculate the time of completion of a particular project. This allows managers to make more informed decisions regarding the awarding, training and development of personnel. At the same time, most manufacturers of CRM and ERP systems remain more conservative and restrained in the use of artificial intelligence in their systems. Some only test this technology, others use classical mathematical algorithms (considering them more predictable than modern intelligent systems).

However, it is important to note that the choice of tool depends on the characteristics of the organization that use them. AI tools may be too complex or too functional for a particular company. The cost of

AI tools and the specifics of implementation can create additional challenges for enterprises. Therefore, before choosing an AI tool to analyze, predict and optimize staffing decisions, enterprises should carefully define their needs and capabilities to find the tool that best meets specific requirements.

But one way or another, the growing interest in the use of artificial intelligence in the field of personnel management indicates that this innovative approach can provide a much more efficient use of human resources.

According to Gartner Peer Insights [8], SAP SuccessFactors is widely used in many countries and in the world's leading companies. SAP SuccessFactors has significant potential to transform approaches to HR management, but like any comprehensive system it has its strengths and weaknesses. The main advantage is a wide range of functionality that covers the entire cycle of personnel management, starting from the selection of candidates and ending with the assessment and development of employees. It helps businesses automate and optimize HR processes, which in turn increases employee productivity and efficiency.

But the system may not be suitable for all types of business and the complexity of its use may become a barrier to implementation. At the same time, issues of ethics and data security remain open within the framework of system implementation at enterprises: in particular, the use of personal data of users, their processing and storage, the processes of influencing the behavior of employees, the possibilities of such tools for predicting the performance of employees. The research presented in the article is aimed at studying the capabilities and limitations of SAP SuccessFactors as one of the most used artificial intelligence tools by enterprises and large corporations for analysis, forecasting and optimization of personnel decisions [8].

Therefore, the study of the features of the influence of AI tools and the effectiveness of their use in personnel management within the framework of interactions in the digital space in enterprises is extremely relevant.

The purpose of the article is to study the influence and possibilities of using artificial intelligence tools in managing the behavior of

economic agents at the micro level (level of enterprise) using the example of SAP SuccessFactors, in particular in predicting the effectiveness of employees at enterprises, as well as in making decisions about personnel management, analysis and optimization of personnel decisions.

Methodology

The task of the methodology is to study the possibilities of using the SAP SuccessFactors tool with built-in AI to analyze, optimize and predict the behavior of personnel at the enterprise in order to further manage the relevant processes. The main goal is to determine how effectively AI can influence the processes of managing personnel behavior and identify key factors that affect employee performance.

Within the framework of the cloud-based system SAP SuccessFactors, economic agents (HR managers and employees of enterprise) interact with each other in the process of implementing business processes to achieve the company's goals. The use of SAP SuccessFactors presupposes the standardization of business processes within the framework of the platform and the clear setting the tasks for employees according to the company's goals. At the same time, HR managers (management subjects) control the implementation of processes within the framework of the system. Employees of the enterprise, in turn, perform the assigned tasks within the framework of Sap SuccessFactors and interact with management subjects through the corresponding platform.

Let the management subject (MS) be an economic agent – the manager of the enterprise, namely the head of the department, who uses the SAP SuccessFactors platform to analyze and optimize personnel decisions. The management object (MO) is an economic agent – an employee of an organization that makes decisions about choosing a model of behavior at the workplace. In particular, he decides whether to conscientiously fulfill his duties or to neglect the work process. This includes choosing the level of involvement in tasks, the degree of initiative and responsibility, etc.

The goal of management is to induce the economic agent to make a decision about the conscientious performance of his duties to ensure higher productivity, efficiency and compliance of his behavior with the organization's strategic goals. In this process, the SAP SuccessFactors is used by the enterprise manager as a tool for analyzing, forecasting and optimizing personnel decisions.

According to the conceptual provisions set forth in [15-17], a hypothesis is proposed to identify the features of the manifestations (prerequisites, factors, and causes) of the behavior of economic agents (MO) using artificial intelligence tools. This allows us to highlight the reflexive components of the mechanism of choosing economic agents (MOs), which depend on their propensity to make one or another decision in the process of interactions in the digital space. In particular, these are:

α_{it} – the degree of awareness of the *i*-th economic agent (MO) at the moment of time *t*;

γ_{it} – the competence of the *i*-th economic agent at the moment of time *t*;

ν_{it} – evaluation of the intentions (values of this or that decision for the economic agent) of the *i*-th agent at a moment in time *t*;

ω_{it} – intensity of interaction in the digital space of the *i*-th agent at the moment of time *t*.

Thus, the mechanism of interaction of economic agents in the digital space presented above, where the MS uses the SAP SuccessFactors AI tool in personnel management, is presented in Fig. 1.

The study examines the interaction between the management object, acting as an economic agent (employee of the enterprise), and the management subject (manager of the HR department or HR service) [15]. At the same time, in the process of performing their duties, the economic agents interact to each other to implement business processes at enterprises within the framework of SAP SuccessFactors. In turn, in the process of decision-making for personnel management, the MS uses the metrics of the SAP SuccessFactors AI system to analyze and forecast the behavior of the MOs on the basis of statistical information regarding the interactions of economic agents in the digital space.

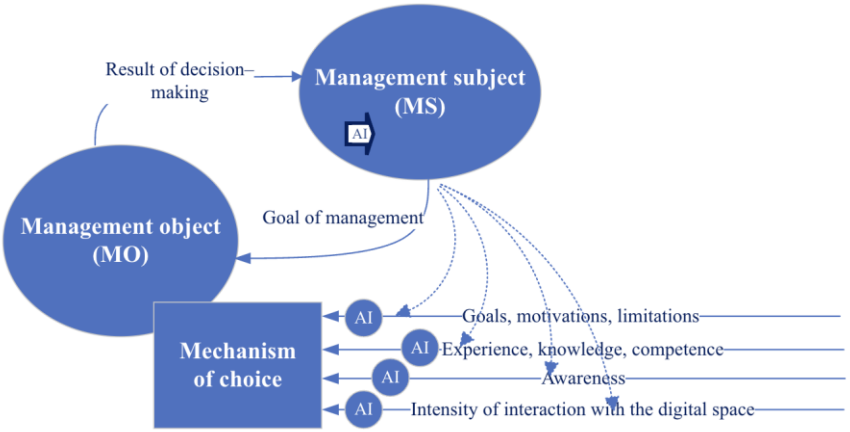

Fig. 1. General scheme of interaction of economic agents in the digital space

In the process of analysis of MO's behavior, decisions made, the quality of work and the process of communication with other employees within the digital space (in particular, the SAP SuccessFactors system), a behavioral picture of the employee will be built, on the basis of which it will be determined which reflexive characteristics must be changed to ensure the targeted behavior of economic agent, that is, to increase the efficiency of his work.

