# Systematic Method of Targeting the Strategic Innovation Research System in Transport

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Abstract: The article considers one of the innovative directions - the research system of strategic innovation activity in transport based on a systematic target setting method. The package of conceptual, algorithmic, structural, functional, informational and criterial models of the research system of strategic innovation activity in transport is presented, which allowed creating a knowledge system for managers to make reasonable management decisions based on intellectual-computer support. In order to create a system of research on the model scientific research methodology, a working slogan, satisfying the principles of measurability, modifiability and continuity of the transport industry, has been developed. To achieve the goal, a tree of objectives was built, which, when decomposed only by the technological approach, yielded more than 600 financial and economic objectives. On the basis of resource and role-based approaches, lists of strategic innovation research system functions were compiled, subjected to cluster analysis, and conceptual modelling of the research system of the transport industry was carried out. Based on the scientific study of strategic innovation research system formed the structure of the research system of strategic innovation activities by introducing the intellectual block of innovation in the form of a knowledge system in transport.



## 1 INTRODUCTION

"Sustainable development is about meeting the needs of the present generation without compromising the ability of future generations to meet their own needs. This principle should become the central guiding principle of the United Nations for all governments and ministries, private companies, organisations and enterprises" (Łuczak and Just, 2021; *Shcheglov, 2018*).

In this regard, the sustainable development of an industrial enterprise is based on the following concepts:

- the need for innovation for the functioning of the production business processes (Cheng, et al., 2020);
- constraints in the development of innovative technologies of the enterprise to meet the demand on commodity markets.

In this case, the following must necessarily change: to increase the number of innovative products and technologies; to increase the efficiency of innovative technologies and the management quality. Such changes help to maintain the growth of demand satisfaction for the production process and the needs on the commodity markets.

Today, economic theories set limits in the form of (Pasinetti, 2021):

- marginal costs;
- marginal profit;
- Supply and demand equilibrium, which do not allow for a lack of innovation.

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Therefore, any technological development (innovation) should be evaluated in terms of its contribution to the enhancement of sustainable economic development (Shabalov, et al., 2021; Mok and Kan, 2013). In addition, investment in innovation on the principles of sustainable economic development allows the industrial enterprise to create a system of long-term and sustainable profit through the efficient use of all resources.

From the point of view of innovation development in the processes of the Russian economy modernization, an important direction is to create such an innovation environment, so that the existing knowledge, technology, innovation development, scientific research could be turned into a final product demanded by the economy in the shortest possible time, to create a priority for the mass implementation of innovation in all spheres of activity (Guo and Shi, 2021; Morgan, et al., 2021).

The most pressing issue in the development of scientific innovation areas can be identified as strategic innovation activity, which is sufficiently well disclosed in the literature, but the research tools and systems of strategic innovation activity (SIRS) themselves are underdeveloped. Therefore, this article applies a systematic method of targeting SIRS, on the basis of which modelling was carried out, conceptual, algorithmic, structural-functional, informational and criterial models of SIRS were developed (Jin Ko, et al., 2021; Vnukovsky, 1999).

The whole package of these models will make it possible to form intellectual-computer support in the future and, ultimately, to create a knowledge system for managers to make competent and well-founded management decisions.

## 2 METHODS

Based on the literature review, the lists and characteristics of stakeholder satisfaction slogans were generated in relation to the development of a research system for the economic, information and management aspects of strategic innovation activities. The primary list of 44 keywords has been evaluated dichotomously (0 or 1) according to their importance for the main actors of innovation and investment. From the primary list of slogans, a working slogan for **Strategic Innovation Research System (SIRS)** (Boso, et al., 2012; Brozovic, 2018; Wales, 2015) was formulated.

The creation of a socially demanded competitive investment and innovation enterprise, relevant to the contemporary transitional economy, with high guarantees of economic security and a special research system (SIRS), which provides qualitative functioning and timely reform of the enterprise taking into account the appearance of innovative technologies which satisfy the principles of measurability, modularity and continuity (Covin and Wales, 2018; Gupta, et al., 2019; Ho, et al., 2016; Li, et al., 2008).

