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ARTICLE

IMPROVING THE EFFICIENCY OF INNOVATION DEVELOPMENT AND IMPLEMENTATION

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ABSTRACT

In the existing ecosystem of creating and implementing innovations that is currently being formed in Russia, the leading role should belong to Universities, which should become centers for creating innovations and developing territories. To ensure this new role, universities need the transformation – they need to create new tools that provide the process of creating innovations. The article discusses modern management problems and proposes methods for solving them. At the stage of developing new technologies, the potential of the University is huge, but as the technology advances, the opportunities are reduced, since large investments are required and guarantees of subsequent returns are not always obvious. Businesses are interested in projects at the last stages of development, when the time to enter and get the effect is reduced. It turns out to be a kind of "valley of death" - the stage of creating innovations, when the University's capabilities are exhausted, and the business is not ready to finance the project. The purpose of the research is to improve the efficiency of development and implementation of innovations by universities. The article provides an overview of the current situation related to the implementation of scientific and innovative activities by universities, analyzes the University's capabilities and business interest in implementing the main elements of the "Science and innovation" business block, considers the problems of developing and implementing innovations, and offers a portfolio of mechanisms that allow generating and bringing ideas to the level of technological readiness required by business. As one of the mechanisms for solving the problem, it is proposed to create information and management crowdsourcing platforms, one of which is being created on the basis of the Samara State Transport University.

KEY WORDS
Science, innovation, information platform, requests for innovation, business, technological readiness levels, digital platform, incubation, acceleration, projects,

INTRODUCTION

The existing problem of developing and implementing innovations by higher education institutions is that the University's ability to create innovations is usually limited to the levels of a prototype or technical solution, and the decision point to start business financing scheme responds to the prototype and design documentation. University's opportunities and business interests are of the opposite nature. At the very beginning of technology development, the University's capabilities are huge: collecting ideas, sifting them out, discussing them, and presenting them at conferences. As technology advances, opportunities are reduced, because large investments are required, and guarantees of subsequent returns are not always obvious. Business is interested in projects at the last stages of development, when the time to enter and get the effect is reduced. It turns out a kind of "valley of death" - the stage of creating innovations, when the University's capabilities are exhausted, and the business is not ready to finance the project [2, 5].

To overcome the "valley of death" (building a bridge) at the University, it is necessary to build mechanisms that allow generating and bringing ideas to the level of technological readiness demanded by business.
The aim of the research is to improve the efficiency of development and implementation of innovations by universities. To achieve this goal, the following tasks have been set and solved:

- Review of the current situation related to the implementation of scientific and innovative activities by Universities.
- Analysis of the University's capabilities and business interest in the implementation of the main elements of the business block "Science and innovation".
- Consideration of the problem of development and implementation of innovations.
- Development of a portfolio of mechanisms that ensure the generation and delivery of ideas to the level of technological readiness required by the business.

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OVERVIEW OF CURRENT SITUATION

A large number of publications are devoted to research on the process of improving the University management system in the context of transformation. We can distinguish the following [1-7]. From the point of view of converting input flows into output, scientific and innovative activities are opposite to each other [Fig. 1]. Scientific activity is an activity aimed at obtaining new knowledge. The source of new knowledge is financial resources: budgetary and extra-budgetary. Innovation activity is an activity aimed at converting new knowledge into innovation, aimed at making a profit [2].

Scientific (research) activities - activities aimed at obtaining and applying new knowledge, including:

- basic (fundamental) scientific research - experimental or theoretical activity aimed at obtaining new knowledge about the basic laws of the structure, functioning and development of a person, society, and the environment;

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- applied scientific research - research aimed primarily at applying new knowledge to achieve practical goals and solve specific problems;
- exploratory research - research aimed at obtaining new knowledge for the purpose of their subsequent practical application (oriented research) and (or) the application of new knowledge (applied research) and conducted by performing research works [2].

Innovation activity - activities (including scientific, technological, organizational, financial and commercial activities) aimed at implementation of innovative projects, as well as creating innovative infrastructure and ensuring its activities [2].

