

ECONOMY AND ENTERPRISE MANAGEMENT

UDC 330.005.312(477)
JEL M11

DOI: 10.26906/EiR.2021.4(83).2521

FEATURES OF ENGINEERING AND DEVELOPMENT IMPLEMENTATION TO INCREASE THE EFFICIENCY OF UKRAINE INNOVATIVE TRANSFORMATIONS

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Стаття отримана редакцією 15.11.2021 р.

The article was received by editorial board on 15.11.2021

Introduction. The organizational form choice of innovation, implementation of projects and programs for the development of high-tech research and production systems (HRPS) depends on many factors. Among the main ones are: the content and complexity of the innovation strategy and development program; the size and potential of HRPS elements, their market positions, as well as financial opportunities.

Also, to select the optimal organizational structure of innovation and production elements of HRPS, it is necessary to determine what type of innovators they belong to. According to the international classification, the following types of innovators (innovative enterprises and organizations) are distinguished:

a) venture enterprises and enterprises that develop radical innovations, i.e. work at the stages of a purely innovation cycle;

b) patients, violents and commutants engaged in improving innovations and worked at the stages of the ordinary goods life cycle (GLC), which have become a radical innovation.

Accordingly, specific innovation strategies and organizational forms of innovation implementation (innovation projects and development programs) are selected.

Overview of recent research sources and publications. The analysis of the leading scientists' opinions and the world leading companies experience showed the lack of existing research and proposals for innovative and high-tech development of domestic enterprises in the new economic conditions. Today there are still no effective mechanisms, procedures and tools for strategic and project management of the national economy scientific and technological progress, including through the introduction of engineering and development, the creation of high-tech systems (RHPS).

The purpose of the article. The purpose of the work is to highlight the results of theoretical research and practical recommendations for effective implementation of engineering and development functions in programs for the development of high-tech research and production systems, scientific and technical centers in

Ukraine, which will increase innovative transformations of the national economy, its high-tech systems and enterprises capable of creating science-intensive and competitive products with a high level of added value. The analytical method of researches is used in the work. The methodological basis of the study is a systems approach, which is based on such principles as integrity, structure, the relationship of system and environment.

Basic material and results. Today there are a large number of organizational structures that create science-intensive and high-tech innovations. These include: technopolises, science and technology parks, powerful innovative corporate systems (companies, corporations, research and production associations, innovative alliances and enterprises). Their main common feature is the presence of a powerful scientific and technical center (STC). The presence of HRPS other structural elements defines the specific features of each of the above innovation and organizational structures. But for the HRPS effective formation and development in its structure should be:

a) coordination councils (or committees), which unite the HRPS heads and other representatives of the structural elements (participants). These councils are created to determine the innovation and production activities strategic parameters and development key areas;

b) special bodies of scientific, scientific-technical and other forecasting, planning and development support, which coordinate innovation activities and project management of programs for the development of high-tech research and production systems;

c) innovation infrastructure, which ensures the viability of HRPS all elements and supports the implementation of its targeted programs;

d) various engineering firms and organizations that form a scientific and technical center for research, design and estimate work, research and development, research production and special tests of complex innovations, development of organizational and construction-investment parts of the development program. These firms provide consulting, engineering, author's supervision and control over the targeted programs implementation;

e) production and industrial corporate systems (ICS), innovative ICS, venture business, information and communication systems, which are engaged not only in creating high-tech production systems for high-tech products, but also develop and implement risky innovations and technologies, all types of HRPS information services activities;

f) financial, marketing, development and other institutions.

The conducted research allowed to determine the main principles and procedure for building the organizational structure of a modern scientific and technical center (STC), as well as the features of the engineering and development functions implementation to increase the efficiency and commercial efficiency of innovative development programs. Therefore, to accelerate the national economy modernization while increasing the innovative transformations commercial efficiency, it is recommended in programs and projects for the development of high-tech research and production systems (HRPS) to implement the following proposals:

1. When forming the structure of the scientific and technical center (STC), during the implementation of the HRPS development program it is necessary to ensure the organization of the main structural elements of the STC, which are shown in Figure 1.

