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METASYSTEM OBJECT DESIGN UNDER CONDITIONS OF THE ANTICIPATORY ENVIRONMENTAL IMPACT

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Abstract

The relevance of this study lies in identifying mechanisms that prevent a control system from entering an unstable state. As such means, an approach is used that ensures the physical and logical independence of business information. Thus, the inclusion of effective proposals for its improvement in the next version of the system is carried out. The performance of these proposals is rooted in the prompt detection of efficiency losses, accompanied by the development of corrective mechanisms that ensure uninterrupted operation under adverse environmental conditions.

Keywords: organization, transformation, restoration, growth, trials, decline, functioning

1 Brief Research Design

The study shows that new technical solutions aimed at satisfying the systemic property of emergence contradict the requirements of the present time. The essence of the contradiction is that it is necessary not only to confirm, not so long ago, the “presence of the systemic property in the organization”, which was important from a practical point of view, but also to propose a program of innovations that guarantees the achievement of the specified efficiency limits in the medium term. We are talking about innovations to which investment-type requirements are imposed, the so-called “greenfield projects”. The formation of a package of proposals is carried out from two positions. Firstly, the effective selection of modifications occurs on the basis of agreed high-level specifications. Secondly, compliance with efficiency in the context of the system’s goal is confirmed in accordance with the procedures of cost management. Within the framework of such procedures, new proposals are imposed on the model of the operating enterprise. The practical application of such an approach, taking into account, on the one hand, the contribution of each improvement, and, on the other hand,

eliminating the acceptance of ineffective applications, made it possible to identify the research problem. Its formulation is reduced to the following expression: "It is impossible to maintain the operability of the management system in the absence of mechanisms for the justified selection of proposals for improving the organization." Such mechanisms are an organizationally separate set of tools, on the basis of which the system is isolated from the environment, functioning during its entire life cycle. Thus, the management of the system change is carried out as part of the methodology that ensures compliance with the principle of physical and logical independence (PLI) [1]. This methodology was the basis for the transition to a new object used in Engineering Systems (Eng_S) applications [2]. The transition to PLI objects is caused by the reaction of system developers to new influences of the external environment. The study shows that new technical solutions aimed at satisfying the systemic property of emergence contradict the requirements of the present time. The essence of the contradiction is that it is necessary not only to confirm, not so long ago, the "presence of the systemic property in the organization", which was important from a practical point of view, but also to propose a program of innovations that guarantees the achievement of the specified efficiency limits in the medium term. We are talking about innovations to which investment-type requirements are imposed, the so-called "greenfield projects". The formation of a package of proposals is carried out from two positions. Firstly, the effective selection of modifications occurs on the basis of agreed high-level specifications. Secondly, compliance with efficiency in the context of the system's goal is confirmed in accordance with the procedures of cost management. Within the framework of such procedures, new proposals are imposed on the model of the operating enterprise. The practical application of such an approach, taking into account, on the one hand, the contribution of each improvement, and, on the other hand, eliminating the acceptance of ineffective applications, made it possible to identify the research problem. Its formulation is reduced to the following expression: "It is impossible to maintain the operability of the management system in the absence of mechanisms for the justified selection of proposals for improving the organization." Such mechanisms are an organizationally separate set of tools, on the basis of which the system is isolated from the environment, functioning during its entire life cycle. Thus, the management of the system change is carried out as part of the methodology that ensures compliance with the principle of physical and logical independence (PLI). This methodology was the basis for the transition to a new object used in Engineering Systems (Eng_S) applications. The transition to PLI objects is

caused by the reaction of system developers to new influences of the external environment. Such an object, being a meta-object, is focused on the toolkit of maintaining agile goals, taking into account the distributed responsibility of individual participants in the organization.

Cognitive activity with regard to the metatype object in question is directed towards the subject that provides the superposition of organization. The application of the superposition effect, in which the "imposition of a new proposal on the model of the operating enterprise" is carried out, is performed on the basis of high-level specifications. Such specifications, synchronizing market proposals with industry requirements, describe a change in the system's operating mode. Due to the new superposition status of the object, the system is configured to select an operating mode. In this case, a specific object corresponds to each mode. This eliminates the drawback characteristic of the System Engineering (S_Eng) approach [3]. Since the S_Eng approach is focused on working with one object, then to prove the restored stability it is sufficient to ensure compliance with the emergence property at the level of object immutability. Such actions guarantee the result with the immutability of the input information and are reduced to checking the conditions of the system's goal, specified by one complex performance indicator. This is not enough for a metaobject, since different forms of the object manifest themselves in different operating modes, it is necessary to check the system of performance indicators [4]. For a metaobject it is not enough, because different forms of the object manifest themselves under different modes of functioning to carry out the verification of the system of performance indicators. In this regard, the use of superposition effect as a subject of study not only prevents the spread of the emergent effect but debugging the system according to the new beginning without compromising the authenticity of the object. In this way the alignment of the meta-object and the new subject is achieved.