The developed research methodology for managing the behavior of economic agents at micro level using the SAP SuccessFactors tool is presented in Fig. 2 and contains the following main steps:

1. Collecting data on employee behavior in SAP SuccessFactors metrics.

The first stage of the study consists in collecting data about the employees of the enterprise, which includes information about education, work experience, results and achievements, in order to evaluate their behavior. The SAP SuccessFactors system has a very large database of each employee. The head of the enterprise (or the head of the HR department) has access to the personal data for each employee. The system stores data about the employee from the moment of employment, and also collects and accumulates information about him during the work process.

Fig. 2. The methodology for managing the behavior of economic agents at the micro level using the SAP SuccessFactors

Consider the data we exported from SAP SuccessFactors to conduct an experiment with manual calculations to manage the behavior of economic agents at the micro level:

a) *Awareness* reflects how well employees were informed about work processes and tasks.

The following aspects are taken into account to determine the awareness level:

a.1. Evaluation of the employee's use of SAP SuccessFactors functionality: for each department (according to its specifics), the em-

ployee can use certain system functions to solve his current tasks. If the employee uses limited functionality, the system lowers this score.

a.2. Feedback and communication: the system monitors how often an employee contacts management and other process participants during the performance of official tasks.

a.3. Evaluation of work results: the system calculates the average values of indicators for the department, with which a specific employee is compared. Comparison of employee achievements, productivity and quality of work against expected indicators and standards occurs automatically.

a.4. Training and support: the system periodically tests employees, giving a small test on knowledge of the system and new functions (after each update). Also, if the management initiates the employee's professional development, the system tracks whether the employee used this offer or not.

a.5. Growth tracking: once every six months, the system compares the professional growth of employees, taking into account evaluation of work results and professional development.

b) *Competence* defines the level of professional training and competence of employees. To determine the level of competence, the following are used:

b.1. Monitoring of task performance: in addition to the fact of task performance, the system takes into account the time and resources used by an employee to perform certain tasks – for the system this is an indicator of professionalism. Depending on this, the system assigns each employee an assessment of competence in performing tasks.

b.2. Interaction and feedback: determining the number of conflicts or misunderstandings that an employee has with a work team or management. The fewer misunderstandings, the higher the assessment of the employee's professional interaction.

b.3. Analysis of results and achievements: the system analyzes professional and competency results, for example, the acquisition of additional skills or competencies (this indicator further recommends the employee for promotion or bonus).

b.4. Training and development of professional competencies within the scope of the position: the system has a list of necessary

requirements for employees of the corresponding position and checks such compliance. According to such a check, once a quarter, the system will assess the development of professional competences.

c) *Intention* shows the employee's purposefulness in effective work in the department. A high score for this parameter shows his desire to work efficiently.

c.1. Analysis of work goals: the employee is checked for compliance with work goals – he periodically passes a survey according to the projects he is performing.

c.2. Assessment of task performance: score (as a percentage from 0 to 100) given by the head of the department according to each project. This means that a manager can assess an employee's intent by observing his performance of tasks assigned in the SAP SuccessFactors.

c.3. Engagement and feedback: the evaluation of the employee, determined directly through the feedback functionality in SAP SuccessFactors by the head of the department, according to the employee's interest and motivation. This includes holding periodic discussions about the career aspects, development and progress of the employee.

c.4. Detection of interests and ambitions: the manager evaluates the employee's intention (in percentage from 0 to 100) by observing his interests and ambitions, which can be reflected in SAP SuccessFactors. This may include information about the desire to be involved in certain projects, development in a specific area or reaching some level in the organization.

c.5. Efficiency and effectiveness: evaluation of the effectiveness of project implementation (in percentage from 0 to 100) is issued by the manager after the completion of the project, which makes it possible to assess the employee's interest and involvement in the work processes of the enterprise.

d) *Intensity of interaction in the digital space* reflects how much time an employee spent interacting with the SAP SuccessFactors software product. At the same time, it is stipulated that the employee performs his direct duties within the system.

d.1. Work time: the SAP SuccessFactors system can track the time an employee spends in the work environment, including time spent on

tasks, breaks, and absences from the workplace. According to the project tasks, SAP SuccessFactors determines the average time spent in the system: communication with other project participants, recording intermediate results, etc. For example, with an 8-hour working day, the employee is in the system for 6 hours (excluding negotiations, meetings, work and business trips, etc.). If the employee stays in SAP SuccessFactors for 6 hours, it is 100 percent, if less, the assessment is given according to the system's calculations.

d.2. Work results: the ratio of the time allocated to the project to the time spent by the employee in the system is evaluated. The score is set automatically by the system based on calculations ranging from 0 to 100 percent.

d.3. Comparison with plans: the planned for the project time is compared with the actual completion time.

d.4. Feedback function: it is analyzed how much time was spent by the employee on interaction with other project participants and management. Provided that the employee did not exceed the allowed time of interaction with other project participants, he receives an assessment in percentages from 0 to 100.

2. Normalization of data to determine reflexive characteristics of agents.

For further analysis and ensuring comparability of characteristics, the obtained data should be subjected to the normalization procedure. This procedure includes the transformation of different types of data into a single format and their scaling within the range from 0 to 1. An example of a possible data normalization technique is given in [17].

If the data are qualitative and represented by linguistic variables, the method based on the theory of fuzzy sets by Zadeh [18] was used to convert the linguistic characteristics of employees into numerical values, as described in detail in [16, 17].

3. Determination of reflexive characteristics of economic agents (employees of enterprise).

To ensure effective management of economic agents, it is necessary to determine their reflexive characteristics, which will help predict their possible behavior and work efficiency. Among the methods of determining reflexive characteristics, various research techniques and

tools are used, such as questionnaires, interviews, psychometric tests, observations and data analysis [19-24]. Each of these methods has its own advantages and limitations and can be used depending on the specific research objectives and available resources. However, in order to work with data from the SAP SuccessFactors system, it is necessary to use such an approach, which would provide the opportunity to take into account numerical and linguistic variables within the definition of reflexive characteristics and, at the same time, would make it possible to obtain a clear, numerically determined measure of the behavioral tendencies of economic agents.

Therefore, within the scope of the study, we will use the proven method of identifying the reflexive characteristics of agents [16], developed on the basis of questionnaire procedures and the theory of fuzzy sets [18] to form a base for determining the numerical values of reflexive characteristics, as well as a neural network model based on Kohonen self-organizing maps toolkit [25] to solve the tasks of diagnosing possible behavior manifestations of economic agents. The use of such an approach will allow taking into account the subjective component in the decision-making process by agents, implementing agent classification procedures and determining numerical values of their reflexive characteristics for further forecasting based on them the results of decision-making by company employees. At the same time, in contrast to the original methodology, within the framework of the study, it is proposed to improve the list of reflexive characteristics according to the research area and methods of data collection (in particular, instead of surveying economic agents, use the metrics of the SAP SuccessFactors system, which were considered above).

After obtaining the reflexive characteristics of agents as a result of analyzing SAP SuccessFactors data, their fuzzy sets are formed to subsequently determine the numerical values of the degree of awareness, competence, the value of this or that decision for a specific agent, and the intensity of interaction in the digital space. In order to numerical determination of the reflexive characteristics of agents and identification of a potential range of employees to whom managerial influences will be directed to manage their behavior to ensure the achievement of the company’s goals, it is proposed to divide the

agents into groups using the Kohonen self-organizing neural network according to the methodology [16].

