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MANAGEMENT SYSTEM FOR METROLOGICAL PROVISION OF INNOVATION TECHNOLOGIES

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Abstract

The programs of the innovative development in the biggest partially government-owned companies with their special purpose productivity and economic efficiency being determined by the relevance and completeness of the metrological and regulatory provision are analyzed. It is shown that a comprehensive system of metrological provision for the innovative development of a technology-based economy has been designed to solve this problem. Regulatory and metrological provision can be optimized with an information analytical management system with the network-centric system as its basis. It is shown that the global computer network is able to establish the links between the developers, and the consumers, and the information database on the used, produced and designed metrological technologies and their regulatory provision which help to create the network-centric management system by articulating the metrological and regulatory measures of innovative programs and projects. It is expected that the application of this system in implementing the innovative programs and projects will surely contribute into the increase of the economic efficiency and special purpose productivity.

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

1. Introduction

One of the burning issues in the competitive development of the national innovative systems concerns the design and implementation of the innovative state and industry programs, as well as the programs of the big partially government-owned companies, special-purpose programs of the federal and municipal executive bodies. Actually, each of these innovative programs includes up to a hundred projects in the design, construction, assembly and usage of facilities with different purposes, products and new

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materials, development of the breakthrough technologies aimed at providing a new quality of life, development of knowledge economy, national security and balanced regional development. The overall number of the implemented innovative projects is hundred thousands, without the projects within the electronic auctions and direct contracts, as well as the grants from many funds and organizations. The efficient implementation of the innovative programs and projects leads to the crucial scientific, technological and technical results and solutions within short timeframes with the strategic value for the innovative development of country's economy.

1.1 Problem statement

Economic efficiency of the innovative programs and projects is determined by the system of quantitative economic statistical and metrological indicators and factors characterizing the planned level for the development of the social economic, scientific technical and technological capacity. These economic statistical indicators are typically defined with the methodology of social economic statistics and the requirements of the international standards, including the ones of the Organization of Economic Assistance in Development and Eurostat.

The special purpose productivity of the implemented innovative programs and projects is based on a set of quantitative factors and indicators which should make it possible to measure the indicators of accuracy, reliability, safety and quality for the designed products, technologies and processes (Firstov, 2013). In this case the special purpose efficiency of the innovative programs and projects is determined by the level and completeness of the regulatory and metrological measures with many highly accurate measurements with advanced measurement methods and means, control and diagnostics, highly technological stands and samples of a new generation, as well as new international and national standards, norms and rules.

This is the way to receive the necessary data on the quantitative values of the planned indicators and factors checking their reliability during an independent evaluation supporting the fact that the accuracy indicators do not exceed the set limits and provide the same understanding of the measured characteristics with clear generally accepted definitions and applicable value units which should eliminate the possibility to have a distorted understanding of the program implementation results. Unclear definition or the lack of it or justification of the quantitative special-purpose factors and indicators will inevitably lead to the complexity of the objective evaluation for the efficient implementation of the innovative programs and projects, to distorted understanding of the achieved results of the program implementation and to the increase of risk of the unsupported conclusions and solutions. This can be illustrated by 42 state programs of the innovative developments and modernization of the technological economy in the Russian Federation (Order of the Russian Federation Government of 15.12.2012, № 2394), with each program in the sphere of the innovative development and economy modernization, as well as some particular programs in different spheres stating new quality of life, provision of the national security and balanced regional development. There are also the measures with the evaluation and implementation being connected with the usage of the modern information measurement, control and diagnostic technologies.