The purpose of this study is to develop a procedure that ensures the achievement of a given level of efficiency before and after changing the system's operating mode. It should be noted that four independent operating modes are set for the meta-object. In this case, each mode is an object for a certain group of subjects. This is where the prefix 'meta' appears in the main element of the methodology.

According to the introduced clarification, four tasks of this study were formulated. It should be noted that a unique approach to measuring efficiency is calculated for each task. In accordance with the formulated goal, the following tasks were set.

1. To assess the current state of the organization by means of diagnosing its growth.
2. To select a short-term growth option based on the mechanisms for analyzing the organization's development.
3. To implement a medium-term scenario for the organization's development in the context of the formation, distribution, use and control of its resources.
4. To ensure the collection of complaints and deviations from the standard, identified throughout the full cycle of the organization.

Regardless of the level of the selected mode, all actions of the meta-object users are aimed at complying with the rules for supporting S_Eng applications. In other words, the subject of the meta-object must meet the requirements set at the S_Eng level. In terms of systems theory, the subjects of S_Eng function under conditions of observing the property of emergence. Therefore, in relation to the transition from the object to the meta-object, control of the system property is carried out in order to eliminate deviations. Despite the significant difference in the initial information involved in solving each of the designated problems, unique algorithmic tools are used. Such tools are adapted to a specific mode. In the event of a message about a negative state, a transition to a certain mode is carried out in a strictly established sequence. First, growth diagnostics is carried out, then – development analysis, then the results of resource distribution are processed, and it ends with the collection of complaints. This is achieved by maintaining the principle of physical and logical independence.

The practical value of the study is that the transition to a meta-object allowed for sustainable growth of the organization in the conditions of changing operating modes. By contrast, traditional statistical methods—aimed at proving efficiency—often force frequent operational halts, causing not only leadership disruptions but also additional costs. Enterprise owners thus gain an adaptable tool which, once tailored to their specific needs, allows performance measurement at any point in the organization's lifecycle.. Thus, the main drawback of modern complex systems associated with the so-called effect of "identifying a link that attracts special attention" is eliminated. According to rule 2/98, in conditions of inoperability, the main efforts are directed at identifying and correcting the bottlenecks of the system that destroy its stability. This drawback is called "Organizational imbalance".

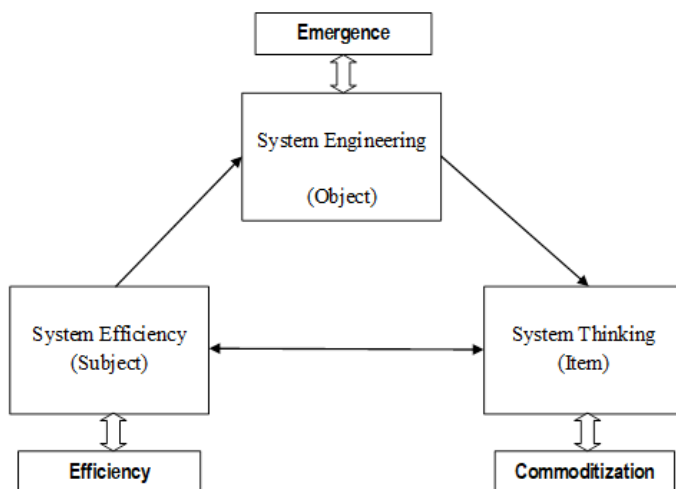
2 Organizational Imbalances Eliminating

The previous section shows that it is no longer enough to debug the system after introducing a package of corrections of suggestions received from

