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FORMATION AND APPLICATION OF AN AGENT-ORIENTED MODEL IN THE MANAGEMENT OF THE OIL INDUSTRY OF THE REPUBLIC OF KAZAKHSTAN

Abstract. Kazakhstan is one of the few countries in the world rich in oil, deservedly called "black gold" because it is the most important source of energy. The relevance of the study of this paper is determined by the fact that the management of the oil industry affects not only the management process itself, but also the social aspects of the implementation of the development strategy of the state as a whole. It is necessary to identify aspects of management activity and define criteria by which it is possible to calculate the effectiveness of managerial decision-making in the analyzed industry. Agent models allow us to identify the main criteria for the effectiveness of managerial decision-making and optimize social and economic costs for their implementation within the framework of interdepartmental planning. The novelty of the research is determined by the fact that agent models are based not only on the associated parameters of the management process, but also affect the possibility of planning current activities for a long period. The article shows that the formation of agent models should affect both the aspect of the formation of matrices of complex managerial actions and calculations on the accounting of competencies in making managerial decisions. The practical significance of the study is determined by the fact that the development of complex models based on agent forms allows expanding the use of forms of control over the industry by the state and other stakeholders. The implementation of a matrix form of management is proposed, taking into account balanced industry indicators of management quality.

Keywords: agent, management, model, industry, oil.

Introduction

It is worth noting several very serious transformations that will, most likely, have a further impact on the development of activities related to project management [1]. The first and, perhaps, the main "transformation" is that "project management" has ceased to be exactly what it was for many years – an approach to managing specific "unique" projects in all manifestations of "uniqueness" – starting from necessity and ending with methods of creating project products [2]. This was reflected in the fact that appropriate knowledge models, methods, and tools appeared, followed by standards describing the logic of management at levels "above the project" – programs and project portfolios. This transformation has occurred in all major knowledge systems that are associated with providers of systems such as PMI, IPMA, and AXELOS, and newly created systems are based on this at first (like the PM2 Alliance). The second transformation is a very aggressive bid for primacy among methodologies by the "flexible approach", which did not declare itself as a methodology at all [3]. But, no less, on its basis, such a framework as SCRUM initially declared itself, which later offered its "scaling" to the level of the entire organization, claiming the influence that classical methodologies, often called "waterfall", could earn [4].

The third transformation was rather a consequence of the first and second – the close penetration of the "product-oriented" approach to project management, which was the result of understanding the need to expand the scope of "project management" beyond the actual physical product of the project, and focused on achieving the benefits that were envisaged from the implementation of the project during its full life cycle - up to before the liquidation (replacement) of the exploited product of the project [5]. As a fourth transformation, it is worth talking about the role and place of "Industry 4.0" technologies in project management throughout the life cycle of modern high-tech projects in such areas as the oil and gas industry [6]. In this regard, it is worth noting not only the already mentioned well-known law of transition to a suprasystem and putting forward as a basic hypothesis regarding the existing contradictions in modern project management and methods of their solution that right now there is such a unification of several knowledge systems that have exhausted the very meaning of their development within themselves, and have been leading for quite a long time "border wars", which are expressed in constant "interventions" on the adjacent territories of other, previously quite "independent", fields of knowledge, that is, they are based on special forms of participation – agents [7].

Historically, there have been two approaches to the use of mathematical methods in the analysis of systems. The mathematical theory of abstract systems is considered as a theory of mathematical models of real-world systems, in which the basic properties of systems are investigated using fairly simple mathematical structures (which are consistent with the intuitive interpretation of these properties) [8]. As it was noted in 1976 and as it remains largely true today, this kind of general theory of systems is currently being developed on the basis of set theory and related fields of abstract mathematics [9]. The choice of such a basis for the general theory of systems is due to the fact that the objects studied in mathematics (regardless of which special section of it is implied in a particular case), in fact (and first of all), are sets and relations between sets and their elements [10].

The differences between separate areas of mathematics are determined mainly by what additional properties (i.e., what "structure") sets (and relations) are considered. It is necessary to distinguish between the objects studied in mathematics and the method of studying these objects [11]. The formalization of the latter process is the field of metamathematics, that is, the formal theory of deductive inference in mathematical disciplines [12]. Metamathematics, in turn, also uses various mathematical structures [13]. These structures are chosen on the basis of philosophical grounds, so they rather sharply reflect that it is intuitively (and on the basis of philosophical logic) that a deductive conclusion is accepted [14]. However, they constitute a special subclass of the class of mathematical structures, and therefore, from a purely abstract, formalistic point of view, they cannot be preferred when constructing a theory of the behavior of various really existing systems [15]. The mathematical structures commonly used in metamathematics are finite, however, more powerful mathematical methods have recently begun to be used here [16]. The introduction of non-finite methods into metamathematics

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made it possible to achieve greater simplicity and increased the effectiveness of research [17]. The above arguments explain why agent theory (i.e., mathematics) rather than logic (i.e., metamathematics) is used as the basis of the general theory of systems [18].

