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MODELLING AGILE-TRANSFORMATION ORGANIZATIONAL DEVELOPMENT PROJECT PORTFOLIO

Abstract: Agile transformation is a necessary process for companies in various fields of activity to ensure their competitiveness in modern business conditions when the uniformity of production processes and the growth of the level of customer (client) demands reduce the impact of traditional ones that remain competitive. Modern business is a «customer-oriented» business, in which instead or in addition to technological or marketing advantages comes the highest value of human resources and teamwork. That means Agile transformation provides companies with a transition to another level, and those who have not moved to this level remain outside of competitiveness, if not in the near term, then in a strategic perspective. Agile transformation is comparable to the need to intro-duce new technologies into production processes to replace obsolete ones since, without new technological solutions, the products created do not meet modern quality requirements or do not have a competitive cost price. Thus, Agile transformation ensures the introduction of new technology not only into the production process but into the management system and product creation processes within the framework of the project or project-oriented activities.

Keywords: Modelling, Agile, Transformation, Project Portfolio, Organizational Development

Introduction

Within the framework of Agile as Scaled Agile Framework (SAFe®) transformation, such a restructuring of the work of enterprises is carried out, in which the receipt of project products is accelerated on the one hand, on the other hand, the most complete coordination of the project team is ensured both with the customer, and between team members, and with other project teams of the enterprise. Created by Dean Leffingwell [1], SAFe (Scaled Agile Framework) is an interactive software framework that enables you to apply Lean-Agile and Scrum practices at large enterprises. SAFe Full Configuration consists of four levels: Team, Program, Large Solution and Portfolio. It is constantly being improved.

Agile transformation takes time and resources (for example, to develop and implement appropriate information platforms and decision support systems, create business process

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procedures, etc.) [2, 3]. Thus, this transformation is carried out through several relevant development projects, which must be organically coordinated with other areas of enterprise development projects. That is, the task arises of forming a portfolio of projects that meet both the traditional development goals and the goals of Agile transformation [4,5].

Analysis of recent publications and problem statement

According to the existing approaches, described above, a portfolio of company development projects should meet strategic goals, taking into account their priority. Each goal is characterized by a specific quantitative indicator, for example, market share, profit level, production cost, etc. [6, 7]. Let the company consider n priority strategic goals, for each of which a target indicator $V_i, i=\overline{1,n}$ is determined, the priority of the goals is characterized by their «weights» $\alpha_i, i=\overline{1,n}$, for which the following is fulfilled:

$$\sum_{i=1}^{n} \alpha_i = 1. \quad (1)$$

Development goals are determined by the state of the company itself, the competitive environment, marketing priorities, changing consumer demands, etc. What does the priority of goals affect? The opinions of experts on this matter boil down to the fact that projects that do not «cover» all the strategic goals, but only the most priority ones can be selected in the project portfolio. This is influenced, first of all, by the limited resources of companies. Thus, in this study, let us assume that the higher the priority goal, the more its corresponding target indicators should be achieved by the set of projects that are selected for implementation shortly. Low priority goals may not be «met» by projects at all, or their targets are only marginally met. This approach is adopted for subsequent modelling [8, 9].

An agile transformation is also an option for the development of companies, but this development is implemented through a whole set of specific projects, which represent an Agile transformation program. Earlier it was noted that the main result of Agile transformation of companies is the acceleration of project completion times, obtaining project products, including based on organizational, information and communication technologies, aimed at the implementation and use of various types of Agile tools (frameworks).

Thus, each company, depending on its vision of the final results of Agile transformation, can set by decomposition a set of corresponding local goals m, for each of which a target can also be set $A_j, j=\overline{1,m}$. Since Agile transformation is a kind of development program, the main goal for it is considered achieved when all local goals are achieved [10]. Therefore, it is not advisable to rank them in any way, since not achieving any of them leads to not achieving the results of the entire Agile transformation.

A conceptual model for forming a portfolio of company development projects taking into account its Agile transformation is shown in Fig. 1. Portfolio projects must, on the one hand, meet development goals, and on the other, meet the goals of Agile transformation.