2. For practical implementation of economy modernization acceleration, increase of commercial efficiency of innovative and technological transformations in HRPS development programs and STC activity it is necessary to introduce modern engineering and development. The following stages of the program implementation are envisaged:

I. Pre-investment phase of pre-project research and formation of the concept of the HRPS development program (innovation project).

II.a. Sub-phase of program activities research and design (project).

II.b. Sub-phase of the HRPS development program active implementation (innovation project):

– orders and tenders;

– construction, reconstruction and technical re-equipment;

– creation and development of new production;

– turnkey completion of innovation and investment transformations.

III. Post-investment phase of the program: development of HRPS capacities, current production, commercial activity, firm service and further development.

Features of the engineering and development functions implementation in the HRPS development programs and the STC activities are shown in Figure 2.

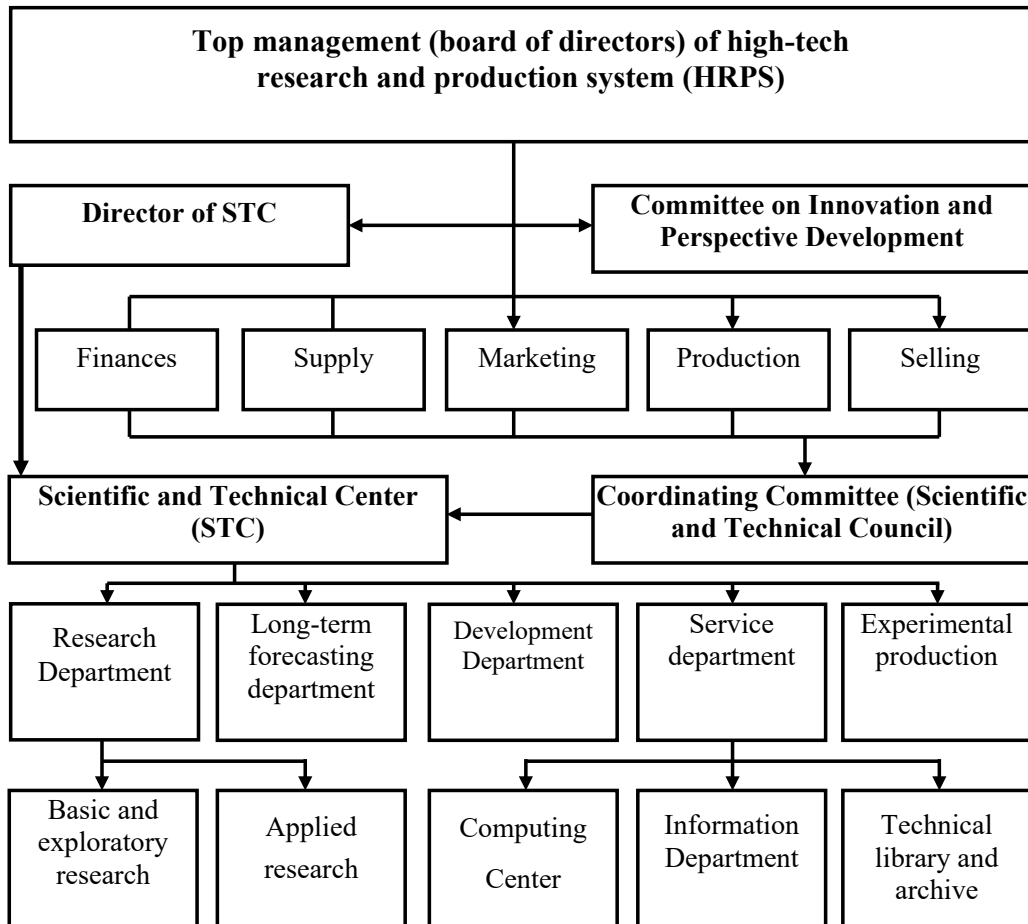


Fig. 1. Recommended organizational structure of scientific and technical center (STC)

Functional engineering includes:

1) *Design and software engineering*: pre-design studies with the design of the source and permit documentation; justification of required resources and investments, including feasibility studies and business plans; collection of initial data and preparation of tasks for research and design; execution of research and design works; examination and support of programs until their full implementation.