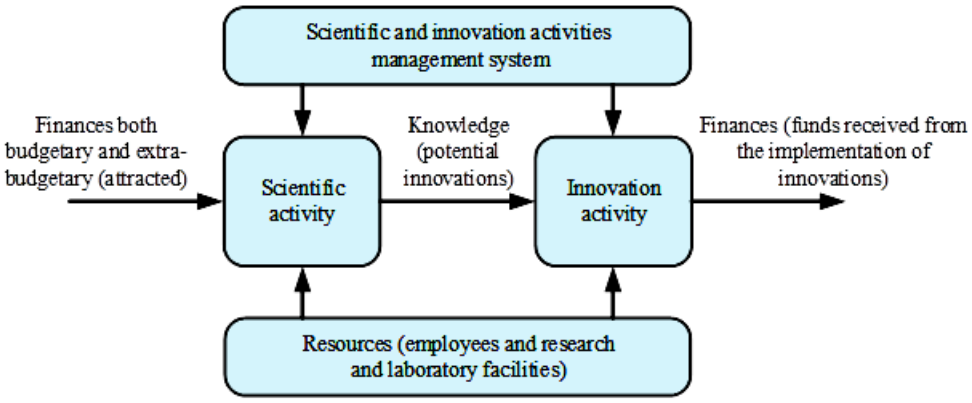

Fig. 1: Structural diagram of the business block "Science and innovation" [1]

We will analyze the University's capabilities and business interest in implementing the main elements of the "Science and innovation" business block [Fig. 2]. The University's capabilities decrease as the level of technological readiness of developments increases. On the contrary, business interest, and, consequently, the availability of funding, increases as the level of technological readiness of developments increases. This is because the risk of getting a ready-made development with a proven economic effect increases as the level of technological readiness increases. Thus, at the level of "Research work" (R & D), work should be financed primarily from the budget. To compensate for the lack of business funding, funds raised from various funds and grant-givers can be used.

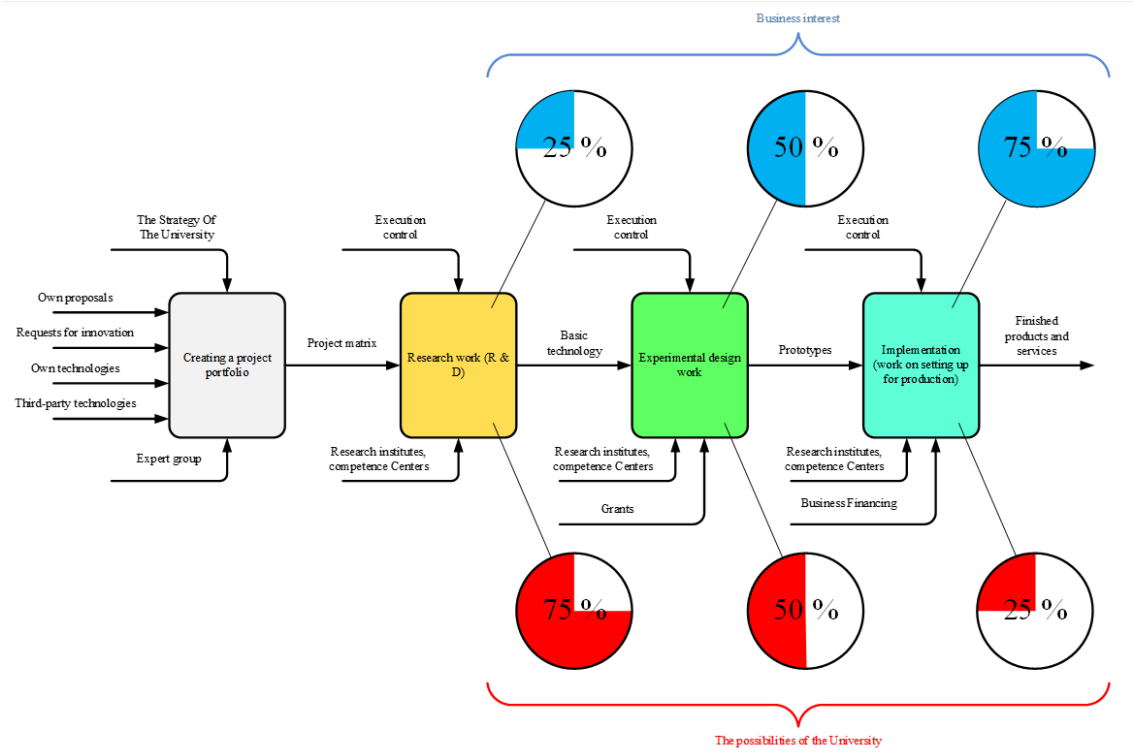

Fig. 2: Analysis of the University's capabilities and business interest in implementing the main elements of the "Science and innovation" business block [2].