The convergence of scientific knowledge [1] leads to the emergence of universal categories and patterns in systems of different nature. An example of one such category is entropy. Moreover, if in an information context, the use of entropy as a measure of uncertainty did not require any theoretical justification, which led to a new view of information, for example, according to the project [2-5], then in the thermodynamic aspect, the “universalization” of entropy required a number of studies (for example, [6-10]), the logical result of which was the entropy concept of managing organizations [11-14].

Entropy – as a measure of the uselessness of the energy of organizations, on the one hand, becomes a universal measure of the success of organizations (in the context of minimizing

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entropy [13]), on the other hand – the main goal for «counteraction» through the introduction of innovative management technologies [12].

The mainstream of innovative management technologies today is agile methodology.

Since today's world is a world in which the boundaries between different areas of knowledge are blurred, and the transfer of results from various sciences takes place [11], it is natural that the ideas of agile project management began to be tested in those areas where it previously seemed inappropriate, more Moreover, the project approach was not used in principle. Thus, the agile methodology, having received a start from projects related to information and software, is rapidly penetrating into other areas of activity both at the project level and in the organization of operational activities [15].

Considering agile methodology and agile transformation, taking into account the main provisions of the entropic concept of management, provides a new innovative approach to the development of organizations in various fields of activity. This approach allows integrating the benefits of the practical component (in the form of agile frameworks) and the new management theory (providing entropy as the main indicator of the state of organizations) [16].

Thus, the purpose of this study is to justify the feasibility and develop the main provisions for the development of organizations based on agile-transformation, which provides resistance to entropy.

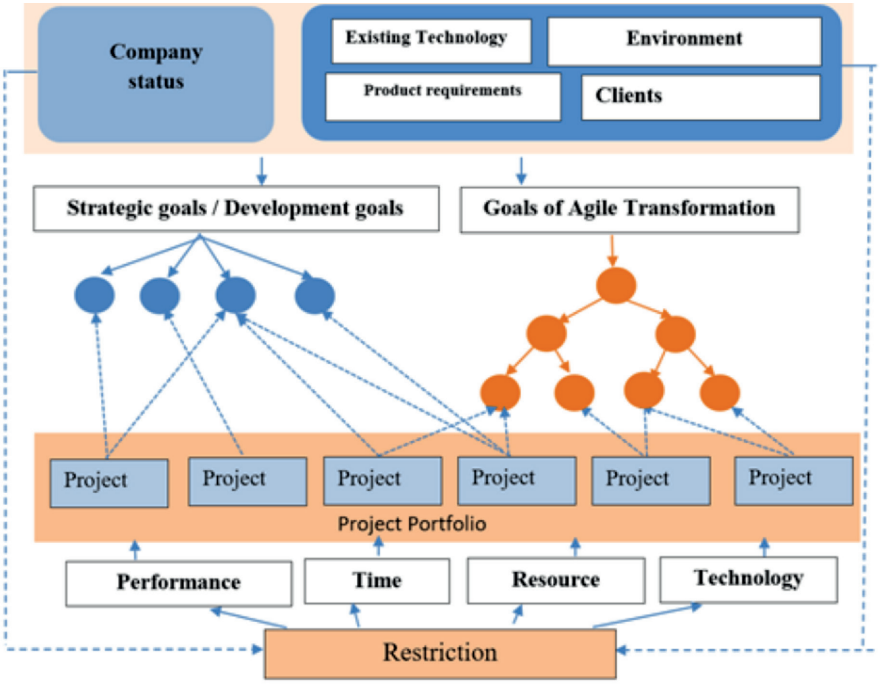

Fig. 1. Conceptual model of the formation of a portfolio of development projects of the company, taking into account its Agile transformation

Moreover, each project can contribute both to the achievement of one development goal, or several (the applied aspect of such compliance is demonstrated by the example of the technical development program in [10, 11]). In addition, the project can provide both the achievement of the development goal (s) and one or more goals of Agile transformation – for example, when it comes to a project for the implementation of a new information platform or a project for staff development. For the latter, the acquired new skills of the staff can be aimed both at mastering certain procedures of Agile frameworks and at improving the quality

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of service, stress resistance, etc. Thus, projects can be «multifaceted» from the point of view of both «traditional» strategic goals of the company development, and the point of view of Agile transformation.