2) *Cost engineering*: development of program (project) estimates and budget plans, control of their implementation.

3) *Technological engineering*: providing the customer with innovative, production, construction and operational technologies together with licenses for their use, transfer of high technologies to Ukraine; formation and maintenance of custom specifications for process equipment.

4) *Financial engineering*: development of new financial, economic and investment instruments and operational schemes for their application and controlling.

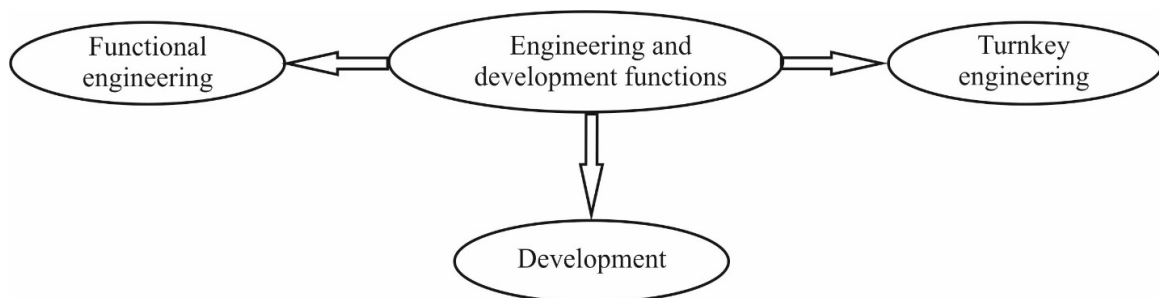


Fig. 2. Features of the engineering and development functions realization in HRPS development programs and STC activity

5) *Operational and production engineering*: preparation of tender and order documentation, their implementation and administration; organizational-technological and other design of working documentation, implementation and support of design solutions in new production organization; author's supervision and controlling the implementation of the program; quality management and ensuring the competitiveness of production and products; installation and testing of equipment, turnkey delivery of facilities, development.

6) *Consulting engineering*: all listed services.

Complex (system-integrated) engineering covers all functions and services provided by Functional Engineering, which provides the ability to implement "turnkey" programs (projects) or BOOT (Build – Own – Operate – Transfer). This system assumes that the main implementer of the program – its management team (PMT) – not only designs and creates HRPS (its objects), but also provides branded operation and administration with the customer on the terms of development for a long time (up to 20-25 years). The manufacturer provides maintenance and further innovation, technical and technological development.

Modern innovative and other marketable products (complex machinery, machines, mechanisms, equipment, transport, buildings, structures), various property complexes and real estate have a long service life: from several to tens of years. And it is during the period of operation that all these properties must bring the maximum economic and other effects, work stably and efficiently, have the appropriate technical and technological level of development, i.e. must be constantly updated. Therefore, in the period of creation, operation and further development of HRPS and complex innovations – the results of programs and projects, it is necessary to use development. This is achieved by forming a "development partnership" between the owner (customer of the property) and its manufacturer, which will ensure long-term integration of their interests, capabilities and mutually beneficial development, production and commercial activities.

To implement engineering and development functions it is necessary to take the following measures:

1) Formation of the internal structure and functions of STC and other HRPS elements, capable of implementing a full range of engineering and development functions to perform "turnkey" development programs and projects.

2) Creation of modern production, able to quickly master and manufacture complex science-intensive and high-tech products that are freely sold in a competitive environment, including those required to perform "turnkey" projects for other customers.

3) Formation on the whole territory of Ukraine (and abroad) of HRPS representations extensive network, which provide:

- search for customers, development and implementation of turnkey projects for them;
- implementation of a full range of branded commercial and development services and "lifelong" maintenance of complex long-term developments.