In particular, as a result of neural network processing of the input data in SAP SuccessFactors metrics regarding the behavior of agents to determine the degree of their awareness, we will obtain a set of parameter values $\bar{A} = \{\alpha_{it}\}, i = \overline{1,N}$, where i is the agent number, and t is the point in time. Similarly, according to the directions of determining the intentional orientation, competence, susceptibility of agents (MOs) to the influence of the digital environment, we will obtain the following sets:

$\bar{I} = \{\nu_{it}\}, i = \overline{1,N}$ – a set of values that determines the intentional orientation of economic agent i (MO) to make a choice of effort to ensure work efficiency or the probability that at time t he is ready to make a choice of target behavior;

$\bar{Y} = \{\gamma_{it}\}, i = \overline{1,N}$ – set of values of parameters that determine the competence of economic agents (MOs) at a moment of time t;

$\bar{\Omega} = \{\omega_{it}\}, i = \overline{1,N}$ – set of parameter values that determine the susceptibility of every i-th agent to the influence of the digital space at a moment of time t.

An important applied value of the interpretation of the results of clustering by Kohonen self-organizing maps is the possibility of obtaining both representatives of specific classes and average values of their reflexive characteristics [16, 17]. The obtained values of these characteristics are further used to predict the results of decision-making by agents using reflexive choice functions, that is, they serve as a basis for predicting the behavior of economic agents (employees of the enterprise).

4. Forecasting the behavior of economic agents using the reflexive choice function.

The obtained values of reflexive characteristics of employees are used to forecast the results of decision-making by economic agents regarding the management goal. Within the framework of the study, we will use the mathematical approach of Lefebvre [26, 27], who proposed simple equations (reflexive choice functions of agents) for predicting human behavior. The parameters of the equations in

Lefebvre basic model are the influence of the world on the subject, the subjective course of action and the subject's intention, and the result is the probability that the subject will perform a certain action. Within the framework of the study, in order to understand how the employee will behave in the future, including whether he will make decisions that meet the goals of the enterprise and the MS, we offer the following modification of the reflexive choice function of economic agents, which takes into account the peculiarities of the decision-making process of employees at the enterprise in the context of the researched topic.

During the interaction between the MS and the MO, the decision of the MO is an act of choosing between some alternative 1 (beneficial to the head of the department) and 2 (opposite). So, the probability that the MS in the process of interaction with the MO will incline him to make a choice in favor of the 1st alternative, according to the reflexive model of bipolar choice by Lefebvre [26, 27], adapted to solve decision-making problems in the system of managing the behavior of economic agents in the digital space can be presented as follows:

$$X_{1_i} = F(x_{1_i}, F(x_{2_i}, x_{3_i})), \quad (1)$$

where $x_{1_i}, x_{2_i}, x_{3_i} \in [0;1]$ and all values of the function $F(x_{2_i}, x_{3_i}) \in [0;1]$.

In (1), the influence of the environment on the economic agent is reflected by the variable x_{1_i} – the probability that the MO perceives the pressure of the MS in the direction of making a decision to choose alternative 1 at the moment of the choice. It is determined by the intensity of interaction in the digital space, that is $x_{1_i} = \omega_i$.

x_{2_i} – the probability that the pressure towards the choice of alternative 1, which is beneficial to the MS, expected from the MO, taking into account his previous experience. It is determined by the product of the awareness and competence of corresponding economic agent (MO): $x_{2_i} = \alpha_{it} \cdot \gamma_{it}$. The degree of awareness of *i*-th economic agent (MO) at a moment of time *t* is characterized by a parameter α_{it} and can change over time for each of the agents, depending on the amount of information available to them. The same applies to competence γ_{it}.

x_{3_i}– the probability that the intentions of the MO to make a choice in the decision-making process in favor of alternative 1, which is beneficial to the MS. The more x_{3_i}, the greater the desire of the MO to make such a choice. It takes into account the intentions of agents as follows: $x_{3_i} = \nu_{it}$.

Function $F(x_{2_i}, x_{3_i})$ – it is a self-model of economic agents, represented by MO (subjective course of action and the subject's intention). Composition $F(x_{1_i}, F(x_{2_i}, x_{3_i}))$ describes the process of cognitive computation of value X_{1_i}: first $X_{2_i} = F(x_{2_i}, x_{3_i})$ is calculated, then $X_{1_i} = F(x_{1_i}, X_{2_i})$. The function corresponding to the self-model of the MO is: $X_{2_i} = F(x_{2_i}, x_{3_i}) = 1 - x_{3_i} + x_{2_i} \cdot x_{3_i}$ [26]. Then by direct calculation we get that $X_{1_i} = F(x_1, X_{2_i}) = 1 - X_{2_i} + X_{2_i} \cdot x_{1_i}$. By substituting X_{2_i}, we get:

$$X_{1_i} = x_{1_i} + (1 - x_{1_i}) \cdot (1 - x_{2_i}) \cdot x_{3_i}. \quad (2)$$

Thus, in the model of the reflexive choice of the MO, the variable x_{3_i} plays the role of intention, and the variable X_{1_i} represents the probability with which the MO is ready in reality to make a decision to which the MS inclines him at the moment of choice.

Therefore, we will consider expression (2) as a generalized model of the choice of MO within the concept of reflexive management of the behavior of economic agents in the digital space. Based on the defined above approach to calculating the reflexive choice function, the behavior of economic agents in the digital space is studied.

5. Determination of groups of agents for the formation of reflexive influences.

Defining groups of agents for the formation of reflexive influences is an important stage of research. After calculating the functions of reflexive choice, we will get a forecast of the behavior of economic agents, namely a predictive assessment of their work efficiency, which corresponds to the values of the function of reflexive choice of an economic agent. Similar to the SAP SuccessFactors system, the predicted effectiveness of employees is divided into three main groups:

1. A group of employees with low work motivation and a tendency to possible dismissal with the value of the function of reflexive choice $X_{1_i} \in [0; 0.4]$. This group may have a low level of job satisfaction, a lack of motivational incentives and a sense of insecurity in their place at work.

2. A group of employees with an average value of the reflexive choice function $X_{1_i} \in (0.4; 0.7)$, who work productively enough and do not intend to resign. This group can be considered stable. Group representatives are quite effective, but there may be opportunities to increase their motivation and involve them in more active participation in organizational processes.

3. A group of effective employees who are interested in professional growth and development and do not show inclination to possible dismissal, with a reflexive choice function value $X_{1_i} \in [0.7; 1]$. This group has a high potential for ensuring the effective operation of the organization and its representatives can be considered as key personnel who can make a significant contribution to the development of the enterprise.

6. Building reflexive influences on groups of agents.

The next stage is the formation of reflexive influences on the defined groups of agents. Knowing the value of reflexive characteristics of employees, we can determine what kind of influence should be applied to this or another group of economic agents. Due to the fact that the reflexive characteristics of the agents in the same group are similar, it is possible to build a reflexive influence on the whole group.