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As technology advances, opportunities are reduced, because large investments are required, and guarantees of subsequent returns are not always obvious. Business is interested in projects at the last stages of development, when the time to enter and get the effect is reduced [2].

PROBLEMS OF INNOVATION DEVELOPMENT AND IMPLEMENTATION

The process of research and development of technologies (Research & Development) can be represented as levels of technological readiness (Technology Readiness Level, TRL): from the first to the ninth level. The result (product) at each level of technology readiness is [Table 1, Fig. 3].

Table 1: Result and amount of work at each of the TRL levels (developed by the author of the article as part of the research) [5]

TRL	Result and amount of work	Result and amount of work
1	Idea	Evaluating the impact of a new technology
2	Technical study, technological concept	Comparison of alternatives, choice of concept
3	Basic technology	Identification of key technology, risk assessment
4	Laboratory prototype, mathematical, physical model	Experimental verification in the laboratory
5	Design of units and modules	Testing the model in conditions close to real conditions
6	First prototype, similar to the expectations	Testing under simulated operating conditions
7	Pilot version	Experimental testing of the prototype
8	Final prototype, ready for pilot / small series (Pre-Production)	Field (factory) tests of a full-scale sample
9	Putting into production, launching a small series, commercialization	Operational testing of a full-scale sample

There are two approaches to the designation of stages of work performed: foreign and domestic (Russian approach).

The foreign approach uses the following terminology: TRL 1 – phase of basic research, TRL 2-4 – phase of technology development, TRL 5-6 – phase of technology demonstration, TRL 7-9 – phase of creating a new sample. Enlarged: TRL 1-4 – phase of scientific research and research, TRL 6-8 – pre-seed phase (Pre-Seed), TRL 9 – seed phase (Seed). The Russian approach uses the following terminology [Fig. 3]: TRL 1-3 – research work (R & D), TRL 4-6 –development work (R & D), TRL 7-9 – work on putting into production. TRL 1-6 – R & D (research and development work) is allocated in a larger way.

The existing problem is that the University's capabilities are usually limited to levels TRL 1-3, and the decision point on starting business financing corresponds to the end of the TRL 6 phase. This is shown schematically in [Fig. 3]: University opportunities and business interests are of the opposite nature. At the very beginning of technology development, the University's capabilities are huge: collecting ideas, sifting them out, discussing them, and presenting them at conferences (red curve). As technology advances, opportunities are reduced, because large investments are required, and guarantees of subsequent returns are not always obvious. For businesses, projects in the last stages of development are interesting, when the time to enter and get the effect is reduced (blue curve). The curves overlay shows the "valley of death". This phase is very conditional and in [Fig. 3] it is in stages TRL 4-6.

TIME TO "BUILD BRIDGES"

To overcome the "valley of death" (to "build bridges") at the University, it is necessary to build mechanisms [Fig. 4]: business incubation of projects - creating "hothouse" conditions for long-term project development (1-2 years); project acceleration - rapid development of projects to the necessary phase that is interesting for business (1-2 months); support for startups through a grant system; formation of techno-parks to attract research groups to their site for startup development; development of internal groups of techno brokers, etc. [2, 5].

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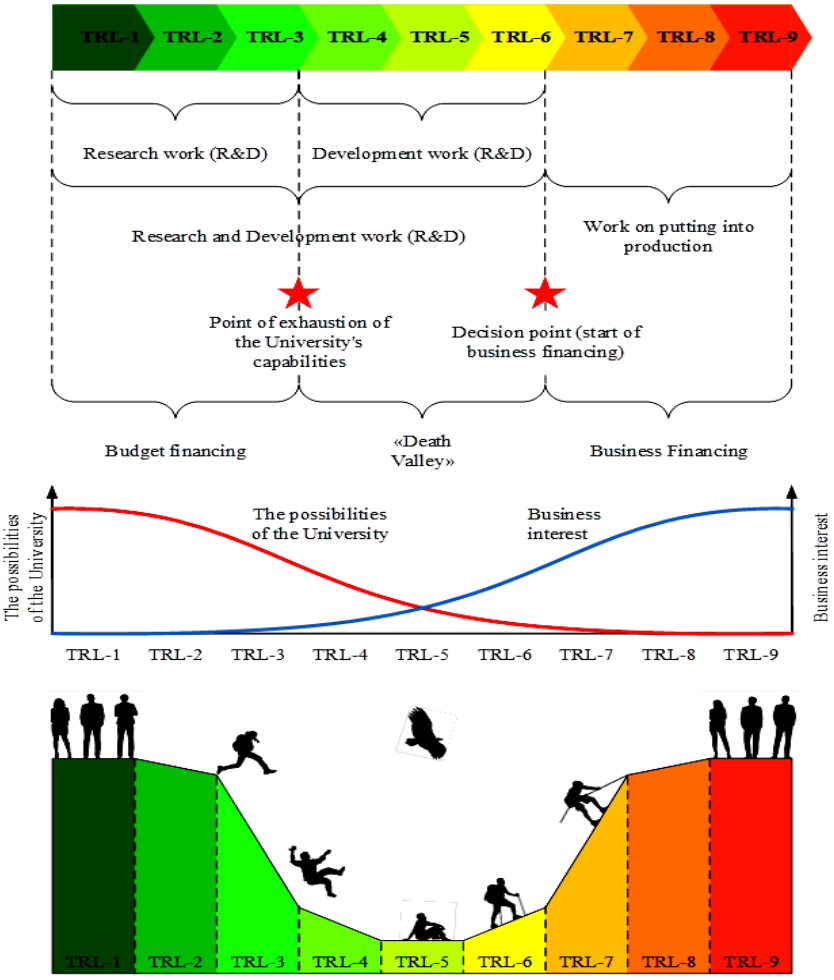