Materials and methods

The law of necessary diversity is one of the regularities of the feasibility of systems. For the first time in systems theory, W.R. Ashby drew attention to the need to take into account the ultimate feasibility of a system when creating it. He formulated a pattern known as the law of necessary diversity [19]. This law reflects the fact that the knowledge and methodological capabilities (potential) VN of a researcher of some N (a decision-maker) should exceed the complexity of the system D that he is investigating [20]. In control theory, it sounds shorter: the complexity (diversity) of the control system VN should not be lower than the complexity (diversity) of the controlled system VD. The problem of the researcher (supervisor/ project manager) is to reduce diversity (VD – VN) to a minimum, ideally (VD – VN) = 0.

In relation to the logic of the competence approach in project management, this means that the project team must have the necessary competencies that correspond to or exceed the complexity of the problems they solve during the implementation of the project. At the same time, of course, there may also be a situation of “firing a cannon at sparrows” – cola (VD – VN) <0. But, if, nevertheless, with regard to the project, we consider it as a temporary enterprise designed to obtain unique products, services, or other results, and assume a significant share of uncertainty about both the content of the project and the choice of team members, then we can hypothesize about the resulting lack of knowledge and competencies in project teams, which creates a risk for the implementation of the project, which is allowed only by the involvement of external (in relation to the project team) expertise.

It is worth noting that the proof of Eschbi’s theorem is possible under the condition that VD has a constant type value, and the expression VD−VN decreases under the condition of steady growth of VN. At the same time, if the decrease occurs in structure N, then the diversity in structure D determines the possibilities for creating an already controlling subsystem. If we go back to the history of determining entropy, L. Boltzmann was the first to establish a connection between entropy H and the thermodynamic probability of the state of the system W:

$$H = klnW \tag{1}$$

In our case, if we use the definition of entropy, based on the interpretation of the concept of entropy given by Schrodinger as a measure of system disorganization, for information systems we can adopt such a definition as entropy – this is how much information is not known about the system, then a reasonable question arises about how to measure it (entropy). Here we can build the following chain of reasoning based on the idea of what is considered “known” and “unknown”. In the works and in the methods of analysis that are proposed relative to the models constructed by them, such an approach is adopted – the system becomes fully “known” at a certain level of its “discrete development” (“Markov process step” n), when there is not a single element in the system (represented by the adjacency matrix of the corresponding degree) that would not be the influence of other elements of the system was revealed (or, what is the same thing, when there is not a single element in the system that would not affect other elements of the system). Accordingly, it is possible to calculate the number of missing links in the system (in particular, the author does this based on the construction of the reach matrix). At the same time, the entropy measurement should be based on an understanding of how many characters are needed to record the number of the microcycle state. Mathematically, this can be interpreted as a logarithm:

$$S = log\ \Omega \quad (2)$$

This indicator is defined as the Boltzmann formula. When measuring microstates, the entropy may be zero. When considering two systems, the total entropy is defined as the total:

$$log(AB) = log\ A + log\ B \quad (3)$$

Accordingly, if we consider the project as a system consisting of several subsystems, then we should also expect the implementation of this logic. In the case of our example, the ICB IPMA competence system can be considered as a combination of three systems – behavioral (P), technical (T) and contextual (K):

$$log(PTK) = log\ P + log\ T + log\ K \quad (4)$$

Expanding the idea of the integrity of the system by including "system (S)" (aimed at "understanding") and "digital (D)" (aimed at using modern information technologies) elements in it will lead to an even greater increase in entropy due to the growing complexity of its structure, which already includes five microstates:

$$log\ (PTKSD) = log\ P + log\ T + log\ K + log\ S + log\ D \quad (5)$$

If there are no losses of the information cycle, then the Hartley formula is used:

$$I = log_2 N \quad (6)$$

where: N is the structure of the notation, I is the symbolic amount of fullness of the message. If the events are independent, the Shannon formula is used:

$$H(x) = \sum_{i=1}^{n} p_i log_2 p_i \quad (7)$$

The resulting value is understood as an equation for the entropy state of the system. The private entropy is defined as:

$$H_i = -log_2 p_i \quad (8)$$

For the example under consideration, it can be shown that, if considered as a control subsystem of IPMA ICB, it is possible to determine the "information flow", the "output" from the corresponding element in the adjacency matrix during the transition of the adjacency matrix of degree n−1 to n, and the entropy of this element is considered to be everything that influenced this element from others elements. Or, perhaps, it is more correct to consider the "absence" of influence – for example, counting "zeros" in the matrix, not "ones", and for higher-order matrices - subtracting the value of any element from the value of the maximum element of the matrix, thereby equating it to zero as "complete knowledge" of such an element). In such logic, external knowledge/influence can be negative and compensate for the increased entropy of the system. In some "analogies", audit, consulting, and training of project team members can be used as such "external knowledge" (in the context of IPMA ICB).

