

Classification of parameters of innovative projects in the framework of digital transformation programs for sustainable development of industrial enterprises

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Abstract. The task of determining the parameters of an innovative project, their composition and structure is a crucial stage in the design and development of an innovative project within the framework of digital transformation. A refined classification of the parameters of an innovative project, considering the specifics of projects aimed at digital transformation of the enterprises, operating in the manufacturing sector, is proposed. The classification separates the parameters of innovative projects into 2 key categories: target parameters and controlled or limiting parameters. When applied to innovative project parameters in digital transformation, target parameters are further divided into gradual and optional types; controlled or limiting parameters constitute basic structure of innovative projects and include road-map and time allocation, costs, market parameters, human resources, technological readiness, regulatory norms. The presented approach leaves room for further research based on additional real case data and risk evaluation, standard and accepted deviations of the project results analysis.

1 Introduction

1.1 The goal of the article

Achieving technological leadership by creating a high-performance export-oriented sector in the basic sectors of the economy, primarily in the manufacturing industry, proves to be one of key priorities in many developing countries. The elements of technology leadership in digital era include:

- transformation of business models in accordance with the principles of digital economy and the 4th Industrial Revolution (including the transition to "service" business models based on digital platforms / Digital Twins).

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- establishing an ecosystem of the digital economy, in which digital data is a key factor of production in all fields of socio-economic activities; effective interaction, including cross-border, business, scientific and educational community, by means of digital ecosystem; formation of institutional and infrastructural conditions, elimination of existing obstacles and restrictions for the creation and (or) development of high-tech businesses and prevention of the emergence of new obstacles and restrictions, both in traditional sectors of the economy and in new industries and high-tech markets [1-3].

Achievement of national strategic goals in this field relies on programs for innovative development of industries, corporations and enterprises. By formal requirements, innovative development programs are elaborated by joint-stock companies with state participation, state corporations and federal state unitary enterprises. The innovative development program can be defined as a set of measures for the medium term (5-7 years) aimed at the development and implementation of new technologies, innovative products and services. Taking into account the production specialization of the company, the program of innovative development contributes to the implementation of priority areas identified on the national level [4]. The innovative development program is decomposed into several innovative projects.

An innovative project can be defined as a set of measures aimed at achieving an economic effect through implementation of innovations, including commercialization of scientific and (or) technology-driven novel results [5]. Within the framework of innovative projects, the parameters are determined. Such parameters, on the one hand, represent the characteristics of a project that determine the conditions and limitations for project's implementation [6]. On the other hand, such parameters are the most important elements of managing the process of implementing innovative projects. When developing digital systems for managing innovative projects, the classical process scheme can also be used [7]; however, the authors define a parameter as a structural element of which the objects of a digital system are composed [8].

Thus, the object of the study is the set of parameters of the innovative projects in the process of digital transformation of industrial enterprises. The goal of the article is to propose a classification of the parameters of an innovative project, considering the specifics of projects aimed at digital transformation of the enterprises, operating in the manufacturing sector.

Firstly, the existing approaches to the classification of the parameters of innovative projects will be analyzed. Secondly, the study examples of innovative projects aimed at the digital transformation of industrial enterprises and complexes will be carried out in order to highlight the key parameters that determine their specificity. Thus, the other task of the article will be completed, which is to highlight new classification features and develop a refined and amended classification of innovative project parameters considering analysis of existing classifications and case-analysis.

2 Materials and Methods

Research methods include content analysis of the literature on the topic, comparative and system analysis, analogy method, induction and deduction logic, typology approach, as well as case method based on the analysis from the practice of industrial enterprises.

2.1 Literature review

Conceptual aspects of innovation project management, including positioning with respect to other aspects of the organization's activities such as management and innovation (project management, R&D, operations), as well as promising areas for research are presented in [8,

9]. The authors emphasize the fact that, despite the historically parallel development of the two disciplines (innovation management and project management), modern companies are increasingly using a project-based approach to their innovation activities. In this regard, it is relevant to consider directly the junction of these disciplines, represented by such an area of knowledge as the management of innovative projects.

At the same time, the study of relevant scientific sources revealed insufficient research into the key aspects of managing innovative projects, including the lack of the unified approach to defining and classifying the parameters of innovative projects.

In [10], the authors consider project parameters as the main design elements included in the process feasibility study for an innovative project. Market opportunities and constraints are highlighted as additional parameters; parameter analysis has a broader context in the work under discussion.

In [11], the authors consider indicators of innovations during their life cycle, while an indicator in general sense is understood as a measurable characteristic that describes the state of the phenomenon. The authors allocate resources (human, financial, instrumental and organizational) as quantitatively described categories. In [12], the authors have developed an integrated indicator - Value Index, which ensures the application of project management approaches in the management of innovative projects. In [13] the authors provide a full range of metrics based on management of innovative projects that assess the level of value proposition.