The national significance of problems of metrological support of the government programs is conditioned by the requirements for the necessity of quantitative valuation of target indicators and

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indicators of state programs defined by the decision of the Russian Government dated from August 2, 2010, № 588 "On approval of the development, implementation and evaluation of the effectiveness of the Russian Federation government programs". "The provisions of the Decree of the Russian Federation" from 13.09.1996, №1101 "On Amendments to the procedure for the development and implementation of federal target programs and international programs, the implementation of which relates to the Russian Federation as a party." In "Methodological guidelines for the development and implementation of state programs of the Russian Federation" approved by the Order of the Ministry of Economic Development of the Russian Federation dated from December 26, 2012, N 817, it is stated that when setting the goals and objectives of the program, it is necessary to provide the ability to check and verify their achievements or solutions for the purpose of which target indicators and indices must comply with the adequacy, accuracy, objectivity, reliability, uniqueness, efficiency and comparability. Target indicators and indices should provide data that allow verification of their authenticity during the inspection, confirming that the accuracy rates do not exceed the set limits and provide a common understanding of the measured characteristics with the use of clear common definitions and approved for use in the Russian Federation of units, which should delete the obtainment of a distorted picture of the results of the program.

The main purpose of metrological provision of innovative government programs and large-scale high-tech projects in their framework is the justification of the effectiveness of selected measurement technologies, implementation of mandatory metrological requirements, confirming the possibility of the planned metrological activities to obtain reliable and comparable measurements, monitoring and diagnosis and thus exceptions of arbitrary decisions and committing wrong actions on the basis of false information. The main condition for the performance evaluation of the program is the successful realization of the planned target indicators and indices for the period of their implementation.

At the same time, despite the requirements according to Article 14, point 1 of the Federal Law "On ensuring the unity of measurements" on compulsory examination of the included in the draft normative legal acts of the Russian Federation requirements for certified reference materials and measurement instruments, the RF Government Decree of 13.09.1996, №1101 has fixed regulatory requirements for providing the products quality (works, services), as well as the metrological support, including the system of program activities on standardization and metrology. These program activities are necessary for the development, production, operation and disposal of products, construction of facilities, organization of technological processes and other activities provided by the program in the methodological guidelines for the development and implementation of state programs of the Russian Federation, approved by the Ministry of Economic development of Russia and registered in the Russian Ministry of Justice. In these programs, there is no corresponding guidance. As a result, in the approved by the Government state programs, aimed at the modernization and technological development of the economy, there are practically no metrological activities as well as metrological indicators to realize a possibility of the checking and verifying their achievements or solution based on the execution of adequacy requirements, accuracy, objectivity, reliability, uniqueness and comparability. However, nearly in all the programs, there are no metrological and regulatory factors and indicators (Firstov, 2014).

The solution of the set task mainly depends on the level of the mterological and regulatory provision for the measures within the innovative programs and projects, the level giving an opportunity to assess the planned quantitative indicators and factors. Metrological provision of the innovative programs

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represents an interconnected set of regulatory legal and technical documents; measurement unit samples; completely new methods and measurement, control and diagnostics instruments of the most advanced measurement equipment; highly technological stands and new generation samples; international and national standards, norms and rules, the cost of which can amount to 10-30% of the financing volume of the program providing an opportunity of achievement of the stated objectives and solution of the outlined tasks by means of obtainment of reliable measurement information at all stages of the program implementation. This problem is of special importance for the technological branches of industry with a developed comprehensive system of metrological provision of the innovative technologies as an efficient tool to support the special purpose productivity and economic efficiency, to implement the planned measures, to receive the reliable results and, thus, to eliminate the possibility to arrive at the groundless solutions and to do erroneous actions based on unreliable information (Firstov, 2013).

1.2 Research questions

During its development, a comprehensive system of metrological provision of the innovative technologies helped to solve a number of regulatory legal, scientific, information analytical and organizational tasks.

First of all, it was necessary to change a traditional trend in the under-evaluation of the importance in the metrological provision for the innovative programs' measures from the experts participating in their development and implementation. This can typically be explained by the fact that these experts do not have a special metrological education and underwent or are undergoing educational programs of higher professional education in equipment and technology where the questions of the metrological provision are looked at within one general professional subject. As a result, they acquire basic knowledge and skills in the sphere of unified measurement, confirmation of conformity and stardartization which appear to be insufficient for the qualitative works in the articulation and implementation of the metrological measures in the innovative programs.