In such a logic, the "entropy of competencies" can be minimized by working (spending "energy") aimed at obtaining ("accounting") knowledge ("influences") on this element from all other elements of the system. It is interesting to draw the following analogy – to determine

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the "power of the alphabet" of a professional language (glossary), if we consider the elements of competencies as elements of such a "language". If we consider IPMA ICB4 as elements of such an alphabet, then, according to the formula that determines the amount of information, we will find: N= 28 (the number of elements of competencies); the nearest integer value is b=5 (2x2x2x2x2=32). Any "informational message" will then look like a "vector" reflecting the number (presence) of impacts from any "sender" to the entire "system" (a set of "recipients", including possible feedback from the "sender" to himself).

It is clear that such a representation is very simplified – it would be more correct to consider as a single symbol" not an element of competence, but, for example, an element of a professional glossary, in terms of which the elements of competencies are described. In this case, of course, the hierarchical structure for the "system model" of competencies would acquire another level ("intersection" into "sets of finite elements", which, in this case, would no longer be obtained from the names of the elements of competencies, but from terms and definitions).

Results

As an example, let's consider the list of problems, the solution of which is necessary for the development of an agent-oriented model in the management of the oil industry of Kazakhstan, which includes, in particular, such problems as: transition to the modular principle of building management programs, which will allow for flexibility and variability of the model in the management of the oil industry of Kazakhstan, greater compliance with market demands; wide the use of new management technologies and other methods that stimulate the activity of agents. The presented list of problems does not create an opportunity for their structuring and building of a clear and technological scheme for their solution, which is very likely to lead to the failure of their implementation in the complex, and, accordingly, leads to the non-receipt of the desired product of the project. The development of product requirements should include the process of identifying, formulating, analyzing, documenting, and verifying the requirements to be fulfilled in the product. And the formation of a list of problems in such logic to be a scientist of some useful and interrelated intermediates (functional) of the final product. It is proposed to use the same universal tools to solve the structuring problem:

- Graph theory.
- Markov methods.
- The theory of decision-making under uncertainty (game theory).
- Microsoft Excel toolkit.

It is proposed to carry out an additional division of the list of problems with the subsequent determination of the logic of possible relationships between the conditions that can be created when solving each of them, assuming the possibility of using such created conditions as prerequisites for a more effective solution of other problems from this list. In fact, this is the construction of a directed graph, the vertices of which are identified on the basis of the analysis of the problem, and the edges have a positive effect from solving a specific problem to solve other problems in the appropriate direction. Based on this logic, we present the resulting oriented graph in the form of an adjacency matrix, where "1" will mean the presence of such a connection (edges) between the problems (vertices of the graph) in the direction from the element in the row to the element in the column, and "0", respectively, the absence of such a connection. The matrix obtained by the described method is shown in the following figure (see Fig. 1.)

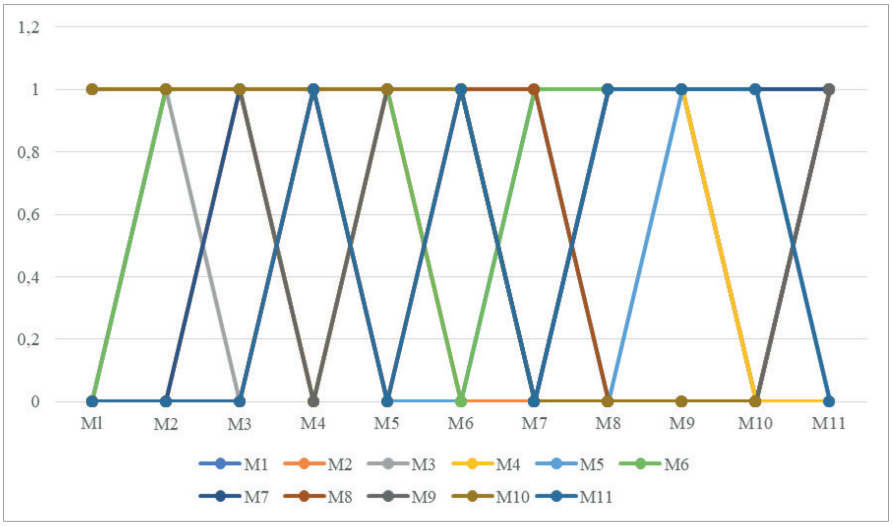

Figure 1. The adjacency matrix of the first stage for this system of problems

Further execution of the analysis steps of the resulting system, according to the described methodology, leads to obtaining an adjacency matrix (if the system is ergodic), which by an order of n no longer contains "zero" elements, i.e. the possibility of obtaining such a matrix indicates that there is not a single such element in the system that would not, directly or indirectly (but not more than for (n-1) other elements) influencing any other element of the system. The smaller the degree of the adjacency matrix (n), the stronger the internal connections the system in question has. In our case, we need an adjacency matrix "assembled" already for n = 2. Figure 2 shows the adjacency matrix of the second degree for the system of problems under consideration.