The global goal of SIRS is to develop a demanded SIRS that provides information on the quality functioning and timely reform of the innovative enterprise.

A technological approach has been chosen to identify local goals.

**Level I local targets:**

1. Fixing the quality of SIRS input streams.
2. Fixing the quality of SIRS regulations.
3. Fixing the quality of the SIRS implementation tools.
4. Fixing the quality of the SIRS output streams.
5. Fixing the quality of the innovation process technology.

**Local Level II objectives:**

1.1 Fixing the quality of SIRS customer quality information.

1.2 Fixing the quality of information about innovation capital.

1.3 Fixing the quality of SIRS input information.

2.1 Fixing the quality of regulations by type of ID.

2.2 Fixing the quality of standards by areas of IA application.

3.1 Fixing the quality of innovation resources (IR).

3.2 Fixing the quality of innovation tools (IT) of RS.

4.1 Fixing the quality of SIRS clients on outputs.

4.2 Fixing the quality of innovation capital at output.

4.3 Fixing the quality of output information.

5.1 Fixing the quality of innovative technological processes (ITP) by stages.

5.2 Fixing the quality of ITP by management levels.

5.3 Capturing the quality of ITP by professional levels.

Decomposition according to the technological approach alone resulted in more than 600 specific financial and economic tasks.

In order to obtain a list of functions from the list of tasks, a method for distinguishing two components was used - a routine one, based on precedents and oriented on computer databases, and a creative one, designed for the user's intellect. The creative component - innovation analysis is organised with the

help of a smart cueing system (SCS), SIRS, which helps to find a way to solve the problem.

More than 80 SIRS functions are derived, presented according to groups: quality of innovation processes, breadth of innovation services, technology of innovation processes, customer classification and documentation.

The resource-based approach additionally considers the current state of the innovation enterprise, the quality of innovation processes and their results, and the information-intellectual nature of the enterprise's innovation activities.

In the role-based approach, lists of main and subject support roles of IA were formed, to which subject-system and information-computer aspects of the problem were attributed. The obtained role structure of innovative enterprise allowed to make an additional list of functions for the roles of the head and main innovation manager, which in terms of breadth of coverage of IA issues satisfy the requirement of the list completeness as much as possible.

Based on these approaches, various SIRS lists of functions were compiled and subjected to a cluster analysis. To describe the properties of the functions, the main types of SIRS support, its resource and technology components were considered, and the object orientation was taken into account. The object orientation was expressed by the IA specificity, the resource component by knowledge-intensiveness, and the technological component by the quality of processability. A dichotomous way of quantifying the properties of SIRS functions was used. Cluster analysis takes into account the principle of function synthesis and the need to combine specific and non-specific functions in SIRS. The complete structure of the functions has three main levels: routine, knowledge-intensive and specific highly intelligent multimedia.

For each selected function, a list of requirements was generated for implementation in SIRS, in terms of generating the information to be collected for each IA profile and presenting the diagnostic opinion dynamically, for example, for each type of security (ordinary shares, preference shares, debentures, convertible bonds and other securities). The dynamic nature for all types of investment activities is adjusted with inflation projections for each calculation period, and risks are considered and assessed at all stages of IA development.

According to the typology of technological systems of strategic innovation research, the main stages, methods and models used, as well as the corresponding tool support for technological schemes of innovation research are grouped.

As the next step in the systematic method of goal-setting, SIRS modelling was carried out. Conceptual, algorithmic, functional-structural, criteria and information models of SIRS have been developed.

The general concept of SIRS consists in modelling SIRS by implementing the cycle: management, identification, interoperability, optimization of the lower IA levels on the basis of subsystems: computing and information environment, the SIRS object and interface means, functionally interconnected by human investment activities aimed at improving the quality of SIRS processes and results.

The base-level concept of SIRS is to model SIRS through distributed management of the downstream implementation - management, identification, interoperability and optimisation of the lower levels of the LED through sub-systems-based dialogue points.