Naturally, a portfolio of projects is formed under objective constraints associated with both the company's capabilities (for example, in terms of resources) and the availability of certain resources and technologies on the market. Technologies also impose restrictions on the time of project implementation and their fundamental implementation. Efficiency in the traditional sense of individual projects or the portfolio as a whole should also be set in the form of the minimum acceptable frontier following the interests of the company. And, of course, time – if the results of projects and the portfolio as a whole are received in the wrong timeframe, which is expedient, then this does not ensure the achievement of the set goals in terms of time. Thus, to ensure the success of development projects and Agile transformation, the portfolio as a whole, the products and project results must be achieved on time. In [5], in particular, it is indicated that in some situations it is required to invest with greater intensity to ensure the timely implementation of the project and the receipt of its product, this will allow timely and more efficient use of the result (for example, when launching a new product, or opening a new branch, etc.). If we are talking about Agile transformation projects, then the transition to a new level in this context later than all competitors will not give the necessary effect and result of this transformation. Thus, resources, time, efficiency and technology are the main constraints on a portfolio of development projects.

Identification of multiple characteristics of projects

According to modern project management methodology, the result of the project implementation can be defined as "value". In [4, 10], it was proposed to use the degree of "contribution" to the achievement of company goals as the value of projects. Thus, taking this approach as a basis, we will take the following value for the value of each project:

$$PV_k = \sum_{i=1}^{n} \alpha_i \frac{V_i^k}{V_i} + \sum_{j=1}^{m} \frac{A_j^k}{A_j}, k = \overline{1, K}, \quad (2)$$

where PV_k is the value of the *k*-th project for the company, K is the total number of projects under consideration, is the contribution V_i^k of the k-th project to the achievement of the i-th development goal, is the contribution of the k-th project to the achievement of the j-th goal of Agile transformation.

So, each project can be described by a whole set of characteristics reflecting what is necessary for its implementation, and what is expected as a result of its implementation, including its value in terms of achieving the company's goals, both developed in the traditional sense and Agile transformation. as a specific development program.

In addition to the above values – the contributions of projects to the achievement of goals, the traditional set of characteristics for the k-th project includes (Fig. 2):

- Re_k the required resources in financial terms;
- F_k economic efficiency;
- R_k risks in monetary terms (for example, possible deviation ΔF_k, or increased costs $\Delta \mathrm{Re}_k$);
- T_k time of project realization.

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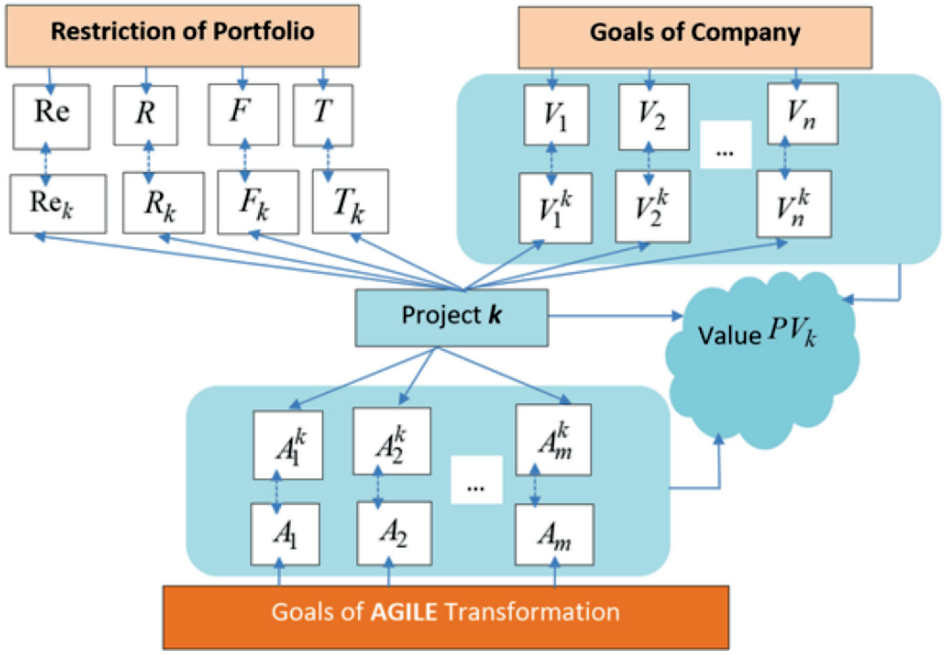

Fig. 2. A set of project characteristics used for the model of forming a portfolio of company development projects in the process of its Agile transformation

On fig. 2 Re – available resources; F – economic efficiency; R – risks; T – the time of realization of this portfolio of projects in terms of achieving its goals.