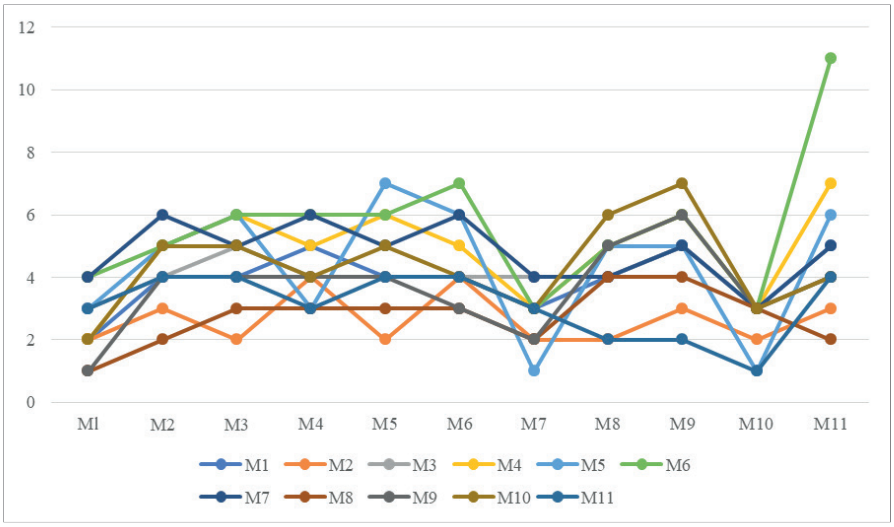

Figure 2. The adjacency matrix of the second degree for the system of problems under consideration

To understand the logic of the interaction of elements in this system, we will recombine columns and rows in descending order to obtain a matrix that visually forms the "system landscape" of the analyzed system. Figure 3 shows the recombined adjacency matrix of the second stage for this system of problems.

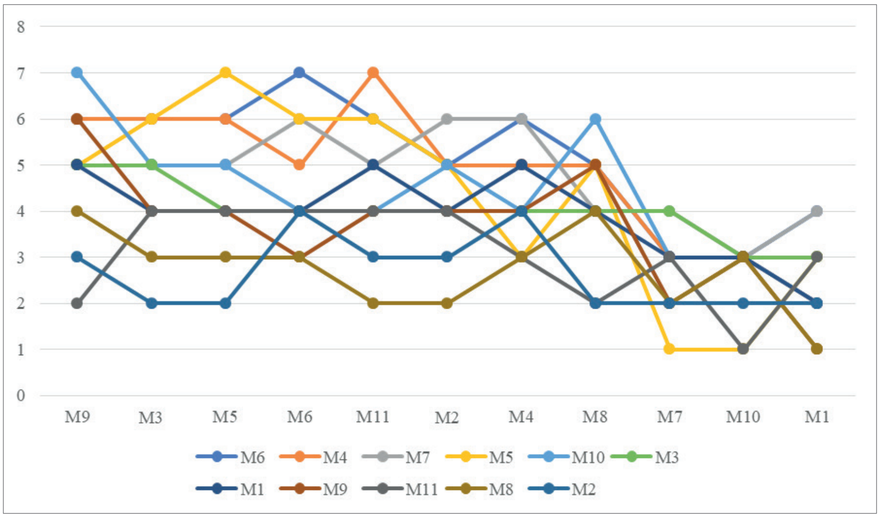

Figure 3. Recombined adjacency matrix of the second stage for this system of problems

It is logical to assume that by influencing the elements of the rows in the upper left quadrant, the maximum impact will be exerted not only on the corresponding columns from the same quadrant, but will also have the maximum impact on all other elements of the system. Obviously, such matrices can be considered in general terms as payment matrices. On the other hand, it is possible to check the presence of a "saddle point" in this system, which will mean that it will be possible through one element (one solved problem from our list) to get the maximum effect on the scale of the entire system. The result of completing the second-order adjacency matrix with the corresponding additional row containing the maximum value from the corresponding column and an additional column consisting of the minimum value in the corresponding row is shown in Fig. 4. Figure 4 shows the adjacency matrix of the second degree as the "payment matrix" of this problem system with an additional column and row for analyzing the presence of a saddle point.