In works [14, 15], tools for managing (identifying) innovative projects are presented, including those aimed at determining the general characteristics of innovative projects and using these features to categorize such projects. The features under consideration can also be defined as parameters of an innovative project. The influence of the implemented innovative projects on the internal environment of the organization in the context of the development of key competencies is considered in [16], while the compliance of the project with the strategic goals of firms and the level of such compliance can be distinguished as a separate parameter. An integrated structure for strategic project management for product innovation projects is developed in [17]. In [18], a hierarchy of parameters of innovative projects is presented, including parameters of strategic importance, parameters of the hierarchy of strategic planning, and structural parameters of an innovative project.

The paper [7] proposes an approach to typology of parameters for IT projects. However, the set of parameters' types is valid for all innovative projects and it is not defined by the specifics of projects of digital transformation.

The task of determining the parameters of an innovative project, their composition and structure is a crucial stage in the design and development of an innovative project within the framework of digital transformation. Yet, the literature review shows that there is no unified approach to classifying parameters of innovative projects, including projects aimed at digital transformation, neither a complete classification is developed. At the same time, according to the Independent Project analysis (IPA) [14], a consulting agency that is a leader in the quantitative analysis of project management systems, their annually updated information base contains more than 20,000 thousand projects, where each project is characterized by more than 2,000 attributes, including technologies, costs, project framework, implementation timeframe, etc. These attributes can also be considered as project parameters, and the volumes of data generated by organizations and collected by IPA additionally confirm the thesis about the relevance of the development of new approaches to managing the parameters of innovative projects, taking into account their diversity, and the first the stage and basis of such work is the development of a more complete classification of the parameters of innovative projects.

2.2 Case-analysis

Project №1: development of an unified information environment for data exchange between information systems in the chain of cooperation.

Target parameters and effects:

- Integration of information resources that will make it possible to create a unified information environment for data exchange between information systems of enterprises in the cooperation chain, as well as provide all life cycle processes with unified up-to-date data.
- Increase the efficiency of managing the chain of cooperation.
- Standardization and unification of regulatory documents.
- Less risks during the procurement campaign.
- Cost reduction by obtaining consolidated financial statements: reduction of costs by 50%, due to the use of common reference books for all accounting systems of enterprises in the cooperation chain;
- Reduction of excess stocks by 10%, due to the optimization of reference books and inventory of warehouse stocks.

Project 2: implementation of an unified management system that ensures the optimization of planning processes, transparency in the execution of production orders, reduction of time for the formation of production plans, monitoring of production capacity utilization on the critical path (at the level of workshops and technological conversions).

Target parameters and effects:

- Interaction in a unified system of planning and production management that will allow fast assess of manufacturing feasibility of products for the given program parameters and identify production bottlenecks. Monitoring and analytics of production data and processes created during the implementation of automated enterprise resource management should allow efficient load and redistribution of production resources, as well as the development of new products for various purposes.
- Reduction of non-productive costs.
- Reduction of the volume of warehouse stocks.
- Improvement of the quality of production planning, reliability of accounting and management accounting.
- Optimization of management decision making.
- Reduction of the deviation of the actual course of production from the planned targets by 15-20%.
- Reduction of total losses from unplanned downtime in monetary terms by 10-20%.

Project 3: new technology implementation in order to improve the efficiency of management of development and production preparation processes, reduction of time for the implementation of new programs and flexibility increase in placing orders at various production sites of the holding.

Target parameters and effects:

- Reduction of the cost of operating high-tech products and the cost of the full life cycle.
- Ability to provide contracts for the life cycle of high-tech products.
- Reduced time-to-market through the use of the latest design methods, virtual simulation of manufacturing processes and product testing.

Project 4: survey and reengineering of integrated logistic support processes for after-sales service processes for high-tech products, purchase of software and equipment, adaptation of software to organizational processes, integration of software with hardware and software systems for exploitation monitoring.

Target parameters and effects:

- Implementation of industrial technology should allow:

- forecasting of the needs of operating organizations in the supply of units and performance of work for the proactive acquisition / manufacture of the necessary units;
- reduction of time for processing the request of operating organizations and preparing the required technical solutions;
- organization of the necessary technical data collection concerning the operation of high-tech equipment and timely feedback provision for the development and modernization processes;
- increase in the company's share in the world market by increasing the competitiveness of its products.
 - Reduction in development time for application software documentation up to 40%.
 - Reduction in development and completion time for products according to operational requirements by up to 30%.
 - Increase in the speed of generating reporting documentation up to 50%.
 - Reduction in time for developing a maintenance plan up to 30%.
 - Increase of the company's share in the world market up to 15-17%.
 - Growth of the share of after-sales service in the company's revenue up to 50%.
 - Reduction for 30% in development time, coordination and approval of maintenance plans and documentation.

3 Results

Based on the analysis of [20], the parameters of projects (including those applicable to innovative projects) were identified, which are objects of management in the process of designing and implementing projects in accordance with PMBOK:

- project scope;
- time resources;
- costs within the project;
- quality;
- human resources;
- communication plan;
- project risks;
- procurement plan;
- stakeholders.

A generalized classification of the parameters of innovative projects presented in [6] was material for the current research. The authors chose the following project characteristics for classification:

- managerial resources;
- cost;
- time;
- material resources;
- technology;
- informational resources.