departments engaged in direct interaction with the client. High qualification of IT specialists and access to modern software tools do not cause problems to satisfy in the shortest time the whole set of dissatisfactions received from users. However, difficulties begin in the organization if among the introduced changes there were no requests that included hidden prerequisites for loss of stability. In other words, the next version missed errors of the second kind [5]. The level of such errors has destructive consequences in the future. In addition, introducing changes to the next version may turn out to be incompatible at the software level with the improvement suggestions implemented in one of the previous versions. With this approach, there comes a time when the organization experiences enormous difficulties, since for some time it is unable to independently cope with the functions assigned to it. Examples include cases of cost overruns, downtime, and invitation of third-party consultants. The reason for getting into such a state is a shortcoming typical for organizations that, in situations of loss of stability, direct their efforts to return the system to the emergent state. Let us consider the prerequisites caused by the desire to preserve the property of emergence when implementing the next version of the system. First of all, the factors are identified due to which the system is unable to preserve the established features and standards. After that, innovative proposals are developed, the implementation of which confirms the presence of the property of emergence in the system. As evidence, facts are attached that the value of the performance indicator falls within the specified interval. This technology is well developed and does not require large expenses for corrections. In most cases, notifications of a complaint nature are used as factors influencing the loss of stability. Such notifications come from system clients, which are received by employees of different functional departments. In total, small costs for rework, quick return to a stable state, satisfaction of user dissatisfaction create prerequisites for the application of System Thinking Technology (STT) [6]. Such technology is effectively applied in conditions of a guaranteed development fund and an established schedule of changes. STT is the subject of the System Engineering methodology. Fig. 1 shows the interaction diagram of three main elements: object, item, subject.

STT is aimed at providing clear management of the entire activity. Its clarity is conditioned in the context of ensuring a given level of efficiency, and therefore excludes any effectiveness on the part of individual participants. However, in the conditions of frequent modifications of the system and a large number of complaints, conflicts of interests of individual services of the organization are inevitable. At the same time, representatives of the services, first of all, are interested in eliminating dissatisfaction arising from the clients

with whom they interact. In addition, the selected innovative proposals are a source of additional income. The described circumstances are the source of the manifestation of the effect of effectiveness. Therefore, all aspirations to ensure the transfer of the system to a stable state by means of observing the emergence conditions do not seem possible. In such situations, when the management of organizations using ST technology as a subject loses full control over the activities of the organization, the so-called "organizational bias in favor of private opinions" is observed. To eliminate it, it is necessary to make a transition to a new type of subject, within which both private interests and private changes in the system would be combined. Such a transition is shown in Fig. 2.



**Figure 1. Scheme of object description
in terms of System Engineering methodology**

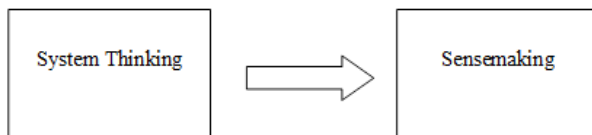


Figure 2. Changing the subject of research

The object used is the Sensemaking Unit (SMU).

SMU combines the functions of a four-level device:

- Bio-vital (reproduction – reaction to destruction);
- Conceptual (goal setting, organization);
- Technological (overcoming crises: B, C, A, L);
- Constructive (V, M, S, G, P, D, C, A).

Fig. 3. shows a conceptual diagram of the description of the meta-object

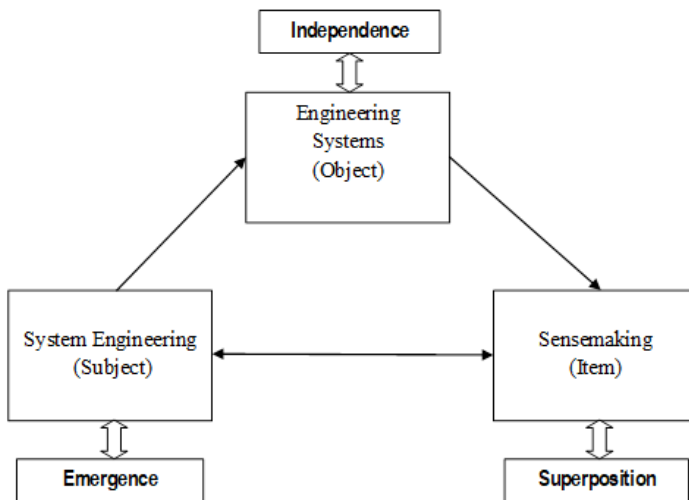


Figure 3. Scheme of conceptual description of a meta-object in terms of Engineering Systems methodology

The replacement of the subject required the change of the object and the subject (see Fig. 3).