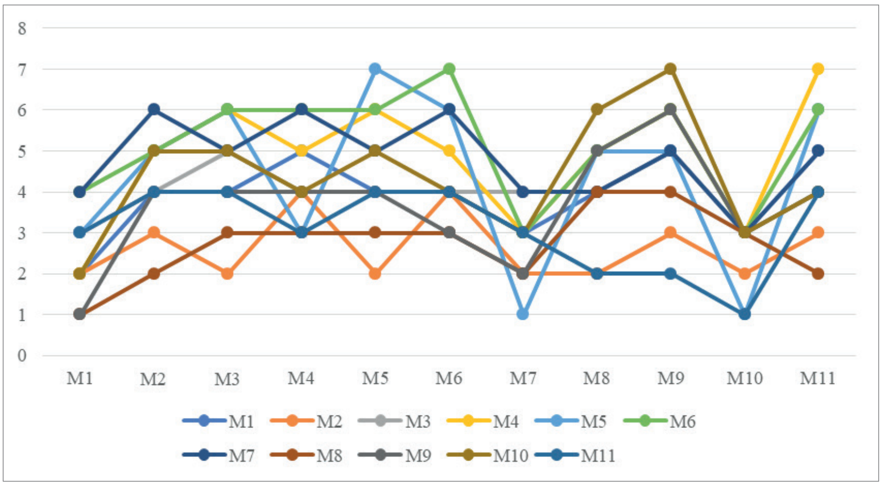

Figure 4. The adjacency matrix of the second degree as a "payment matrix" for this system of problems with an additional column and row for analyzing the presence of a saddle point

The meaning of such an interpretation will be clearer when completing such a column and row (in search of the presence of the same element in them) for a recombined matrix. Figure 5 shows a recombined adjacency matrix of the second degree as a "payment matrix" for this system of problems with an additional column and row for analyzing the presence of a saddle point.

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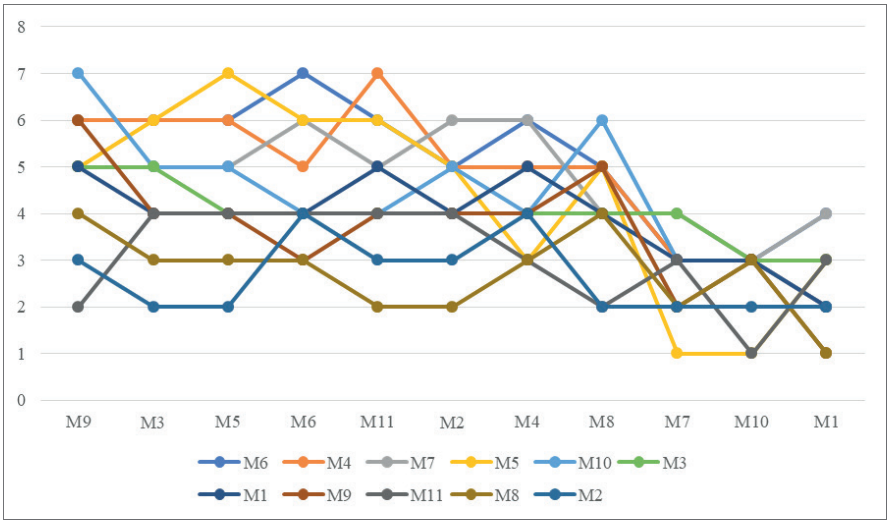

Figure 5. Recombined adjacency matrix of the second degree as a "payment matrix" for this system of problems with an additional column and row for analyzing the presence of a saddle point

It is obvious that the analyzed system (its "payment matrix") does not have a saddle point, accordingly, it does not have any "pure" or "dominant" strategy (in our case, a "supereffective" one, in the case of its implementation, problems). On the other hand, it is obvious that there is some kind of "mixed" strategy that can give the maximum result. In this case, the most effective combination would probably be the priority solution of such problems as M9, M3, M5, M6, M11, and M2. Equally obvious is the use of other decision-making methods from the field of game theory, including both the formation of strategies aimed at trying to maximize the possible effect, as well as an approach related to minimizing losses.

As for the high rating in the M9 problem, then, perhaps, if we do not consider its formal solution as a kind of "goal in itself", it is quite possible that the solution to this problem, in the case of which a high "recognition" of agent processes will be achieved, then, as shown by the model developed when analyzing the logic of developing in-demand agency programs, this factor will definitely increase the competitiveness of such a program, and, as can be seen in Fig. 6, the analysis of such a matrix shows that the greatest value from the implementation of such a program may lie not only in the priority developments received in the oil and gas industry, but also in the possibility of using such a program as an element of the "designer" of another program. In Figure 6, you can see the "System Landscape" for the adjacency matrix of the third-order properties of the agent program.