Fig. 3: levels of technological readiness [5]

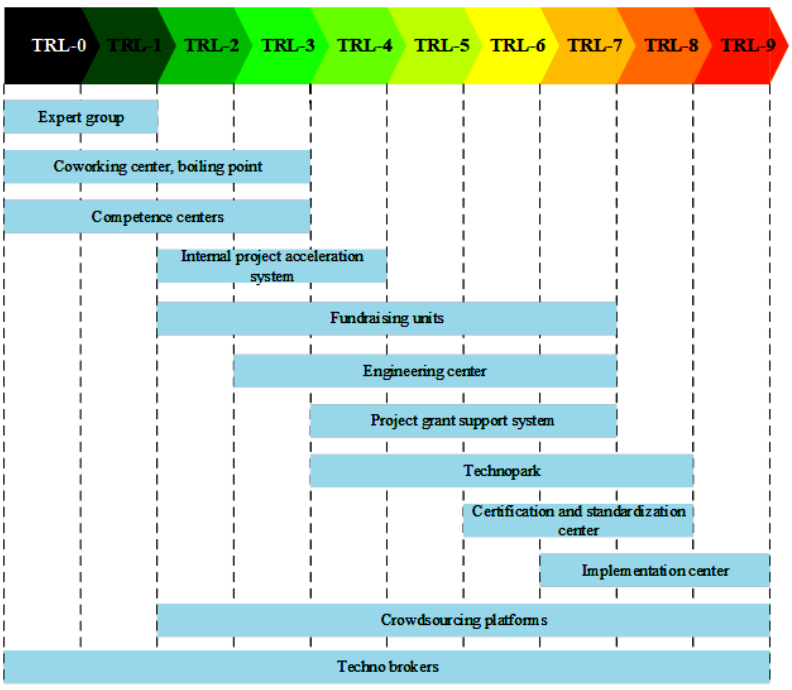

Fig. 4: Formation of mechanisms for overcoming the "Valley of death" (the author's drawing).

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One of the mechanisms for solving the problem is the creation of information and management crowdsourcing platforms, one of which is being created on the basis of the Samara State Transport University. The unified inter sectoral information and management platform (hereinafter referred to as the Digital platform) is an automated information system with a set of digital services. Services are defined as the ability of customers (certain participants and partners) and competence centers to solve problems of developing and implementing innovations.

Digital platform objectives are: 1) expert and technical support for the effective work of railway equipment manufacturers, operating organizations and scientific organizations; 2) B2B solution for active market participants who do not have a clear idea of what set of technological operations will be required to perform their tasks and/or what the cost of these works is.

CONCLUSION

The research is aimed at improving the efficiency of development and implementation of innovations by Universities. The considered mechanisms for overcoming the "valley of death" make it possible to ensure the effectiveness of the development and implementation of innovations. Mechanisms that support innovation at TRL levels 4-6 are of the greatest interest, since this is the most vulnerable phase of development. The creation of an information and management crowdsourcing platform, implemented by Samara State Transport University, will form an effective tool for bringing innovative solutions to the level of technological readiness that is in demand among businesses. In the future, such a platform can become a platform for supporting innovative solutions in the transport industry.

CONFLICT OF INTEREST

There is no conflict of interest.

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FINANCIAL DISCLOSURE

None.

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