The third group of employees, which has the highest values of the reflexive choice function, does not need to increase certain reflexive characteristics, since the values of their reflexive choice functions correspond to effective behavior in achieving the company's goals.

The formation of managing influences for the first and second groups of agents (with the lowest and average values of the reflexive choice functions), which have rather low scores on almost all reflexive characteristics and correspond to insufficiently effective behavior in achieving the company's goals, can combine measures aimed at increasing agents' intentional focus on the company's goals

(interest in the work process), awareness, competence or intensity of interaction in the digital space.

Effective for increasing the reflexive characteristics of employees at the enterprise can be:

To raise awareness:

– Informing and open communication: providing employees with up-to-date information about the state of affairs in the organization, its goals and strategies.

To improve competence:

– Competence development: providing opportunities for learning and professional development of employees through trainings and courses.

To raise intentions:

– System of motivational incentives: development of a system of internal motivators and incentives, such as bonuses for high performance and achieving goals.

– Recognition and reward: involves the introduction of a system of recognition and rewards that motivates employees to achieve high results. This may include the providing bonuses, awards, verbal praise or even the opportunity to participate in projects that are marked as important within the enterprise.

– Career development: provides opportunities for career growth and development, creation of prospects for employees in the organization in accordance with individual goals (intentions).

– Ensuring comfort in the workplace: it involves providing employees with comfortable working conditions, opportunities for self-expression and development of creative potential.

– Involvement in decision-making processes: providing opportunities for employees to participate in making important decisions about the organization's activities.

To increase the intensity of interaction in the digital space:

– Balanced workload: provides an even distribution of the workload. A balanced work schedule helps to increase motivation and productivity.

These reflexive management methods will allow to influence and encourage the company's employees to work better and increase their personal efficiency.

7. Prediction of the decision-making result of economic agents after management and its comparison with the predicted values of the efficiency of economic agents by SAP SuccessFactors AI

After directing managerial influences on economic agents to increase the values of reflexive characteristics, it is necessary to re-evaluate the values of these characteristics to determine the efficiency of behavioral management. For this, it is again necessary to export data from SAP SuccessFactors, calculate the reflexive characteristics and the values of the reflexive choice function. In this way, we will get three groups of employees, similar to step 5. Comparing the values of the functions of reflexive choice of employees before and after managerial influences will allow to assess their effectiveness and the need for further changes in the reflexive characteristics of economic agents to achieve the target behavior and work efficiency.

Under the condition, if the goal of management is not achieved, you should return to the step 5 and review the defined set of reflexive influences to achieve the target behavior of economic agents.

Further comparison of the results of the predicted behavior in accordance with the function of reflexive choice according to our proposed methodology with the predicted values of the behavior of economic agents by SAP SuccessFactors AI will allow to evaluate the effectiveness of using AI tools in managing the behavior of economic agents in the digital space at enterprises. This comparative analysis will allow to determine the difference between the forecasts provided by the SAP SuccessFactors system, in comparison with the calculations based on Kohonen maps and Lefebvre reflexive choice model using the exported data in SAP SuccessFactors metrics on the behavior of economic agents.

Results and discussion

Let’s consider the implementation of the proposed methodology for managing the behavior of economic agents at the micro-level using SAP SuccessFactors on the example of the work of the Strategic resource management department, which involves 22 employees and the department head. The department specializes in HR management

for other companies, focusing on strategic planning, staff development, performance evaluation, analytics and motivation to achieve the organization's strategic goals. The main tasks of the department include the development and implementation of strategic initiatives in the field of personnel management, in particular, the analysis of employee performance.

1. Collecting data on employee behavior in SAP SuccessFactors metrics.

The SAP SuccessFactors system automatically collects data about employees, starting from the moment of employment (data that the employee enters about himself: personal information, education, work experience, etc.). Other information about the employee, certifying the quality of his work, motivation, etc., is automatically collected by the system during the entire working time.

The SAP SuccessFactors system allows the manager (by entering a special key) to export the necessary data throughout the department. Exported data are in the form of scores (in the selected areas), mostly in percentages from 0 to 100. For calculations according to the methodology given above, all the necessary data are uploaded to a file and a table is created for further processing and calculations.

2. Normalization of data to determine reflexive characteristics of agents.

After downloading, the data from the SAP SuccessFactors system had various forms: percentage, text or numerical. Therefore, for further calculations, all obtained data were normalized according to the methodology [17].

In particular, a method [18] based on the theory of fuzzy sets by Zadeh was used to translate the linguistic characteristics of employees into numerical values, which made it possible to normalize various data from the SAP SuccessFactors system, turning them into a format suitable for further calculations and analysis. After normalization, we obtained data between 0 and 1 (see Table 1), with which we will continue to work further. For the convenience of calculations and analysis of the obtained results, let's designate the agents as Agent 1, Agent 2, etc. up to Agent 22 by the number of department employees.