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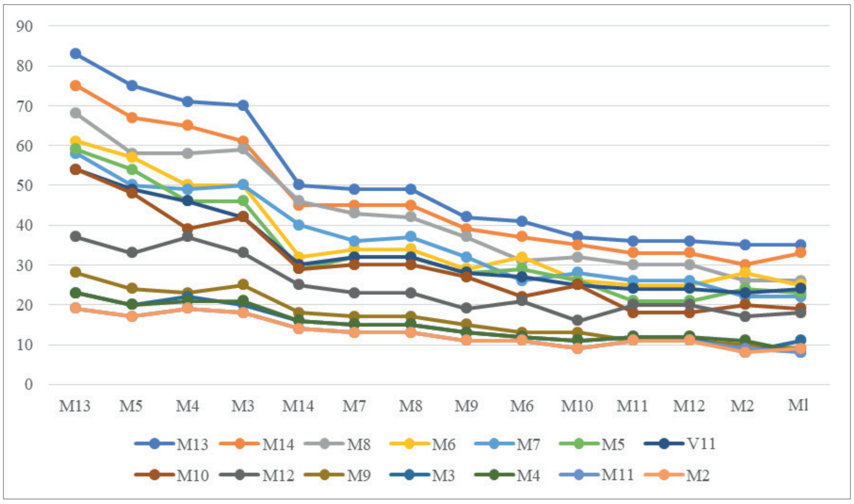

Figure 6. "System landscape" for the adjacency matrix of the third order properties of the agent program

The proposed approach is based on a formal analysis of the relationships between the elements of this system. At the same time, such an approach can be a strong point of such a decision-making method, in particular, which allows you to make independent decisions. On the other hand, one way or another, the very definition of connections in the system can be quite subjective, unless you use a large number of observations (measurements, experiments, experts, etc.) to determine the objective nature of the presence of such connections. At the same time, the processing of the formal results of the analysis in the presented methodology takes place before the "stitching" of the indices with the values / concepts / entities that stand behind them. And this happens precisely at the final part of the analysis, as it is presented above – the list of problems, the need for the structuring of which was mentioned in the statement of the problem, is presented in Table 1. According to this logic, the proposed system of problems, even in the case of its ideal implementation, will be able to give the maximum effect in the following "technological sequence", as shown in Fig. 7, where the elements M1-M10 of this system are presented in the logic of priority from the maximum value to the minimum software per column (corresponding to their "rating" from the position of the Hurwitz criterion).

Table 1. Prioritization of problems based on the calculation of the Hurwitz criterion for this system of problems

4,6	Development of projects related to updating the content of education and technologies of agent models	M6
4,2	Ensuring the innovative nature of agent models through the integration of education, science and production	M4
4	Development of projects related to the development of various sectors of the economy, fundamental and applied science	M5
4	Entering the space of agent models	M9
4	Widespread use of new agent models, including remote diagnostics technologies	M11
3,6	The use of interactive forms of agent models, design and other methods that stimulate the activity of agent models	M2
3,6	Transition to the modular principle of building agent models	M3
3,6	Updating of the material and technical base and infrastructure of agent models, its more intensive informatization	M8
2,2	Using methods that form information analysis skills, increasing the role of agent models	M1
2,2	Creating conditions for the investment attractiveness of the system of agent models	M7
1,8	Formation of a common space of agent models in the EAEU	M10

The resulting "backlog" in this form can already be used to build a "roadmap" of the entire project. In particular, the presented methodology can be used in the analysis of not only individual problems of a specific project, but also in the analysis of strategic initiatives of the organization with the subsequent formation of a portfolio of projects and programs in the activities of the organization of the strategic project management office.

Returning to our problem, it is clearly seen that with such an assessment methodology, the number one priority will be precisely M6 – the development of projects related to updating the content of agent models with a transition (and possibly with a parallel start) to M4 – ensuring the innovative nature of agent models through the integration of education, science, and production. And only then think about everything else, including modular programs and design forms of agent models. During the initial phase of the study, a primary hypothesis was formed, which consists of rethinking the role of an "expert user" into the role of an "expert architect" forming a set of competencies for agents and then switching to the role of an "expert facilitator" in the course of accompanying agents during their passage of relevant blocks with certain content. As such a logic for further development of the "pilot course" created according to such a model, it is proposed to consider an element of the modified PDAA model, where A = Assess, as proposed, which is very close in essence to the earlier modification of the PDCA-PDSA model, where S = Study. Figure 7 shows the system landscape for the adjacency matrix of the third stage for the extended PDAA model.