Note that a portfolio of projects in the general case is a dynamic structure to which projects can be added, taking into account the emergence of new goals. Therefore, we believe that the implementation period is T the period for the established composition of projects, taking into account the established goals of the company.

Naturally, the set of project characteristics can be expanded taking into account the specifics of the company's field of activity and approaches to the formation of a project portfolio. In this study, the main task is to form a generalized model that establishes a balance between the necessary development (achievement of strategic goals) and the goals of Agile transformation. Thus, individual aspects of the set of development projects can be introduced into the model as characteristics of projects and portfolio constraints.

Note that the proposed value estimate (2) can be used in the processes of selecting projects outside the model, for example, if there are few alternative projects, or, conversely, with a sufficiently large number of alternative projects for their primary «filtering».

The model for forming the optimal composition of the project portfolio

The characteristics of projects highlighted above correspond to the main characteristics of the project portfolio, which are the basis for establishing the criterion and limitations of the portfolio. So, the integral achievement of a set of goals (strategic / development and Agile transformation) is taken in this study as the main criterion for forming a portfolio of projects. Resources, time, efficiency and risks are the main characteristics of the portfolio, which are set as the constraints of the model.

So, let a set of alternative projects be formed, with a total of $K + L$ both to ensure development goals (K projects) and to ensure Agile transformation (L projects). Analysis of projects allows us to establish their characteristics in terms of achieving the considered integral set of goals, as well as those that correspond to the main limitations of the portfolio (see Fig. 2).

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Let's introduce the variables $x_k = \{0;1\}, k = \overline{1,K}$ that are responsible for the selection of a particular development project $y_l = \{0;1\}, l = \overline{1,L}$ in the portfolio – for the selection of projects related to Agile transformation. To ensure the achievement of the integral set of goals, we introduce a criterion of the following form:

$$Z = \sum_{i=1}^{n} \alpha_i \left(\sum_{k=1}^{K} \frac{V_i^k}{V_i} \cdot x_k + \sum_{l=1}^{L} \frac{V_i^l}{V_i} \cdot y_l - 1 \right)^2 + \\ + \sum_{j=1}^{m} \left(\sum_{l=1}^{L} \frac{A_j^l}{A_j} \cdot y_l + \sum_{k=1}^{K} \frac{A_j^k}{A_j} \cdot x_k - 1 \right)^2 \to \min. \tag{3}$$

The values $\frac{V_i^k}{V_i}, \frac{V_i^l}{V_i}, \frac{A_j^l}{A_j}, \frac{A_j^k}{A_j}$ are relative values characterizing the achievement of each goal of the company, thanks to the implementation of a specific project. The use of relative values eliminates the problem of target heterogeneity. Ideally, the achievement of the company's goals by a portfolio of projects should be 100% ensured, that is, it should be completed

$$\sum_{k=1}^{K} \frac{V_i^k}{V_i} \cdot x_k + \sum_{l=1}^{L} \frac{V_i^l}{V_i} \cdot y_l = 1, \tag{4}$$

$$\sum_{l=1}^{L} \frac{A_j^l}{A_j} \cdot y_l + \sum_{k=1}^{K} \frac{A_j^k}{A_j} \cdot x_k = 1. \tag{5}$$