Secondly, one requires a strict system to justify the practicability for the development or choice of the efficient measurements technologies, algorithms and methods of measurement. This is connected with the fact that presently, in the Russian Federation, the measurement instruments and testers amount to more than 1.5 bln units, the nomenclature of which exceeds 10,000 names, and at that, more than 4.5 thousand of scientific organizations and higher educational establishments in Russia have more than one billion units of instrumentation equipment for the scientific researches and carry out the scientific research and technological developments of new technologies and measurement instruments and control devices. The information about the manufactured and used on the territory of Russia measurement equipment is based on the leaflets and catalogues of the particular enterprises and suppliers and is of advertising nature which does not help in dealing with the metrological provision for the innovative programs (Korchak, 2007).

Thirdly, the analysis of the regulatory legal documentation shows that the current legislation system sets certain limits in the application of the scientific technical capacity of the scientific metrological institutes of the Federal Agency on Technical Regulation and Metrology and the leading universities of the Ministry of Education in Russia in articulation, evaluation and implementation of the metrological measures in the innovative programs, the designed regulatory technical documents partially cover the issues of the metrological provision for the innovative programs.

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A comprehensive system of management for the metrological provision of the breakthrough technologies developed within the innovative programs and projects is developed to solve the specified challenges. The system consists of academic, information analytical, regulatory legal and consulting expert subsystems. The stages of the system construction can be represented in the form of a ladder with the consistently implemented steps-modules.

The first module is about the implementation of a specialized program of professional advancement of the specialists directly involved into the articulation, evaluation or implementation of the state or federal innovative programs, interdisciplinary projects in the preferred spheres of modernization and technological development of the economy. This program is based on an educational program of professional advancement "Regulatory and metrological provision of the special purpose scientific technical programs and projects designed for the preferred spheres of the Russian economy development" (Firstov, 2013). The program is characterized by a balanced integrated professional knowledge in metrology, standardization, qualimetry, innovatics and conformity evaluation, as well as by looking at the issues of the metrological provision for the programs of the innovative development of the leading industries.

The second module providing the prompt and reliable information about the designed and produced means of measurement, control and diagnotics is an electronic information analytical monitoring system for the innovative programs with the experience acquired from the development of the innovation analytical system of classification of the science-based means of measurement, control and testing and diagnostics equipment necessary for the innovative technology development (Firstov, 2013). One of the challenges to be faced at developing the information analytical system for the regulatory and metrological provision of the innovative programs and projects was the design of one uniform database of the measuring technologies including the means of measurement, control and diagnostics, testing stands, standard samples and references. A close look and analysis of the foreign practices and the results of works in classifying the supplies showed that the classification principle made it possible to create one uniform database at all stages of the life cycle - from generating the idea of a product to its usage with further organization of research, design, production, application, storage and recycling. This classifying system helped to improve the efficiency, planning, development, order, design, delivery and usage due to the targeted management of the nomenclature (Zatuliveter, 2010; Yefremov, & Maksimov, 2010). The main purpose of the electronic information analytical system of the measuring technology classification is to provide the federal and local management bodies with the prompt and reliable analytical information necessary for the metrological measures and indicators of the innovative programs and projects to be defined, as well as to provide the scientific, academic and other consumers with the reliable information about the producers and regulatory production documents.

2. Discussion

One of the chief tasks of this system is to support the appropriate choice between the order and the development of a new measuring technology or the application of the already existing one. On the one hand, this is complicated due to the amount of the measuring means and instrumentation used in the scientific and academic establishments and organizations. On the other hand, tens of thousands of innovative programs and projects with the metrological or regulatory measures which are developed in

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the organizations representing different executive bodies, in the biggest economic subjects of the state economic sector or in particular companies or firms are independent in the context of insufficient information and coordination. As a result, there is a great danger of formation and realization of thematically close or duplicating each other scientific researches or technological developments and, in a number of cases, production of non-competitive commodities not corresponding to the requirements of the national and world standards and rules. The possibilities to coordinate, evaluate and apply the metrological and regulatory measures of the innovative programs and projects are limited by the possibilities of the organizations implementing the policy in the innovative development and modernization of an economy sphere.