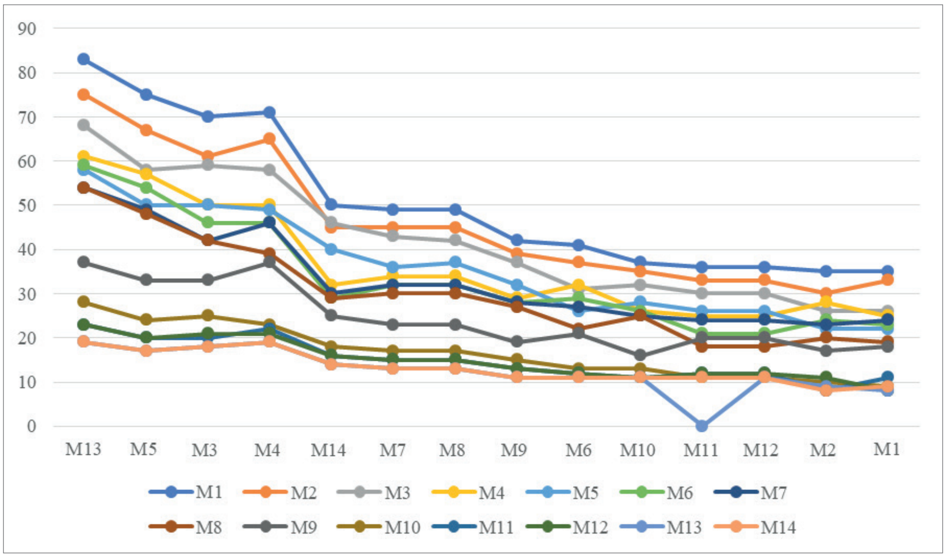

Figure 7. System landscape for the adjacency matrix of the third stage for the extended PDAA model

The analysis of simulation modeling performed on the basis of the model analysis is also indicative. When constructing a matrix of transition probabilities between factors based on an expert assessment of the model, an approach based on the Laplace criterion was used to select possible values for each of the rows of the resulting matrix, as shown in Figure 8.

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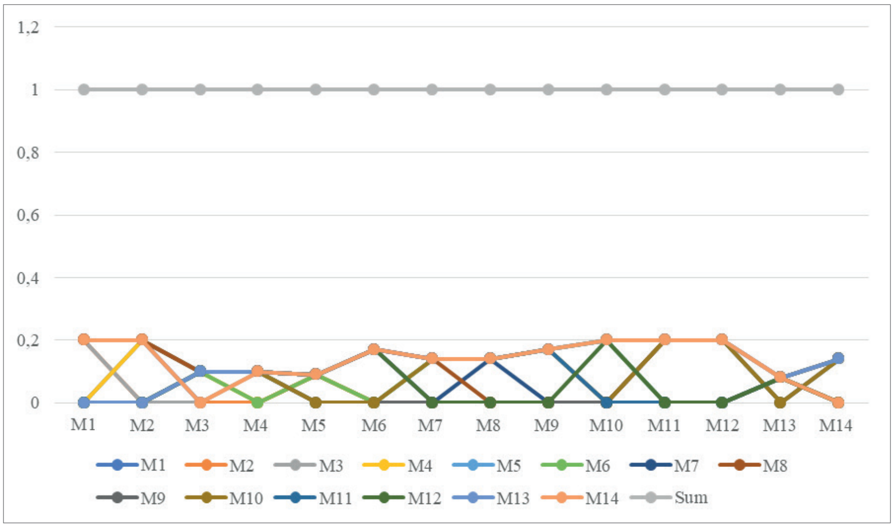

Figure 8. Transition probability matrix for the adjacency matrix for the extended PDAA model

As can be seen from the transition probability matrix constructed on the basis of this matrix, transients, if you start in simulation from the state corresponding to the start of adaptation of the agent model as a reference model, which provides the maximum probability that the main success indicators will be achieved, namely, the "Win-Win" state is reached - when the consumer receives as a result of his participation in such a project, there is not only "some" knowledge, but also recognition of the quality of such a model by other authorized and recognized providers of the oil and gas market. And the provider gets the maximum probability of selling additional, already paid services "accompanying" the main one, provided free of charge, and, as can be seen from the logic of the model itself, at almost every step of the stakeholder interaction process with the system.

Discussions

It would probably be more correct to consider the use of criteria such as the Hurwitz criterion and the Hodge-Lehman criterion, which operate with such a parameter as "the degree of confidence in the position of "extreme caution", which allows you to get a more balanced decision. In particular, Table 2 shows an example of calculating the Hurwitz criterion for this system with the corresponding set of values in columns "H" and "B" corresponding to the position of "Pessimism" and "Optimism" (usually denoted as the parameter "V").