The new scheme reflects the change of the status of the S_Eng object. Compliance with the "Emergence" property at the system level is characterized as an active desire to ensure the principle of physical and logical independence. Thus, for the Eng_S methodology, the object of study is the PLI approach. Sensemaking technology (SMT) [6], considered as the subject of the meta-object, uses the "Superposition" mechanism. Its content is revealed by superimposing new projects on the model of the current organization. The novelty of the project is manifested not in the elimination of the traditionally used fixation of complaints, but in the improvement of the

system, capable of overcoming the negative impact of the external environment in the future. In fact, a complete modernization of the system occurs. Not only errors of the second kind according to Shewhart and Deming are revealed [5]. But the main thing is found, and then the damaged link is corrected, causing significant efforts to change the organization.

As part of the ongoing improvement, tools are developed that lead to an increase in the growth potential of the organization. The results of ineffective management are assessed in terms of SGR methodology.

3 Metaobject modes

First of all, it is necessary to highlight the highest level mode. We are talking about the object of diagnostics, reduced to the current assessment of the state of the organization. Users of the assessment are persons with special powers. As a result, users of the first level object, interested in the growth of the organization, have an active impact on the quality of the diagnoses issued.

The second mode is characterized as an object of analysis. The main function of the analysis is expressed in the organization of control of activities carried out over a short-term period of time. In other words, the results of control are used by persons who, on the basis of annual reports, receive evidence confirming the fact of the organization's development.

The third mode is configured to describe the object of processing business information collected during the implementation of a medium-term scenario, usually set in the period from three to five years. The clients of the system are the managers of the organization, endowed with the functions of the best distribution of the organization's resources.

The fourth mode reveals the contents of the object associated with the collection of notifications from a wide range of users of the organization throughout the life cycle of the organization. The long-term perspective of the collection procedure is to record the proposals accepted during the analysis of events that are prerequisites for the destruction of the organization. Such events are the results of violation of the established operating regulations and are deviations from the approved standard. Moreover, notifications of a complaint nature can be selected, which describe proposals concerning the justified improvement of the organization's activities.

The description made in relation to the meta-object allowed us to develop an approach to its construction. This approach takes into account the requirements for the compatibility of two constructs in the device, one of which is a meta-technology and the other a meta-system.

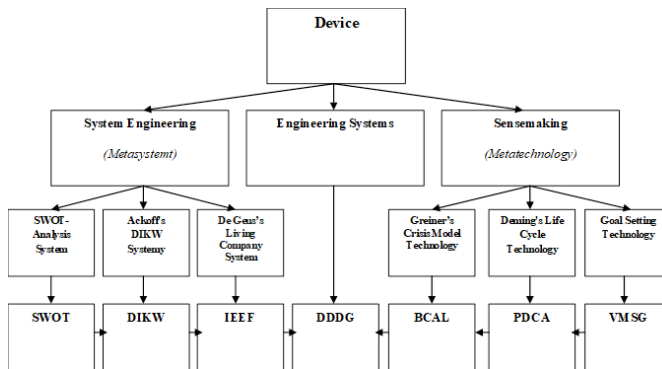
4 Creating a device

The presence of a description of four modes identified after the elimination of the organizational imbalance allowed us to find grounds for moving to the place of loss of control. We are talking about combining two structures within one device (see Fig. 4).

Table 1

Description of metaobject modes

Level	Mode	Function	Duration	Potential for change	Interests	Key efficiency indicator parameter
1	Bio-vital	Diagnostics	Long-term perspective	Growth	Owners, developers	SGR
2	Conceptual	Analysis	Medium-term scenario	Development	Investors	ROE
3	Technological	Processing	Short-term option	Distribution	Financial manager	CTR
4	Constructive	Collection	Current moment	Destruction	All participants	ROI

**Figure 4. Scheme of designing the device of the metaobject**

The principle of operation of this device is aimed at protecting the metasystem from the use of ineffective algorithms. It should be noted that the main harm to the organization is caused by unadjusted algorithms, as well as algorithms that have organizational redundancy.

The first design is associated with finding a weak link and developing algorithms for transferring the system to a stable state. The "Production of Meaning" design uses the goal-setting foundations of the VMSG technology (vision, mission, goal strategy) in the context of identifying a weak link, as

well as PDCA technology. Combining two technologies allows you to test the organization in the conditions of BCAL crisis management technology (bureaucracy, control, autonomy, leadership) [7]. As a result, access is closed for proposals, the use of which destroys the value of the organization, and the problem of superficial selection is eliminated.

