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Information and Management System for the Metrological Supervision of Innovative Technologies

Firstov Vladimir Grigoryevich[1]

[1]*Doctor of Technical Sciences, Professor Moscow Technological University (MIREA)*

ABSTRACT

The analysis of innovation development programs of major partially state-owned companies was carried out. It showed that their targeted effectiveness and commercial efficiency are largely determined by sufficiency and completeness of the metrological and the regulatory supervision. It was shown that a complex system of the metrological supervision for the innovative development of the technological economy was developed to solve this problem. The system consists of the educational and methodological, information and analytical, and reference subsystems. Prospects of the transition from traditional information systems to information and analytical systems for the management of the metrological supervision of innovative technologies was considered to improve the effectiveness of innovation programs and projects. To this end, it is proposed to use the network-centric system. It is shown that capabilities of the global computer network allow establishing links of developers and consumers with an information database on operated, manufactured and developed innovation technologies and their metrological supervision. Based on this, it was proposed to use the network-centric management system for forming distributed data on the metrological supervision of innovation technologies, which are implemented in the framework of programs and projects. It is expected that the use of this system in implementing innovation programs and projects will, undoubtedly, promote further increasing their economic and targeted effectiveness.

Keywords: Information and analytical systems, network-centric management, metrological and regulatory supervision.

1. INTRODUCTION

One of the priority problems of the competitive development of national innovative systems lies in the implementation of the innovative state and industry programs, as well as programs of the big partially government-owned companies, target-oriented programs of the Federal and municipal executive bodies. Actually, each of these innovative programs includes up to hundred projects in the design, construction,

assembly and operation of different purpose facilities, products and new materials, development of breakthrough technologies, aimed at providing a new quality of life, development of the knowledge economy, ensuring national security [11]. The target effectiveness of innovation programs and projects is based on a complex of quantitative indices and indicators, which should provide the possibility to measure indices of accuracy, reliability, safety and quality of innovative technologies [10, 12]. To this end, a set of metrological measures is used, including numerous high-precision measurements with the use of fundamentally new methods and means of the measurement, control and diagnostics, high-tech benches and standards of the new generation, as well as new international and national standards, norms and rules. As shows the experience of the implementation of large-scale technological projects, lack or insufficiently clear formulation or substantiation of quantitative target indicators inevitably leads to complexity of the objective assessment of achieved results and subsequent increase in the risk of making unreasonable conclusions and decisions [13, 14]. To avoid such faults, attempts are made to develop and use various analytical, information and measurement systems for the assessment and management of innovative technologies [24, 25].

2. MATERIALS AND METHODS OF THE RESEARCH

The target effectiveness of implemented programs and projects of the innovative development is determined by the level and sufficiency of the metrological supervision of innovative technologies, which allow assessing quantitative indices and indicators, planned for the implementation. The metrological supervision of innovative technologies represents the interconnected set of normative and regulatory and technical documents, standards of value units, new methods and means of measurement, control and diagnostics, high-tech benches, the cost of which can be up to 50% of the total program funding amount [19]. To increase the effectiveness of innovative programs, the possibility of using the integrated management system of metrological supervision of innovative technologies was considered.

The most important system tools, which were used in the construction of an integrated system of metrological support for innovative technologies became:

- system of monitoring, analysis and cataloging of measurement technologies, developed or used in innovative technologies [7, 22];
- regulatory and legal framework [21], including normative and legal acts and normative and technical documents [13, 14], establishing and ensuring the procedure for the formation, expert examination and implementation of metrological activities, innovative programs, integrity, reliability, completeness and sufficiency of metrological indicators;
- educational and methodological system of advanced training in the field of metrological and regulatory and legal support for employees involved in the development, expert examination and implementation of innovative programs, with the aim of gaining the necessary and sufficient skill level for the implementation of works on the formation and implementation of metrological activities [20].

3. RESULTS

The integrated management system for metrological supervision of innovative technologies consists of three interrelated subsystems: educational and methodical, information and analytical, normative and legal, as well as consulting and expert system for their maintenance (Figure 1).

Figure 1 integrated metrological support management system structure.