Procedures for the implementation of branded service are shown in table 1.

1) The most important engineering advantages in innovative measures are:

- increasing the efficiency of scientific and practical, engineering, technical and other project solutions, rational attraction and use of investment resources within the program budget;
- reduction of the works stages performance terms, operational and general expenses;
- consolidation prospects attractiveness for the customer of modern program realization procedures and tools;
- individual standards creating possibility for the professional activity benefits implementation and development programs and projects management;
- investment and other risks reduction;
- increasing the competitiveness and commercial efficiency of innovative developments, products, programs and projects.

2) The usage of engineering and development functions in development programs and innovative projects allows:

- to reduce the works complexity and program duration up to 25%;
- to reduce operating costs up to 25%;
- to reduce the total program cost up to 15%.

Thus in the leading countries of the world:

- engineering is considered one of the recognized and highly effective functions of modern business and innovation, the essence of which is to provide research, design, calculation, analysis, production and organi-

The essence, procedures and tools of modern branded and life-long service, which is implemented on the basis of engineering and development

The essence of branded and life service
<p>Today, branded service is the same key area of business of the world's leading manufacturing companies, as well as the innovative process of creating and manufacturing the most modern competitive complex high-tech and science-intensive equipment. The concept of "branded service" should cover the full range of services of marketing, research, design, calculation and analytical, production, organizational, financial, economic and development nature, including the development of feasibility studies and business plans, projects and programs, recommendations and services in areas of training, organization and continuous improvement of production, business processes, marketing and management. Implementation of innovative "turnkey" projects and lifelong development ensure the highest quality of results, commercial efficiency and competitiveness of results.</p>
Basic procedures and tools for the branded service implementation
<p><i>The concept of "branded service" includes:</i></p> <ul style="list-style-type: none"> • constant marketing and a full range of commercial activities in the strategic, tactical and current (operational) content of these concepts; • search and maximum satisfaction of consumers and clients needs with the most advanced, reliable, qualitative and effective production at the shortest terms of orders execution; • providing turnkey branded service, covering: <ul style="list-style-type: none"> – receiving (according to the individual scheme of work with the client) his orders; – preparation of contract documentation to order under mutually beneficial for the customer and the manufacturer (supplier) conditions of the contract implementation and payment; – individual design, manufacture, transportation, construction and installation, commissioning, testing and transfer of equipment and all infrastructure in the volumes and nomenclature required by the client; – "lifelong" (warranty and post-warranty) branded maintenance during operation, including training (preparation) of personnel, provision of the full range of planned and preventive repairs (PPR), implementation of necessary modernization, replacement morally and physically worn equipment, its components and details, implementation of rearmament; • creation (design), manufacture, supply, construction and installation, commissioning of various flexible modules and systems based on the unique products of an innovative manufacturer (so-called "turnkey" projects and development projects); • leasing of all equipment according to schemes that are mutually beneficial for both the client and the innovative enterprise; • attracting investors, banking and insurance companies, suppliers and trade intermediaries under modern schemes of economically sound cooperation and cooperation in order to obtain an effective comprehensive and competitive infrastructure in the long run; • organization of exhibitions, presentations and other promotional events.

Source: author's development

zational nature, including the development of feasibility studies and business plans, projects and programs, recommendations in the field of production organization, marketing and management;

– development is considered as one of the most advanced concepts of program-target and project (system) management, when within the innovation-investment program (project) not only the object of any complexity and uniqueness is created (complex HRPS or one enterprise, building or shop, engineering structure, equipment and communications, etc.), but also the constant and long-term development of the object, and also its system management is carried out. All this is a function of both the legal owner, which will carry out commercial or other operation of the entire object (equipment), and the possible or actual co-owner – its manufacturer (creator). Such a development company of these two entities is interested in continuous improvement of the facility, increasing its technical and technological capacity, increasing competitiveness, modernization, improving the system of branded service, as well as mutually beneficial production and commercial operation of the facility in the long run. That is, development is a mutually beneficial form of implementation of various business projects and programs for innovative enterprises – developers and manufacturers of a unique product – a product, and for buyers – the main owners of this product.