3. Conclusion

The obtained data and the practices of the transnational corporations support the idea of shifting to the network-centric management system as the most promising way to solve this problem. The theory of the network-centric management in warfare suggested by Arthur K. Cebrowski and John Garstka in 1988 can become a prototype for this system (Yefremov, Maksimov, 2010). This information management system is based on the usage of the global information network (Yefremov, & Maksimov, 2010) consisting of a set of autonomous computer-intelligent objects united by an overall global network and being able to act both independently and as a group to fulfill one targeted function.

Presently, this approach is successfully applied in designing the network-centric information management systems of special purpose (Zatuliveter, 2010; Burenok et al, 2009). They are based on the global information grid with a vertical integration among the information sources (information analytical system in the measuring technologies, means of control, diagnostics, etc.), acceptance nods (metrological and regulatory measures of innovative technologies developed within the programs and projects of different levels) and executive bodies (clients and innovative program and project providers), as well as the horizontal links between different suppliers, processors and consumers circulating in the information management systems for the metrological and regulatory information (Tanenbaum, & Van Steeen, 2003).

The possibilities to implement the suggested theory are determined by the possibilities of the global computer network which unites more than one and a half billion personal computers (data taken from the International Communication Union). The computer medium includes the networks of the mobile connections which have already united about 4.5 bln phone users, as well as the networks connecting the stationary and mobile facilities with in-built microprocessors, thus managing different technologies of mass usage.

The information network-centric management system for the regulatory and metrological measures of the innovative programs and projects enables one to use the information flows from the developers and suppliers of the measuring technologies, experts preparing and evaluating the developed and applied metrological and regulatory measures to receive the maximum information for its further usage in the solution supporting systems in the context of the total computerization of the network technologies (Lavrenov, 2005; Slipchenko, 2004). The global networks give an opportunity to create this system on the basis of the mass usage of the net-centric computing to solve the management problem with the metrological and regulatory provision of the innovative programs and projects and to increase their targeted productivity and economic efficiency.

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References

A list of the Russian Federation State Programs in the Version Introduced by the Order of the Russian Federation Government on 15.12.2012 № 2394-p - URL: *http:// programs.gov. ru/Portal/ programs/ documents,*

Burenok, V.M., Ivlev, A.A., Korchak, V.Yu. (2009) *The development of military technology of the XXI century: problems, planning, implementation*. Tver: Publishing house OOO "KUPOL".

Firstov, V.G. (2013). *Role of Metrological Provision in Increasing the Efficiency of the Innovative Scientific Technical Programs.* M.: Standards and Quality. 12. 52-55.

Firstov, V.G. (2014). *Metrological Provision of the Economy Innovative Development*. M.: Quality, Innovation, Education. 2. 58-63.

Korchak, V.Yu. (2007). Cataloguing of knowledge and technology system. *Tekhnicheskoe regulirovanie.*6. 24-30.

Lavrenov, S.Ya. (2005). *XXI century War: Strategy and Armory of the USA*.M.: OOO "AST".

Slipchenko, V.I. (2004). *New Generation War: Distant and Touchless*. M. OLMA-PRYeSS.

Tanenbaum, E., Van Steeen, M. (2003). *Distributed systems. Principles and Paradigms*. SPb.: Piter.

Yefremov, A.Yu., Maksimov, D.Yu. (2010). Network-centric system - that is embedded in the concept. . *The third conference "Technical and program management, monitoring and measuring"*. 159-161.

Zatuliveter, Yu.S. (2010) Computer Basis of Network-Centric Management. *The third conference "Technical and program management, monitoring and measuring"*. 493-511.