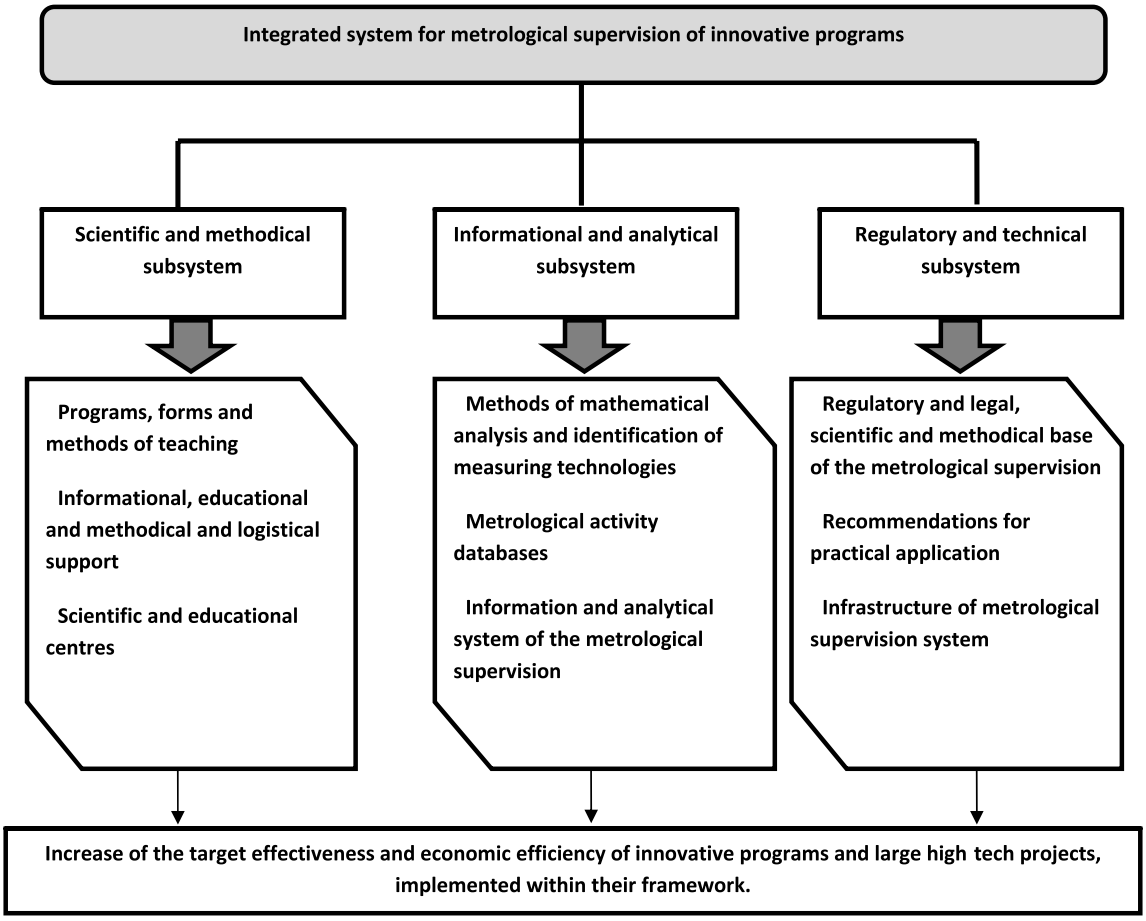

Figure 1: The structure of the integrated management system for metrological supervision

The educational and methodical subsystem is based on the specialized program of advanced training specialists, who are directly involved in the formation, expert examination or implementation of the State or Federal innovation programs, integrated interdisciplinary projects in priority directions of the modernization and the technological development of the economy. The basis of the subsystem is the basic program of advanced training "Normative and metrological supervision of innovative technologies of targeted scientific and technical programs and projects, developed in priority directions of development of the Russian economy" [20]. The program is characterized by the harmonious integration in it of the professional knowledge in the field of metrology, standardization, qualimetry, innovation studies and conformity assessment, as well as by considering issues of the metrological supervision of innovative development programs of leading industries.