Therefore, in (3), the distance between the actual indicators of $\left(\sum_{k=1}^{K} \frac{V_i^k}{V_i} \cdot x_k + \sum_{l=1}^{L} \frac{V_i^l}{V_i} \cdot y_l - 1 \right)$ achieving goals as a result of the implementation of portfolio projects and ideal ones is used. Note that in (3) the "largest" elimination of inconsistencies is carried out for the goals with the highest weights. The quadratic form of this criterion minimizes the «distance» between the portfolio results and the integral set of goals. At the same time, in (3) it is taken into account that Agile transformation projects can contribute to the achievement of strategic goals, as well as the opposite, development projects can ensure the achievement of Agile transformation goals. Thus, the «versatility» of the project results is taken into account. That is why, by (2), the most valuable is a project that either "covers" a significant number of goals, or "covers" one goal as much as possible, and the most priority one when it comes to strategic / development goals. Note that the value of projects is used in a somewhat implicit form in (3), the criterion ensures the selection of those projects that, in aggregate, have the maximum value for the company, taking into account both the current strategic / development goals and the goals of Agile transformation.

The value

$$\sum_{i=1}^{n} \alpha_i \left(\sum_{k=1}^{K} \frac{V_i^k}{V_i} \cdot x_k + \sum_{l=1}^{L} \frac{V_i^l}{V_i} \cdot y_l \right) + \sum_{j=1}^{m} \left(\sum_{l=1}^{L} \frac{A_j^l}{A_j} \cdot y_l + \sum_{k=1}^{K} \frac{A_j^k}{A_j} \cdot x_k \right) \tag{6}$$

can be interpreted as the value of a portfolio of projects, thus (3) maximizes the value of a portfolio of projects for the company by minimizing the discrepancy between its results and goals.

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It should be noted that in some cases, individual goals may not simply have a higher priority set by the aid (for goals not directly related to Agile transformation). The need to ensure a certain minimum degree of goal achievement can be specified in the form of constraints of the form:

$$\sum_{k=1}^{K} \frac{V_i^k}{V_i} \cdot x_k + \sum_{l=1}^{L} \frac{V_i^l}{V_i} \cdot y_l \geq S_i, i = \overline{1,n}, \tag{7}$$

where $0 \leq S_i \leq 1$ is the minimum permissible degree of achievement of the i-th goal. Similar constraints can be formed for the purposes of Agile transformation:

$$\sum_{l=1}^{L} \frac{A_j^l}{A_j} \cdot y_l + \sum_{k=1}^{K} \frac{A_j^k}{A_j} \cdot x_k \geq S_j^a, j = \overline{1,m}, \tag{8}$$

where $0 \leq S_j^a \leq 1$ is the minimum permissible degree of achievement of the j-th goal of Agile transformation.

Thus, taking into account conditions (7), (8), the model will ensure not only the maximization of the value of the project portfolio but also its minimum allowable boundary, taking into account each aspect of the value reflected by a specific goal from the considered integral set.

So, having decided on the criterion for the formation of a portfolio, we will establish the main limitations of the model. The first and foremost is the limitation on available resources (in monetary terms):

$$\sum_{k=1}^{K} \mathrm{Re}_k \cdot x_k + \sum_{l=1}^{L} \mathrm{Re}_l \cdot y_l \leq \mathrm{Re}, \tag{9}$$

at the same time, a restriction can be introduced separately for projects related to Agile transformation:

$$\sum_{l=1}^{L} \mathrm{Re}_l \cdot y_l \leq \mathrm{Re}^a, \tag{10}$$

where Re^a – is the limiting amount of resources that the company is ready to spend on the transition to another qualitative level from the point of view of Agile.

Portfolio risk limit:

$$\sum_{k=1}^{K} \mathrm{R}_k \cdot x_k + \sum_{l=1}^{L} \mathrm{R}_l \cdot y_l \leq \mathrm{R}. \tag{11}$$

We will assume that the risks are assessed in monetary terms, as a possible increase in costs or a shortfall in profit from commercial projects. Since in this study the issues related to various aspects of the portfolio, except for Agile transformation, are not the main ones, we will restrict ourselves to an introduction to the consideration and consideration of risks without delving into their essence and assessment methods.