Hierarchical computing facility, LED object and modular interfacing facilities, functionally linked by the activities of SIRS users and maintenance personnel, aimed at determining the stability of the current situation, selecting and applying adaptive bifurcation mechanisms of development, evolution of the self-organising SIRS system, improving the efficiency and quality of innovation processes and SIRS results, automating research on technological investment processes and implementing active learning methods in order to improve the SIRS science and technology base and create a modern industry of innovation activities.

The base-level concept of prospective SIRS consists in modelling and synthesis of SIA through centralized management of top-down cycle - management, identification, compatibility and optimization of lower levels of SIA according to the requests of system users based on subsystems with programmable architecture: computing environment, SIA object and intelligent interface tools, functionally united by user activities as well as system integration, formalization, structuring, modelling, optimization, on the one hand, and intellectualization

The architecture of the main subsystems of SIRS is constructed as a programmable structure in the form of a set of properties and characteristics that define the relationships between the blocks of the system. The architecture of the computing environment is programmable in order to align it with the nature of the SIA task at hand. The programmability of the SIA object structure allows to solve the task of synthesis, i.e., creation of the SIA

object based on the known model. The SIA object structure programmability can be considered as one of the ways to control the SIA object. Programmability of interface architecture provides functional flexibility of subsystems during their interaction with SIA and computational environment.

The general concept of the computing environment within SIRS consists in the implementation of receiving, transmitting, processing and storing information about SIA, SIRS and its subsystems by managing it through a human-machine dialogue, based on software and hardware, aimed at automating the acquisition of information about strategic innovation activities to improve the efficiency and quality of research tools.

The base-level concept of computing environment at the present stage within SIRS consists in realization of reception, transfer, processing and storage of data and knowledge about SIRS and its subsystems by its management by means of human-machine dialogue, based on software-hardware, aimed at automatization of obtaining new knowledge about SIA to increase the efficiency of experimentation tools and creation of modern IA industry.

The general concept of interface tools within the framework of SIRS is to provide information interaction between the computational environment and the SIA object by organizing impact on the SIA object and recording its response to impact on the basis of experimental hardware, aimed at increasing the efficiency of primary information acquisition for the purpose of end-to-end automation in the IA field.

The base-level concept of modern interfacing means within the framework of SIRS consists in providing information interaction between modern computing environment and SIA object by means of adaptive stabilization of control parameters of IA object and registration of integral responses of SIA object on the basis of modern hardware and software, aimed at increasing informativeness of SIA research with the purpose of end-to-end automation and digital transformation under the influence of SIRS.

The general concept of human innovation activity in SIRS consists in heuristic search for solutions by implementing informal operational research of SIRS and its subsystems, aimed at efficient operation, maintenance, service and upgrading of the system to ensure the life cycle of SIRS.

Human investment activities in SIRS are closely intertwined with human activities in general. The feedback of this activity model is presented in the form of an activity law for this development stage:

$$Y = F (X1, X2, X3, X4, X5, X6; R ), \quad (1)$$

where X1-X6 are the factors for the existence of activities: by scope, focus, product, scope, dynamics of innovation processes;

R is a relationship matrix between these factors.

In most detail, the algorithms of the block responsible for the work of the decision maker - user of the innovation manager, financial analyst and designer (systems engineer) with the knowledge system in the operation of SIRS were investigated. The algorithms of SIA situation assessment with sustainability analysis and economic risk management of innovation activities are also presented.

Thus, based on the conducted scientific research of strategic innovation research system, the structure of SIRS can be formed and presented in the form of the following scheme (Figure 1).