The main tasks of the information and analytical subsystem became monitoring of innovative technological projects, obtaining of the operative and reliable information about the developed and produced measuring, control and diagnostic tools, developing a single information base of innovative measurement technologies (cataloging), including measurement, control and diagnostic tools, test benches, standard samples and standards. When creating the information and analytical subsystem of metrological and normative support of innovative technologies, the experience of developing the information and analytical

system of cataloging knowledge-intensive measurement tools, control and test and diagnostic equipment, which is necessary for carrying out researches and the educational process was used [22].

The main goal of the information and analytical subsystem is to provide the Federal and local authorities with operational and reliable analytical information, which is necessary for the formation of metrological activities and indicators of innovative programs and projects, as well as providing scientific, educational and other consumers with a reliable information about manufacturers and regulatory documents, according to which it is produced.

The regulatory and technical subsystem of the metrological supervision establishes and maintains the procedure, content and organization of works for the development, expert examination, acceptance and implementation of metrological measures, determines requirements and methodical recommendations for the formation of metrological indicators and the development of metrological indices. It includes normative and legal documents and scientific and methodical instructions and recommendations, agreed and adopted in accordance with the established procedure. Among main tasks of the subsystem is the regulation of the relationships of participants in the development, expert examination, acceptance and implementation of the metrological supervision of innovative technologies.

4. DISCUSSION

One of the main goals of the integrated system of metrological support of innovative technologies is to substantiate the decision-making of the optimal choice between the order and the development of a new or use of existing measurement technology. On the one hand, this is complicated by the capacity of the park of measuring instruments and the instrumentation, used in scientific and educational institutions and organizations, on the other hand, an abundance of thousands of innovative programs and projects, which include metrological activities [24]. These developments are carried out in organizations of various bodies of executive power, largest economic entities of the public sector of the economy or individual firms or companies independently of each other in conditions of deficient information capacity and coordination. Due to this, there is a great danger of formation and implementation of similar in the subject-matter or simply duplicating each other scientific researches or technological developments, and, in some instances, the production of noncompetitive products, which do not meet requirements of national and world standards and regulations. Possibilities of coordination, expert examination and implementation of metrological and regulatory procedures of innovative programs and projects are limited by capabilities of organizations, implementing policies in the field of the innovative development and modernization of the technological economy. The solution of this problem requires new approaches to solution of the problem of the metrological supervision of innovative technologies and the transition from information and analytical systems of the metrological supervision to management systems of modern measurement technologies. As shows the experience of transnational corporations, the most prospective way to solve this problem is to use a network-centric management system of the metrological supervision of innovative technologies [6, 18]. The principle of such system lies in using capabilities of the global information network [4, 17], consisting of the distributed network of independent objects, equipped with the computer intelligence and capable to act both independently and in a group for performing a common target function [2, 3]. Today, such approach is successfully used in network-centric management systems of organizing and war fighting [1, 9, 15], as well as in designing information and management systems for special purposes [2, 4, 8].

5. CONCLUSION

The construction of an information and management system for metrological supervision of innovative technologies is based on a global information grid, which is based on the vertical integration between information sources (information and analytical system on measuring technologies, means of the control, diagnostics, etc.), nodes of decision-making (choice and implementation of metrological activities, which are needed for the implementation of innovative technologies, developed in the framework of programs and projects of various levels) and executive bodies (customers and executors of programs and projects), as well as horizontal links between diversified suppliers, developers and consumers, circulating in metrological and management systems of metrological and normative information [23]. All these objects, which make up the infrastructure of the metrological supervision of innovative technologies can be considered as elements of a network-centric management system, which is characterized by principles of transparency, openness, scalability, weak hierarchy and united by the global computer network [5]. The possibility of implementing the proposed concept is confirmed by the data of the International Union of Communications, that today the global computer network unites more than one and a half billion personal computers and mobile communication networks, which had already united about 4.5 billion subscribers.

The use of the information network-centric system for metrological supervision management of innovative technologies will provide an opportunity to obtain the fullest possible information from developers and suppliers of the metrological supervision of innovative technologies, experts, who prepare and carry out the expert examination of the metrological activities under development and implementation, employees, who form innovative programs and projects for further use in decision-making support systems in conditions of the total computerization of network technologies [16].

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