Conclusions. As a result, it should be noted that the experience of engineering and development-oriented innovation companies in the world when applying in their business projects the above engineering and development functions and systems allows these companies to significantly reduce the complexity, duration and cost of innovation projects and economic development programs with a significant increase in the quality and competitiveness of program and project results.

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UDC 330.005.312(477)

JEL M11

Oleksandr Redkin, PhD (Technical Sciences), Associate Professor. **Oleksandr Zyma**, PhD (Technical Sciences), Associate Professor. **Roman Pakhomov**, PhD (Technical Sciences), Associate Professor. **Mariia Hunchenko**, PhD (Economics), Associate Professor. National University “Yuri Kondratyuk Poltava Polytechnic”. **Features of Engineering and Development Implementation to Increase the Efficiency of Ukraine Innovative Transformations.**

The study identified that the most effective organizational structure of the modern combination of advanced science, advanced production systems and technologies, commercialization and competitiveness of innovation is the creation of high-tech research and production systems (HRPS) in Ukraine. Analogs of these systems are such successful global companies as Boeing, BMW, Sony, Samsung and many others, which are integrated into a single system of research (engineering), manufacturing, commercial, development and other departments. It is proved that for effective work and achievement of competitive results the modern HRPS should include: coordination and scientific and technical councils, divisions on strategic researches, forecasting and planning; engineering departments that form the basis of scientific and technical centers (STC); effective financial, marketing, development and other institutions; extensive and flexible infrastructure. In the process of research and in the article the following are determined: rational-organizational structure and functions of STC; the content and sequence of development and implementation of "turnkey" programs for the HRPS development; the essence of branded and lifelong service of unique innovative objects. The implementation of the developed proposals will accelerate the transition of domestic enterprises to world standards of management and continuous innovation and high-tech progress, as well as: reduce the complexity of work and duration of programs; reduce operating costs; reduce the total cost of programs; significantly increase the quality and competitiveness of domestic innovative developments and their manufacturers.

Key words: engineering, development, innovative transformations, research and production systems.

УДК 330.005.312(477)

JEL M11

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В ході дослідження визначено, що найбільш ефективною організаційною структурою сучасного поєднання передової науки, прогресивних систем виробництва і технологій, комерціалізації та забезпечення конкурентоспроможності інновацій є створення в Україні високотехнологічних науково-виробничих систем (ВНВС). Аналогом цих систем є такі успішні світові компанії, як Боїнг, БМВ, Соні, Самсунг та багато інших, в яких інтегровані в єдину систему науково-дослідницькі (інжинірингові), виробничі, комерційні, девелоперські та інші підрозділи. Доведено, що для ефективної роботи і досягнення конкурентних результатів сучасна ВНВС має включати: координаційні та науково-технічні ради, підрозділи зі стратегічних досліджень, прогнозування і планування; інжинірингові підрозділи, що створюють основу науково-технічних центрів (НТЦ); дієві фінансові, маркетингові, девелоперські та інші установи; розгалужену і гнучку інфраструктуру. В процесі дослідження і в статті визначено: раціонально-організаційну структуру і функції НТЦ; зміст і послідовність розробки та реалізації «під ключ» програм розвитку ВЕВС; сутність фірмового та по-життєвого сервісу унікальних інноваційних об'єктів. Впровадження розроблених пропозицій дозволить прискорити перехід вітчизняних підприємств на світові стандарти господарювання та неперервного інноваційно-високотехнологічного прогресу, а також: скоротити трудомісткість робіт і тривалість реалізації програм; зменшити експлуатаційні витрати; знизити загальну вартість програм; значно підвищити якість і конкурентоспроможність вітчизняних інноваційних розробок та їх виробників.

Ключові слова: інжиніринг, девелопмент, інноваційні перетворення, науково-виробничі системи.