The paper [7] proposes the following approach to typology of parameters for IT projects:

- expected results of the project,
- project limitations: the available time, cost and technical limitations of the project,
- 'road map': includes a list and deadlines for the completion of the project phases;
- project risks with a description, prioritization and risk response activities;
- quality control plan: defines the list of works at each stage with the formation of the quality control matrix by the project team members;
- organizational structure of the project.

To assess the competitiveness of planned innovations in [21], the following set of parameters is introduced, according to which planned projects are compared (different weights are also applied):

- the goal of innovation;
- duration of the innovation cycle;
- the level of innovation risk;
- the level of efficiency of innovation;
- level of innovation feasibility;
- the level of novelty of innovation.

In the course of the study, the existing and identified on the basis of the analysis of the design practice of classifications of project parameters, including innovative ones, were included in the refined classification. At the same time, an additional dimension was included in the classification, (feature) that allows one to determine the nature of the parameter: target parameters and limiting parameters.

When using the developed classification, it should be borne in mind that in the context of a separate project, a number of parameters can be rigidly specified (for example, cost parameters), while within the framework of the design an optimization problem can be solved that provides maximum return within other parameters (for example, minimizing time costs).

Table 1. Innovative project parameters.

| Innovative project parameters | |
|--|--|
| Target parameters: | Controlled or limiting parameters: |
| <ul style="list-style-type: none"> • end -product/ -service or -result characteristics. | <ul style="list-style-type: none"> • road-map and time allocation; • costs (financing including sources and allocation by period); • market parameters (business-model, target segment, sales volume, competition, etc.); • human resources (number and qualification); • technological (TRL, MRL, CRL); • regulatory norms. |

In the context of the priorities of innovative development, projects aimed at the digital transformation of the economy, industry, and enterprise are most relevant. At the same time, digital transformation should be understood not as a simple “digitization” of the existing process, but as a fundamentally new process based on the introduction of digital technologies.

The parameters of the target group are relevant and of high interest, since they are the central parameters of the project and determine its specifics.

Table 2. Innovative project parameters in digital transformation.

| Innovative project parameters in digital transformation: | |
|--|--|
| Target parameters: | Controlled or limiting parameters: |
| <p>Gradual:</p> <ul style="list-style-type: none"> • level of information systems integration (% of seamlessly integrated systems); • level of automatization (% of operations conducted without human participation). <p>Optional:</p> <ul style="list-style-type: none"> • efficiency; • transparency of business-processes insured by digital technology; • real-time data availability; • business-process reengineering (new process based on digital technology); • shared digital workplace for distributed teams. | <ul style="list-style-type: none"> • road-map and time allocation; • costs (financing including sources and allocation by period); • market parameters (business-model, target segment, sales volume, competition, etc.); • human resources (number and qualification); • technological (TRL, MRL, CRL); • regulatory norms. |

Target effects of ongoing projects were identified and summarized:

- increasing the efficiency of decision-making;
- standardization and unification of regulatory documents;
- reduction of project execution time;
- reduction of non-production costs;
- reducing the deviation of the actual progress of the project from the planned indicators;
- reducing the cost of operating high-tech products and the cost of the full life cycle;
- shortening the response time to changes in the external environment;
- increasing the company's share in the world market;
- increasing the energy efficiency of production;
- formation of new methodologies for technological preparation and organization of production.

4 Discussion

The study is based on the analysis of 4 cases describing experience of Russian industrial enterprises in managing IT projects in the course of digital transformation. Thus a more specified set of parameters of the innovative projects is developed, which considers the specifics of projects aimed at digital transformation of the enterprises, operating in the manufacturing sector.

Key findings agree with the current knowledge on the subject of innovative project management while adding to existing approaches a new dimension that allows one to determine the nature of the parameter (target parameters and limiting parameters). It is pointed out that both measurable (gradual) and unmeasurable (optional) parameters can constitute target parameters. Further research can be focused on developing approaches to measure gradual parameters and/or develop metrics for optional parameters to provide tools for project managers.

In current research empirical data was considered, however, each case is unique and specific. It is not stated that all the analyzed cases present the whole range of parameters that need to be managed. The analysis of additional cases, including international experience and cases of companies that are the world leaders in digitalization and IT applications, can contribute to the field.

The other debatable issue the lack of parameters describing project risks, standard and accepted deviations of the project results, etc [22], strategic perspective [23] and relation to corporate architecture [24]. These aspects under discussion define the directions of the future research on the study topic.

5 Conclusions

A refined classification of the parameters of an innovative project, considering the specifics of projects aimed at digital transformation of the enterprises, operating in the manufacturing sector, is proposed. The classification separates the parameters into 2 key categories: target parameters and controlled or limiting parameters. This approach takes into consideration specific features of IT projects in framework of digitalization programs and allows planning and controlling the projects' progress more efficient. The presented approach leaves room for further research based on additional real case data and risk evaluation, standard and accepted deviations of the project results analysis.

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