Table 1

TABLE OF NORMALIZED INPUT DATA FOR DETERMINING THE REFLEXIVE CHARACTERISTICS OF AGENTS

Agents	Awareness					Competence				Intention					Intensity of interaction in the digital space			
	Evaluation of the use of functionality	Feedback and communication	Evaluation of work results	Training and support	Growth tracking	Monitoring of task performance	Interaction and feedback	Analysis of results and achievements	Training and development of professional competencies	Analysis of work goals	Assessment of task performance	Engagement and feedback	Detection of interests and ambitions	Efficiency and effectiveness	Work time	Work results	Comparison with plans	Feedback function
1	0,7	1	0,8	0,75	0,2	0,7	1	0,8	0,75	0,7	0,75	1	0,75	0,2	0,7	0,8	0,8	1
2	0,6	1	0,3	0,7	0	0,6	1	0,6	0,9	0,6	0,6	1	0,6	0,1	0,6	0,9	0,8	1
3	0,3	0	0,8	0,6	0,2	0,3	1	0,3	0,9	0,3	0,9	0	0,9	0,3	0,9	0,9	0,5	0
4	0,8	1	0,4	0,3	0,3	0,8	0	0,8	0,9	0,8	1,0	1	1,0	0	1,0	0,9	0,8	1
5	0,4	0	1,0	0,8	0,2	0,4	1	0,4	0,9	0,4	0,5	0	0,5	0,3	0,5	0,9	1,0	0
6	1,0	1	0,9	0,4	0,2	1,0	0	1,0	0,5	1,0	0,7	1	0,7	0,2	0,7	0,5	0,7	1
7	0,9	1	0,7	1,0	0,1	0,9	1	0,9	1,0	0,9	0,9	1	0,9	0	0,9	1,0	0,7	1
8	0,7	1	0,8	0,9	0	0,7	1	0,7	0,5	0,7	0,5	1	0,5	0,1	0,5	0,5	0,8	1
9	0,8	1	0,1	0,7	0,3	0,8	1	0,8	0,5	0,8	0,6	1	0,6	0,1	0,6	0,5	0,6	1
10	0,1	0	0,6	0,8	0,2	0,1	1	0,1	0,7	0,1	0,7	0	0,7	0	0,7	0,7	0,9	0
11	0,6	1	0,0	0,1	0,2	0,6	0	0,6	0,7	0,6	0,6	1	0,6	0,1	0,6	0,7	0,8	1
12	0,0	1	0,2	0,6	0	0,0	1	0,0	0,6	0,0	0,8	1	0,8	0,1	0,8	0,6	0,9	1
13	0,2	0	0,3	0,0	0	0,2	1	0,2	0,6	0,2	0,5	0	0,5	0,1	0,5	0,6	0,8	0
14	0,3	1	0,9	0,2	0	0,3	0	0,3	1,0	0,3	0,9	1	0,9	0	0,9	1,0	0,8	1
15	0,9	1	0,8	0,3	0,1	0,9	1	0,9	0,7	0,9	0,5	1	0,5	0	0,5	0,7	0,5	1
16	0,2	0	0,3	0,9	0,1	0,2	1	0,2	0,6	0,2	0,9	0	0,9	0,1	0,9	0,6	0,7	0
17	0,9	1	0,8	0,7	0,3	0,9	0	0,9	0,7	0,9	0,5	1	0,5	0	0,5	0,7	0,7	1
18	0,5	1	0,3	0,6	0,2	0,5	1	0,5	0,6	0,5	0,7	1	0,7	0,3	0,7	0,6	0,5	1
19	0,9	1	0,8	0,2	0,2	0,9	1	0,9	0,7	0,9	0,8	1	0,8	0,1	0,8	0,7	0,9	1
20	0,7	1	0,5	0,9	0	0,7	1	0,7	1,0	0,7	0,7	1	0,7	0,2	0,7	1,0	0,8	1
21	0,9	1	0,8	0,5	0	0,9	1	0,9	1,0	0,9	0,7	1	0,7	0,3	0,7	1,0	0,7	1
22	0,3	0	0,8	0,9	0,1	0,3	1	0,3	0,5	0,3	0,9	0	0,9	0,1	0,9	0,5	0,5	0

3. Determination of reflexive characteristics of economic agents (employees of enterprise).

To determine the values of reflexive characteristics of employees according to the methodology, we use the Kohonen maps tools in the Deductor Academic software package. We provide input data from Table 1 to the inputs of the neural network and obtain clusters of employees with similar behavior.

The inputs of the neural networks are fed with the normalized values of indicators of the corresponding directions of detection of reflexive characteristics, and the outputs are Kohonen maps, on which we obtained clusters that classify agents according to these directions: awareness (Fig. 3.a), competence (Fig. 3.b), intentions (Fig. 3.c), and intensity of interaction in the digital space (Fig. 3.d). As a result of applying the author's methodology [16] for determining reflexive characteristics using Kohonen maps, we obtain three clusters for each direction with values of employees' reflexive characteristics corresponding to the cluster centers (they are presented in Table 2).

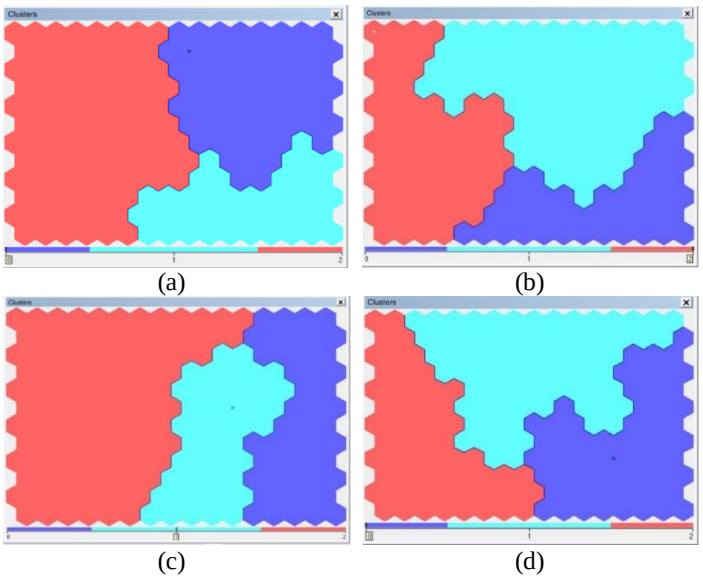

Fig. 3. Kohonen maps for determining the reflexive characteristic of economic agents at enterprise: awareness (a), competence (b), intention (c), and intensity of interaction in the digital space (d)

Table 2

THE NUMERICAL VALUES OF THE REFLEXIVE CHARACTERISTICS OF ECONOMIC AGENTS FROM THE KOHONEN MAPS

Agent number	Awareness	Competence	Intention	Intensity of interaction in the digital space
1	0,62	0,77	0,67	0,80
2	0,62	0,77	0,67	0,80
3	0,45	0,57	0,53	0,69
4	0,62	0,77	0,67	0,80
5	0,45	0,57	0,53	0,69
6	0,62	0,77	0,67	0,80
7	0,62	0,77	0,67	0,80
8	0,62	0,77	0,67	0,80
9	0,45	0,57	0,53	0,69
10	0,33	0,49	0,33	0,53
11	0,45	0,57	0,53	0,69
12	0,45	0,57	0,53	0,69
13	0,33	0,49	0,33	0,53
14	0,45	0,57	0,53	0,69
15	0,62	0,77	0,67	0,80
16	0,33	0,49	0,33	0,53
17	0,62	0,77	0,67	0,73
18	0,45	0,57	0,53	0,69
19	0,62	0,77	0,67	0,80
20	0,62	0,77	0,67	0,80
21	0,62	0,77	0,67	0,80
22	0,45	0,57	0,53	0,69

Next, we calculate the forecast of the results of employees' decision-making.

4. Forecasting the behavior of economic agents using the reflexive choice function.

Using the numerical values of the reflexive characteristics of economic agents, we calculate the value of the reflexive choice function of each employee according to formula (2). We obtain the predicted results of economic agents' decision-making. In this way, the modified reflexive model of bipolar choice of Lefebvre, which is used, allows to determine the choice of an economic agent between two models of behavior – to work efficiently or to neglect one's official duties. Below will be given the corresponding values of prediction for the investigated agents with the analysis of the obtained results.

5. Determination of groups of agents for the formation of reflexive influences.

After calculating the reflexive choice function for each employee, we have probable characteristics of their behavior. According to this, we can form three groups in the same way as is implemented in the SAP SuccessFactors system (the first group is in the range from 0 to 0.4, the second group is from 0.41 to 0.69, and the third group is from 0.7 to 1). Having such an efficiency Table 3, the system tries to draw the manager's attention to certain employees who have low motivation or efficiency.

The first group (yellow) in the Table 3 includes the least effective employees who will have the lowest level of reflexive choice function values, the worst work efficiency, and the highest probability to quit. The second group (blue) includes moderately effective employees who have different values of reflexive characteristics, which determine the corresponding values of the reflexive choice function. The third group (green) contains the most effective employees who have the highest level of values of the functions of reflexive choice and the corresponding behavior in terms of conscientiously performing their job duties and achieving the company's goals.