Table 2. Calculation of the Hurwitz criterion (at V = 0.4) for a recombined adjacency matrix of the second degree as a "payment matrix" for this system of problems

Factor name	To	M6	M4	M7	M5	M10	M3	M1	M9	M11	M8	M2						
From	2	6	4	7	5	10	3	1	9	11	8	2	min	max	P	0	R	Rmax
M9	9	6	6	5	5	7	5	5	6	2	4	3		7	0,6	0,4	4	4,6
M3	3	6	6	5	6	5	5	4	4	4	3	2	2	6	0,6	0,4	3,6	
M5	5	6	6	5	7	5	4	4	4	4	3	2	2	7	0,6	0,4	4	
M6	6	7	5	6	6	4	4	4	3	4	3	4	3	7	0,6	0,4	4,6	
M11	11	6	7	5	6	4	4	5	4	4	2	3	2	7	0,6	0,4	4	
M2	2	5	5	6	5	5	4	4	4	4	2	3	2	6	0,6	0,4	3,6	
M4	4	6	5	6	3	4	4	5	4	3	3	4	3	6	0,6	0,4	4,2	
M8	8	5	5	4	5	6	4	4	5	2	4	2	2	6	0,6	0,4	3,6	
M7	7	3	3	4	1	3	4	3	2	3	2	2	1	4	0,6	0,4	2,2	
M10	10	3	3	3	1	3	3	3	3	1	3	2	1	3	0,6	0,4	1,8	
M1	1	4	2	4	3	2	3	2	1	3	1	2	1	4	0,6	0,4	2,2	

In such a logic, a more promising approach would be to determine the next prioritization in the implementation of the designated problems as M6, after which M4, and after that move to M9, M5, M11, then to M3, M2, M8, and perhaps M7, M1, and M10 will no longer require much effort for their implementation. If we calculate the Hodge-Lehman criterion (and any other known ones), which is not difficult given the capabilities of modern tabular reactors, in particular, Microsoft Excel, then, as can be seen, the situation will not change dramatically for M7, M1 and M10 anyway (Table 3). It is interesting in this particular case that according to the general logic of prioritization, the calculation data of such criteria as “maximax” (maximizing the possible effect) and the more balanced Wald criterion (Maximin criterion) are consistent.

Table 3. Calculation of other various criteria for a recombined adjacency matrix of the second degree as a “payment matrix” for this system of problems

1-V	V	Hurwitz		MaxiMax		MaxiMin (Wald)		BL		HL		LL		Factor name
p	0	R	Rmax	R	Rmax	R	Rmax	R	Rmax	R	Rmax	R	Rmax	
0,6	0,4	4,6	4,6	7	7	3	3	4,545		3,6182	3,6182	50		M6
0,6	0,4	4,2		6		3	3	4,273		3,5091		47		M4
0,6	0,4	4		7	7	2		4,909	4,909	3,1636		54	54	M9
0,6	0,4	4		7	7	2		4,545		3,0182		50		M5
0,6	0,4	4		7	7	2		4,545		3,0182		50		M11
0,6	0,4	3,6		6		2		4,545		3,0182		50		M3
0,6	0,4	3,6		6		2		4,273		2,9091		47		M2
0,6	0,4	3,6		6		2		4,182		2,8727		46		M8
0,6	0,4	2,2		4		1		2,727		l,6909		30		M7
0,6	0,4	2,2		4		1		2,455		1,5818		27		M1
0,6	0,4	1,8		3		1		2,545		1,6182		28		M10

As can be seen from the presented, the three elements (M7, M1, and M10) of the system, when using any of the criteria to assess the degree of their influence, are consistently at the end of the list. On the other hand, there is no doubt about the group of “leaders” - M6, M4, M9, M5, and M11, including when evaluating using other criteria. And if it makes sense to understand in more detail the prioritization of problems that were included in the first half of the list, perhaps, during the discussion of their specific content, then, perhaps, regarding the second, lower part of the rating, there is probably no sense in discussing the initiation of these problems before the completion of the previous ones. So in this sense, the proposed method can be considered as “Occam’s razor”, with which you can quickly cut off excess: “There is no need to multiply entities unnecessarily.”

Conclusions

The obtained results of constructing a diagram of transients, at first glance, contradict the logic of the factors presented on the recombined adjacency matrix of the 3rd order, which was chosen to build a “system landscape” on its basis (due to the absence of “zero” elements for the 2nd degree in the resulting matrix. In the “system landscape”, the desired elements are also at the “top” in terms of the degree of impact, but from the point of view of “influence”, it is just the most difficult to achieve – this indicates that in order to really achieve this “Win-Win” state, it is necessary to constantly keep in focus the main value – the creation of a quality product, and only after that, count on financial success.

The proposed model can be used as a “control Markov double” for created digital products in the field of oil and gas, implementing the “Free-to-learn” business model, as well as to test the viability of MVP in the field of startups. This approach corresponds to the logic of the “V-V”

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model built on the basis of the original model. On the other hand, such an approach is able to ensure the implementation of a "knowledge funnel" on the one hand, on the other hand, to become a kind of "game" capable of "keeping" such a "player" in the system for a certain time, ideally for life, which can become an element of the implementation of the concept of long Acticity and the basis for a new concept of corporate interaction.

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