The second design is used as an implementation of the described algorithms, their testing, implementation, and development of operating instructions. The device includes elements of three systems: SWOT analysis, DIKW purposefulness (data, information, strategy, purpose) and the living company Arie De Geus IEEF (Involvement, education, feeling, justice) [8]. The developed designs made it possible to develop a program for diagnosing the state of an organization in the context of assessing the influence of the external environment. Such a program includes four functions for measuring the potential of an organization: diagnostics, analysis, processing and collection. The correctness of the functions identified during the analysis of the device designs is checked in the context of their application when creating a toolkit that allows for timely determination of the state of exit from a stable state. Such a check is carried out taking into account their completeness (completeness and integrity). The condition of timeliness is considered in terms of advanced impact. Taking into account two limitations, it is necessary to obtain a justification made in accordance with the requirements of the Engineering Systems methodology.

5 Conclusion

The scientific novelty of the study lies in the presence of a fundamentally new approach. In the course of constructing the meta-object, new methodological foundations were determined. Thus, the meta-type system (Engineering Systems) was used as a new object, and the meta-type technology (Sensemaking) was used in the context of the new subject. Their application allowed changing the position regarding the selection of applications for improvement. Ensuring compliance with the principle of physical and logical independence in accordance with the provisions of Engineering Systems, a new technology was adopted and debugged in accordance with the requirements for Sensemaking. Such technology includes two functions: the function of selecting effective innovations and the function of rejecting effective proposals. The direction of the accepted proposals is determined by the obligation associated with returning the organization to a stable state. The return is carried out by means of increasing manageability. Thus, a new quality of improvement is manifested, characteristic of the newly developed version of the management system. The version includes

compensatory mechanisms that provide a timely response to negative environmental influences. Taken together, such mechanisms form a device of advanced response, the basis of which is the goal-setting technology. Given the applied nature of the meta-object design, the second device was developed. Taking into account the conditions of advanced action, the basis of the device was the mechanisms of the goal-setting system. These mechanisms ensure comprehensive control of events that lead to a violation of the emergence property. The content of comprehensiveness is revealed on the basis of the automated diagnostic system developed in accordance with the rules of designing System Engineering. Observing the emergence conditions at all phases of the system life cycle, the fact of achieving a given level of efficiency is confirmed, and the fact of eliminating complaints made during the operation of previous versions of the system is demonstrated. The combination of the two above-mentioned devices, goal-setting technology and the goal-setting system, makes it possible to concentrate efforts to support the system on two most important points. In the first case, it is possible to clarify the bewilderment that arises regarding the challenges of the external environment. This is done by searching, finding and selecting such proposals, the implementation of which will protect the organization from losses and destruction. This is achieved by improving growth algorithms, development options, scenarios for the distribution of the main resources of the organization. In the second case, the system developers are freed from the effective pressure of individual participants in the organization, and are engaged in the implementation of effective proposals. Moreover, this is done according to the established schedule of changes (the principle of "forget the back and move on to the front"). Summarizing the two described points, the name of the meta-subject of the technology is determined, within the framework of which the functions of efficiency control in all modes of operation are implemented. When constructing a meta-object, cognitive activity is directed to the subject of "Superposition". In other words, the selection of proposals included in the changes to the future version of the system occurs in the format of tracking the most promising innovations, and as an unprepared response to a negative private opinion. At the same time, new innovative projects are painlessly superimposed on existing models, ensuring their full compatibility. The combination of two devices, the goal-setting technology on the one hand, and the goal-orientation system on the other hand, made it possible to identify four modes of the organization's functioning and develop a system for measuring performance indicators in each mode. The peculiarity of such a system is that when measuring a complex performance indicator in situations where it goes beyond the established

norms, not only the location of the violation of the operating mode is detected, but also the direct participant of the organization whose activity caused the occurrence of an event of negative content is determined. Thus, all participants of the organization contribute to the overall goal of the system. In addition, the presence of a reasonable structure was the basis for describing the principles presented to ensure sustainable growth of the organization. According to the approved principles, the developed automated system diagnoses the state of the organization for different periods of time. The results of the diagnoses are summarized in the form of issued conclusions on the state, and in the form of packages of promising recommendations for improving the activities of both the organization as a whole and its main participants.

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