Table 3

PREDICTED EMPLOYEE PERFORMANCE VALUES ACCORDING TO THE REFLEXIVE CHOICE FUNCTION

Agent number	The value of the reflexive choice function before managing influence	Groups of economic agents
13	0,31	1
10	0,34	1
16	0,39	1
22	0,42	2
5	0,45	2
3	0,53	2
12	0,54	2
11	0,55	2
14	0,62	2
18	0,63	2
9	0,66	2
17	0,71	3
8	0,73	3
15	0,73	3
2	0,74	3
6	0,74	3
4	0,76	3
20	0,78	3
19	0,79	3
1	0,79	3
21	0,85	3
7	0,88	3

It is important to note that the analysis of the results of the behavior of economic agents within the framework of Lefebvre reflexive choice function, which was further developed within the scope of the study, shows that agents whose function value exceeds 0.7 actually make appropriate decisions [17]. This is because their choice is intentional or, in other words, they have a clear motivation to make such decisions, which always corresponds to their readiness to make a choice. In the event that the probability of making a decision

about conscientious performance of official duties is less than 0.7, agents prefer another (opposite) alternative.

6. Building reflexive influences on groups of agents.

Within the scope of the conducted experiment, insufficient awareness, low level of intentions and interaction with the digital space of employees of the second group with average indicators of work efficiency were found.

In order to change the values of the reflexive characteristics of the relevant economic agents to increase the values of their reflexive choice functions, the following controlling influences were applied. Created a system of motivational incentives that includes recognition and rewards, bonuses, awards and verbal praise. The potential for career development is highlighted and the prospects for further growth in the organization are created to stimulate employees to achieve high results.

Internal motivation methods, that have been applied to the relevant group of agents, include increasing competence through training and professional development of employees. Informing and open communication about the organization's strategy and goals are also used to motivate employees to be more passionate about their work. A balanced workload and support through mentoring have also been used to motivate average performing staff.

These influences are argued by the values of the reflexive characteristics of each agent and are based on the methodology described in our study. The outlined measures are used for positive influence on changing the behavior of economic agents and increasing the values of reflexive choice functions.

7. Prediction of the decision-making result of economic agents after management and its comparison with the predicted values of the efficiency of economic agents by SAP SuccessFactors AI

After carrying out an experiment on the application of appropriate managerial influences, new data about the work of employees in SAP SuccessFactors metrics were collected. After data processing, a change in the values of reflexive characteristics and the general value

of the function of reflexive choice was revealed (see Table 4). In particular, the identified managerial influences made it possible to change the values of the relevant reflective characteristics and increase the value of the reflective choice function for all but one employee. Five of them moved to another group: two from the low-effective group to the medium-effective one, and three from the medium-effective to the group with the highest efficiency.

Table 4

ASSESSMENT OF THE FUNCTION OF REFLEXIVE CHOICE OF ECONOMIC AGENTS BEFORE REFLEXIVE MANAGEMENT AND FORECAST OF ITS VALUE AFTER THE INFLUENCE

Agent number	The value of the reflexive choice function before managing influence	The predicted value of the reflexive choice function after managing influence
13	0,31	0,27
10	0,34	0,45
16	0,39	0,49
22	0,42	0,50
5	0,45	0,53
3	0,53	0,60
12	0,54	0,65
11	0,55	0,66
14	0,62	0,71
18	0,63	0,74
9	0,66	0,76
17	0,71	0,81
8	0,73	0,82
15	0,73	0,82
2	0,74	0,85
6	0,74	0,86
4	0,76	0,88
20	0,78	0,90
19	0,79	0,92
1	0,79	0,94
21	0,85	0,96
7	0,88	0,96

Thus, the use of the obtained reflexive characteristics of economic agents allows predicting the behavior of employees and timely paying attention to those who need it to improve the quality of the work.

The SAP SuccessFactors system has its own built-in algorithm for predicting the effectiveness of employees (which works based on artificial intelligence). The study aimed to compare the effectiveness of predicting employee productivity using the author's methodology with SAP SuccessFactors, so it is necessary to bring the final calculation data into the one format (percentage performance forecast). Therefore, the obtained evaluations of reflexive choice are given in a similar form for a better quality of comparison (Table 5).

The results of calculating the difference between these two estimates determine what changes have occurred in the predicted values of employee performance. At the same time, the probability of dismissal is inversely proportional to the efficiency of work within the system. For example, similar to the method of calculating the efficiency of SAP SuccessFactors employees, if an agent has 55% efficiency, then there is a 45% probability of being fired.

The results of the comparison of the predicted efficiency values for each employee allow us to conclude that the SAP SuccessFactors system tends to overestimate the corresponding indicators of highly effective employees and underestimate low performers. As a result, there is an essential gap between the minimum and maximum values of employee efficiency. However, such a difference in assessing employee performance is unfounded. Thus, a detailed analysis of the information in the database showed that, for example, if an employee misses work on projects several times, the SAP SuccessFactors automatically reduces his rating and can identify him as ineffective. At the same time, in fact, an employee may have valid reasons for missing work on projects, such as business trips, family circumstances, health problems, etc.

This can lead to wrong decisions by the managers of the company's personnel services, in particular, regarding bonuses. In addition, such discrepancies can cause additional costs and distort managers' perceptions of the real efficiency of employees. In this context, wrong management decisions can be made regarding motivation, work

incentives and other aspects of personnel management, which can affect the overall economic efficiency of the enterprise.

Table 5

COMPARATIVE TABLE OF PERFORMANCE FORECASTING CALCULATIONS USING THE AUTHOR'S METHODOLOGY WITH THE RESULTS OF FORECAST OF THE SAP SUCCESSFACTORS PLATFORM

Agent number	The predicted value of the reflexive choice function after managing influence		The predictive assessment of the performance of employees by SAP SuccessFactors AI		Calculation difference in %
	Work efficiency (%)	*Probability of dismissal (%)*	*Work efficiency (%)*	*Probability of dismissal (%)*	
13	27	73	21	79	6
10	45	55	29	71	16
16	49	51	33	67	16
22	50	50	47	53	3
5	53	47	51	49	2
3	60	40	55	45	5
12	65	35	59	41	6
11	66	34	63	37	3
14	71	29	69	31	2
18	74	26	70	30	4
9	76	24	71	29	5
17	81	19	80	20	1
8	82	18	83	17	-1
15	82	18	85	15	-3
2	85	15	86	14	-1
6	86	14	87	13	-1
4	88	12	88	12	0
20	90	10	90	10	0
19	92	8	91	9	1
1	94	6	92	8	2
21	96	4	97	3	-1
7	96	4	98	2	-2

Fig. 4 presents the comparison of the number of employees by groups according to the predicted value of their productivity calculated by the reflexive choice function and by SAP SuccessFactors AI.