Achievement of the set goals must be carried out within a certain time frame; therefore, we will introduce a time limit:

$$\begin{aligned} T_k \cdot x_k \leq T, k = \overline{1,K}, \\ T_l \cdot y_l \leq T, l = \overline{1,L}. \end{aligned} \tag{12}$$

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Note that projects may not start at the same time, and, most often, in practice, this happens to equalize the use of resources, first of all. In [3], a model was proposed that took into account the options for the possible distribution of projects over time. But we consider it expedient, within the framework of the problem being solved, not to take into account the different beginnings of projects. According to [15], the task of forming a set of projects is aimed at their selection according to their compliance with the criterion, and the time distribution for optimizing resources should be carried out within the framework of a separate task – implementation planning. Thus, (12), in principle, allows for consideration of projects, the term of which does not exceed a certain established one.

If a specific deadline is set for Agile transformation, then it is ensured by the fulfilment of the constraint

$$T_l \cdot y_l \le T^a, l = \overline{1, L} \tag{13}$$

for the case of the absence of technological dependence on projects. If it is available, it is advisable to use the approach [14] and form alternative options for the Agile transformation program, and make a choice within the model not of individual projects, but the whole program. The use of this approach practically does not change the structure of the model, but changes meaningfully y_l, defining it as a variant of the Agile transformation program, while it becomes necessary to introduce a restriction that ensures the choice of only one such program:

$$\sum_{l=1}^{L} y_l = 1. \tag{14}$$

By the way, the number of projects in the portfolio can also be limited if there are certain reasons for this. In such a situation, a constraint of one of the following types can be introduced into the model:

$$\sum_{k=1}^{K} x_k \le N, \tag{15}$$

$$\sum_{k=1}^{K} x_k + \sum_{l=1}^{L} y_l \le N, \tag{16}$$

where N is the allowed number of projects in the portfolio. The use of (15) or (16) is determined by both the scale of alternative projects and the vision of the company's management.

Concerning efficiency. For commercial projects, efficiency is the main attribute and, as a rule, determines the value of these projects. The portfolio includes both commercial projects and projects, the value of which is not associated with obtaining a clear economic effect, but affects its receipt in the future. For example, Agile transformation allows you to increase the number of orders (customers), which can be estimated as an increase in profits. But, as a rule, this effect «customer growth – profit growth» is laid down in the form of the target indicator of Agile transformation, that is, it is the essence of one of the $A_j, j = \overline{1, m}$.

In addition, profit growth, an increase in the company's assets, etc. can also be used as strategic goals/development goals (and this is most often the case in practice). Therefore, it makes practical sense to introduce into the model additional restrictions related to economic efficiencies, such as:

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$$\sum_{k=1}^{K} F_k \cdot x_k + \sum_{l=1}^{L} F_l \cdot y_l \geq F, \tag{17}$$

which provides the total minimum permissible efficiency frontier for the portfolio. It should be noted that it is advisable to set the lower limit of efficiency for each project only for commercial, investment projects, and this should be done before solving the problem of forming a portfolio of projects. Thus, projects that are related to purely commercial purposes, and that do not meet the necessary performance requirements, are not considered as alternatives. For those projects that are related to both commercial goals and other strategic goals, a minimum acceptable boundary $F_g, g = \overline{1,G}$ should be established, taking into account the specifics of the project, that is, compliance with one of the *G* selected categories:

$$F_k \cdot x_k, F_l \cdot y_l \geq F_g, k, l \in U_g, \tag{18}$$

where is the set of projects belonging to the category $g = \overline{1,G}$.

Thus, (3), (7)-(13), (15) (or (16)), (17), (18) constitute a model for the formation of a company's project portfolio in the process of its Agile transformation and allow us to establish such a set of projects, that aligns with both strategic / development goals and Agile transformation goals within a single limited budget.

Conclusion

Unlike existing approaches to the formation of a portfolio of projects, in this study, the value of each alternative project is determined both in terms of the company's strategic goals and in terms of the goals of Agile transformation. Thus, as the value of each project and portfolio as a whole, an integral indicator of their compliance with both the strategic goals and the goals of Agile transformation is taken. Setting time limits and the degree of achievement of each goal associated with the company's transition to a new level from the point of view of the Agile methodology ensures maximum compliance (within the available budget) with the projected results of this transformation – the established values.

Further development of the proposed results is the concretization of the target indicators of Agile transformation at the substantive level, taking into account the specifics of the areas of activity of companies, which will allow the generalized model in a meaningful sense to be adapted and turned into applied ones, which will ensure their high practical value.

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