# 3 RESULTS

The following results have been obtained from the conducted scientific research:

- Methodological, system-informational prerequisites for the development of models of economic, information-innovation and management processes of strategic investment-innovation activity have been obtained to create a research system of strategic investment-innovation activity.
- The investment and innovation activities of modern enterprises have been analysed and modelled taking into account the uncertainties and venture factors of transforming economy as a prototype of technology for the study of investment and innovation activities.
- The following models of strategic investment activity research have been developed: conceptual (general, basic-level, modification-level), systemic (tuple-level).
- The structure of the strategic investment-innovation activity research system is formed taking into account the introduction of a new innovation block for the knowledge system research system.
- System-based requirements for the technological scheme of strategic investment and innovation activity research through the methodological chain "slogans (the most significant factors) - problem - problem - global goal - local goals - objectives" are formulated.

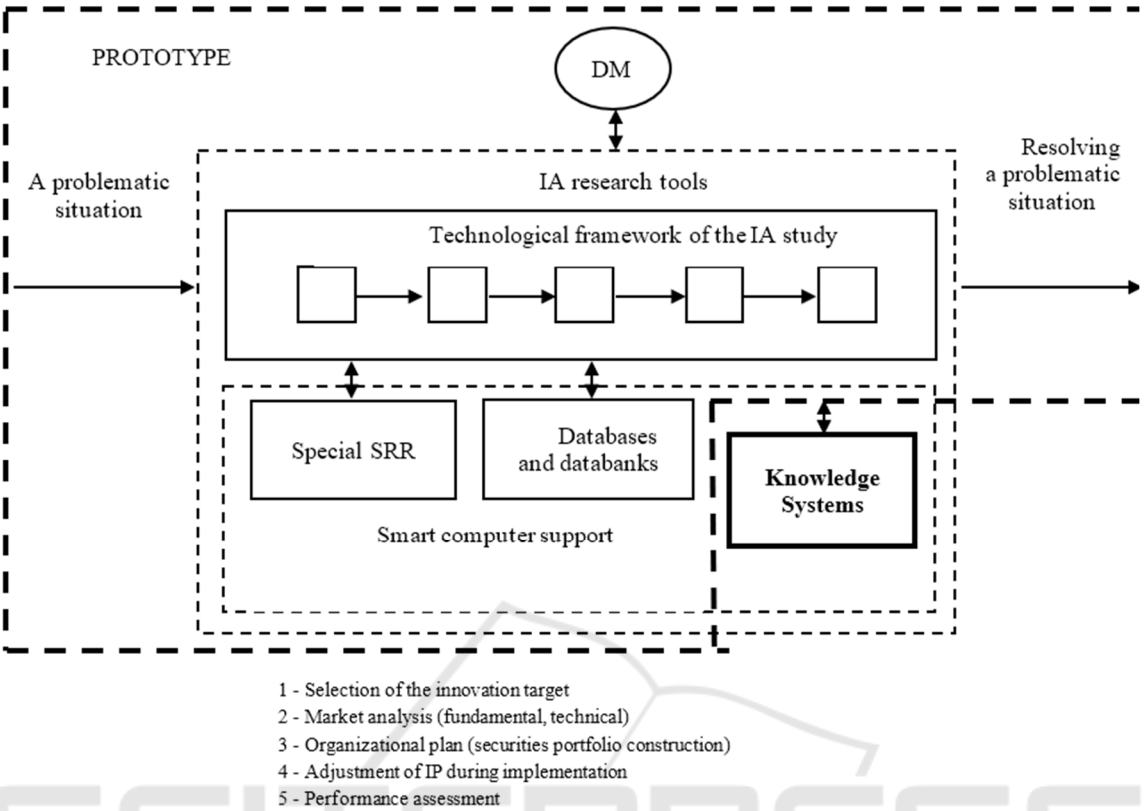


Figure 1: SIRS structure.



## 4 CONCLUSIONS

The importance and value of this work lies in the fact that it provides a methodology for scientific research in any field of activity both for enterprises and organizations, and for the development and improvement of business processes, as well as competitiveness of developing companies and corporations. Further development and modernization of the proposed research system is planned to apply it in practice, taking into account the research of uncertainties in a changing environment based on the assessment of quality criteria for the management of strategic investment and innovation activities of modern facilities.

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