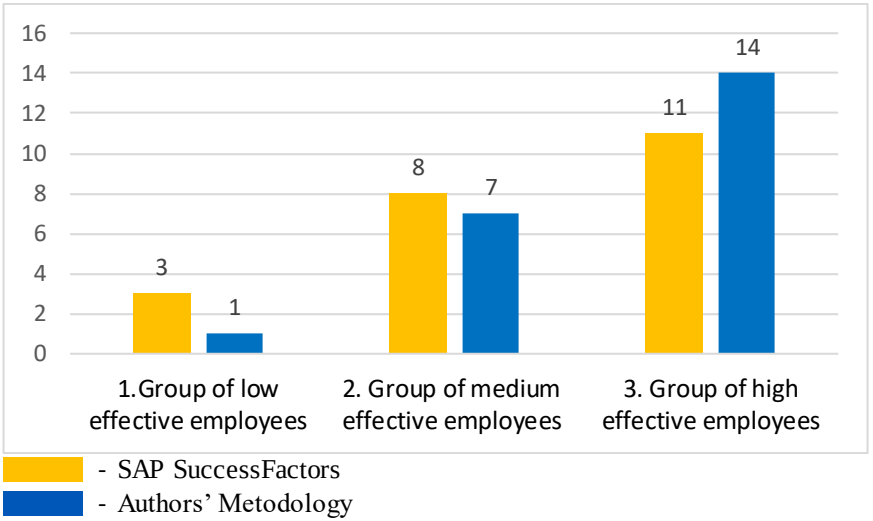

Fig. 4. Comparison of the number of employees by groups according to the predicted value of their productivity calculated with the reflexive choice function and by SAP SuccessFactors AI

In this way, the comparison presented in Fig. 4, allows us to conclude that the SAP SuccessFactors system can evaluate the performance of various personnel groups differently. As already noted, there is an essential gap between the minimum and maximum values of the labor efficiency of employees in groups of low effective and high effective employees. This may occur due to insufficient adaptation of models to the specifics of work and personal characteristics of employees of different levels of productivity. When using the SAP SuccessFactors system, it is important to take this feature into account and make individual settings for different employee performance groups to ensure the adequacy of employee behavior predictions. This is a key aspect to avoid wrong management decisions that can affect the economic efficiency of the enterprise.

Thus, one of the advantages of SAP SuccessFactors is the ability to collect and operate a large amount of data both about employees and

their work efficiency. But during the experiment, a certain list of disadvantages of SAP SuccessFactors was discovered:

1. The imperfection of the SAP SuccessFactors AI recommendation system, which would help specifically influence employees to improve their efficiency. In practical terms, this means that the system can provide useful information about employee performance, but does not provide specific recommendations on how managers should act to improve it. Thus, users should be ready to independently analyze and develop management strategies based on SAP SuccessFactors predictions.

2. There is a certain danger of inadequate evaluation of the employee. For example, when an employee misses work on projects several times, the system automatically lowers the rating of the employee and can identify him as ineffective. At the same time, in fact, an employee may have valid reasons for missing work on projects, including work-related issues of the company.

3. Possible inadequate consideration of individual characteristics of economic agents, which may affect the assessment of the effectiveness of their duties.

In general, the application of the SAP SuccessFactors tool can allow enterprises not only to use their resources effectively, but also to improve the quality of personnel management. It is important to note that the results of this study can be applied in practice to determine optimal personnel management strategies and increase the efficiency of the enterprise.

Conclusions

In today's world, where technological progress determines the direction of enterprise development, the review and optimization of personnel management mechanisms becomes an important task. This dynamic reality requires new approaches to effective human resource management, given the availability of a wide range of personnel management tools. Therefore, modern enterprises use integrated management systems, such as CRM and ERP, which become an integral part of strategic management and contribute to increasing competitiveness.

In turn, artificial intelligence tools provide new opportunities to optimize the work of employees and improve the productivity of companies. This technology is integrated into management practices, ensuring validity and speed in making strategic decisions. Indeed, research shows the prospects of using artificial intelligence tools in personnel management, confirming their ability to improve management quality, support a personalized approach to employees and improve motivation. But together with the advantages, certain nuances of using AI tools in the outlined processes should also be taken into account.

The methodology proposed in the article made it possible to conduct a study of the impact and possibilities of using artificial intelligence tools in managing the behavior of economic agents at the micro level on the example of SAP SuccessFactors, in particular in predicting the efficiency of employees at enterprises.

As part of the study of the possible impact of SAP SuccessFactors AI on the company's personnel management, using the example of the decision-making process by employees to conscientiously fulfill their duties in order to achieve the company's goals, the tendency of this platform to underestimate the indicators of low- and medium-performing employees was revealed. In addition, SAP SuccessFactors tends to overestimate the performance of high-performing employees. Thus, there is an essential gap between the minimum and maximum values of employee efficiency, which is due to the fact that SAP SuccessFactors can evaluate the effectiveness in various groups of personnel differently. This may occur due to insufficient adaptation of platform's models to the specifics of work and personal characteristics of employees of different productivity levels. Therefore, there is a certain danger of inadequate evaluation of the employee. For example, if an employee misses work on projects several times, the SAP SuccessFactors automatically reduces his rating and can identify him as ineffective. At the same time, in fact, an employee may have valid reasons for missing work on projects, such as business trips, family circumstances, health problems, etc.

This can lead to wrong decisions by the managers of the company's personnel services, in particular, regarding bonuses. It can also cause additional costs and distort managers' perceptions of the

real efficiency of employees. In such a context, incorrect management decisions may be made regarding motivation, work incentives and other aspects of personnel management, which may affect the overall economic efficiency of the enterprise. Therefore, when using the SAP SuccessFactors system, it is important to take this feature into account and make individual settings for different employee performance groups to ensure the adequacy of employee behavior predictions.

Thus, using AI tools has its advantages and disadvantages. Advantages include increased speed and accuracy in data analysis, as well as automation of decision support processes. The disadvantages are related to the limited availability of functions during testing and the possibility of systematic errors due to certain nuances of using such AI tools in practice at the micro-level.

The possibilities of using AI are to further improve the system, expand functionality and support effective personnel management. On the other hand, threats include the possibility of mistakes in solving tasks, as well as the interference by unauthorized persons due to the vulnerability of such systems in relation to personal data privacy.

Thus, the conducted research made it possible to reveal the opportunities and challenges of using tools based on artificial intelligence, as well as to outline new directions for the development of the theory and practice of personnel management in the modern digital environment, using the example of the most common tool in enterprises that integrates the latest management systems into their operation.

A promising direction is the research and comparison of the use of new AI tools for monitoring staff behavior and the implementation of appropriate recommendation systems in practice to improve human resource management mechanisms at enterprises, taking into account the outlined opportunities and threats regarding the use of artificial intelligence.

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References

1. Vishnevsky, V., Viyetska, O., Viyetskyi, O., Vorgach, O., Harkushenko, O., Dasiv, A., Zanizdra, M., Zbarazhskaya, L., Kniaziev, S., Kravchenko, S., Lipnytsky, D., Madih, A., Mazur, Y., Nikiforova, V., Okhten, O., Sokolovskaya, O., Turlakova, S., Chekina, V., Shevtsova, G., & Shchetilova, T. (2019). *Smart-promyslovist: napriamy stanovlennia, problemy i rishennia [Smart industry: Directions of development, problems and solutions]*. National Academy of Sciences of Ukraine, Institute of Industrial Economics. https://iie.org.ua/wp-content/uploads/2020/04/2019-smart-promyslovist_napriamy-stanovlennia-problemy-i-rishennia_compressed-1.pdf [in Ukrainian]

2. Kolot, A., Herasymenko, O., Shevchenko, A., & Ryabokon, I. (2022). Employment in the coordinates of digital economy: current trends and foresight trajectories. *Neuro-Fuzzy Modeling Techniques in Economics*, *11*, 78-123. http://doi.org/10.33111/nfmte.2022.078

3. Zuboff, S. (2019). *Age of surveillance capitalism: The fight for a human future at the new frontier of power*. PublicAffairs.

4. Logvinenko, B. (2022). Doslidzhennia instrumentiv shtuchnoho intelektu v upravlinni povedinkoiu ekonomichnykh ahentiv u tsyfrovomu prostori na pidpryiemstvakh [Study of artificial intelligence tools in the management of the behavior of economic agents in the digital space at enterprises]. *The Journal of V. N. Karazin Kharkiv National University. Series: International Relations. Economics. Country Studies. Tourism, 15*, 45-53. https://doi.org/10.26565/2310-9513-2022-15-05 [in Ukrainian]

5. Haan, K. (2023). *How Businesses Are Using Artificial Intelligence In 2024*. Forbes Advisor. https://www.forbes.com/advisor/business/software/ai-in-business/

6. Lohvinenko, B. (2022). Upravlinnia povedinkoiu ekonomichnykh ahentiv na pidpryiemstvakh iz vykorystanniam instrumentiv shtuchnoho intelektu [Managing the Behavior of Economic Agents at Enterprises with

Artificial Intelligence Tools]. *Ekonomika Promyshlennosti (Economy of Industry)*, *4*(100), 78-92. http://doi.org/10.15407/econindustry2022.04.078 [in Ukrainian]

7. Traynor, S., Wellens, M. A., & Krishnamoorthy, V. (2021). An Introduction to SAP SuccessFactors Talent Modules. In *SAP SuccessFactors Talent: Vol. 1* (pp. 1–6). Apress. https://doi.org/10.1007/978-1-4842-6600-7_1

8. Gartner. (2022). *SAP SuccessFactors HXM Suite Enterprise IT Software Reviews*. Gartner Peer Insights. https://www.gartner.com/reviews/market/cloud-hcm-suites-for-1000-employees/vendor/sap/product/sap-successfactors-hxm-suite/reviews?marketSeoName=cloud-hcm-suites-for-1000-employees&vendorSeoName=sap&productSeoName=sap-successfactors-hxm-suite

9. Zuboff, S. (2015). Big other: Surveillance Capitalism and the Prospects of an Information Civilization. *Journal of Information Technology*, *30*(1), 75–89. https://doi.org/10.1057/jit.2015.5

10. Crawford, K. (2022). Atlas of AI: Power, Politics, and the Planetary Costs of Artificial Intelligence. *Perspectives on Science and Christian Faith*, *74*(1), 61–62. https://doi.org/10.56315/pscf3-22crawford

11. Kidd, C., & Birhane, A. (2023). How AI can distort human beliefs. *Science*, *380*(6651), 1222–1223. https://doi.org/10.1126/science.adi0248

12. Yawalkar, V. V. (2019). A study of artificial intelligence and its role in human resource management. *International Journal of Research and Analytical Reviews*, *6*(1), 20–24. https://www.ijrar.org/papers/IJRAR19UP004.pdf

13. Cappelli, P., Tambe, P., & Yakubovich, V. (2019). Artificial Intelligence in Human Resources Management: Challenges and a Path Forward. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3263878

14. Ledro, C., Nosella, A., & Dalla Pozza, I. (2023). Integration of AI in CRM: Challenges and Guidelines. *Journal of Open Innovation: Technology, Market, and Complexity*, *9*(4), Article 100151. https://doi.org/10.1016/j.joitmc.2023.100151

15. Turlakova, S. (2022). Kontseptualni polozhennia upravlinnia povedinkoiu ekonomichnykh ahentiv u tsyfrovomu prostori z vykorystanniam instrumentiv shtuchnoho intelektu [Conceptual provisions of management of the behavior of economic agents in the digital space using artificial intelligence tools]. *Ekonomika ta pidpryiemnytstvo (Economics and Entrepreneurship)*, *49*, 40–54. https://doi.org/10.33111/EE.2022.49.TurlakovaS [in Ukrainian]

16. Turlakova, S. (2022). Modeling the values of reflexive characteristics of agents within the management of herd behavior at the enterprises. *Neuro-*

Fuzzy Modeling Techniques in Economics, *11*, 48-77. http://doi.org/10.33111/nfmte.2022.048

17. Turlakova, S. (2020). *Refleksyvnoe upravleniye stadnym povedeniyem na predpriyatyyakh: kontseptsiya, modeli i metody [Reflexive management of herd behavior at enterprises: concept, models and methods]*. National Academy of Sciences of Ukraine, Institute of Industrial Economics. https://iie.org.ua/wp-content/uploads/2020/04/mono_turlakova_2020_compressed.pdf [in Russian]

18. Zadeh, L.A. (2008). Is there a need for fuzzy logic? *Information Sciences*, *178*(13), 2751-2779. https://doi.org/10.1016/j.ins.2008.02.012

19. Romanos, G. D. (1973). Reflexive Predictions. *Philosophy of Science*, *40*(1), 97–109. https://doi.org/10.1086/288499

20. McClelland, D. C. (2001). Chapter 27: Where Do We Stand on Assessing Competencies? *Counterpoints*, *166*, 479–489. http://www.jstor.org/stable/42977810

21. Spencer, L. M., & Spencer, S. M. (2008). *Competence at Work: Models for Superior Performance*. John Wiley & Sons.

22. Robert, K., & Ola, L. (2021). Reflexive sensegiving: An open-ended process of influencing the sensemaking of others during organizational change. *European Management Journal*, *39*(4), 476–486. https://doi.org/10.1016/j.emj.2020.10.007

23. Jamieson, M. K., Govaart, G. H., & Pownall, M. (2023). Reflexivity in quantitative research: A rationale and beginner's guide. *Social and Personality Psychology Compass*, *17*(4), Article e12735. https://doi.org/10.1111/spc3.12735

24. Burk, D. (2020). *Algorithmic legal metrics*. AoIR Selected Papers of Internet Research, 2020. https://doi.org/10.5210/spir.v2020i0.11184

25. Kohonen, T. (2001). *Self-Organizing Maps*. Springer-Verlag.

26. Lefebvre, V. (2001). *Algebra of conscience*. Springer Science & Business Media.

27. Lefebvre, V. A. (2017). Bipolar Choice in Experimental Chamber. *Bipolar Disorder*, *3*(1). Article 115. https://doi.org/10.4172/2472-1077.1000115

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