

Ensuring the Quality of Defense Industry Products of Russia in the Conditions of Import Substitution

S. B. Baurina

Academic Department of Industrial Economics
Plekhanov Russian University of Economics
Moscow, Russia
baurinaaa@yandex.ru

E. O. Savchenko

Academic Department of Industrial Economics
Plekhanov Russian University of Economics
Moscow, Russia
savchenko_eugene@mail.ru

E. V. Nazarova

Academic Department of Industrial Economics
Plekhanov Russian University of Economics
Moscow, Russia
e.nazarova@list.ru

A. A. Golubev

Academic Department of Industrial Economics
Plekhanov Russian University of Economics
Moscow, Russia
golubev3403@gmail.com

Abstract – The paper is devoted to the problems of ensuring the quality of the products of Russian defense industry. The reasons for the low level of quality of military products are analyzed. Specific recommendations for solving existing problems in terms of import substitution are proposed. A system of quality maintenance for defense enterprises is proposed.

Keywords - quality, products, industry, military-industrial complex, enterprise, sanctions, import substitution.

I. INTRODUCTION

Currently, the Russian economy is in a difficult situation due to negative trends in national economy and rising tensions between Russia and the West. The European Union and the United States have imposed sanctions against Russia and various sectors (including defence). Problems and complexities of Russia's economy are reflected not only in stagnation, declining of industry outputs, cross-defaults, but also in the quality level of manufactured products.

Generally speaking, level of technological sophistication of equipment and know-how generated in Russia is lower compared with advanced economies [1]. Investments in industrial modernisation and new technologies would be justified only if products to be manufactured are competitive and in demand from customers.

The article pays attention to problems and challenges of Russian defence industry functioning under import substitution. The paper is designed to facilitate professional development of academic personnel and to set the pace for R&D work of young researchers and engineers.

II. QUALITY ASSURANCE ISSUES OF DEFENSE PRODUCTION

Defence industry in Russia is very R&D-intensive (Fig. 1, 2). Its frontline research and development is conducive to a technology spill over to other areas of national economy.

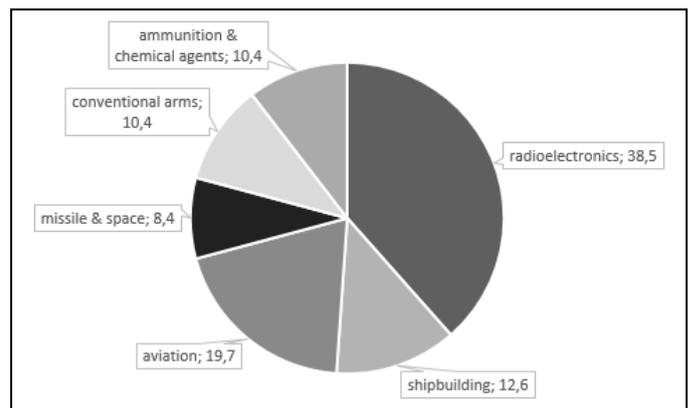


Fig. 1. Sectoral structure of Russian defence industry (%), source: Rosstat

The sanctions against a number of defense enterprises in Russia, broken connections between many manufacturers of military hardware components have put manufacturers in a quandary [2]. However, there are examples of successful activities in the current conditions.

So, the American Defense News says about the holding "Almaz-Antey", which specializes in the production of anti-aircraft systems. At the moment, it ranks 11th among the world's largest arms producers, and over the past year has managed to increase its turnover by more than 10%. The Russian Helicopters holding (turnover increased by 16.3%) and the Tactical Missile Armament Corporation (plus 48.6% of turnover) achieved even more notable successes (<http://www.defensenews.com/>).

At large, for Russian defence industry 2017 was successful as it showed 7.5% year-on-year growth. Now, the industry tends to complete tasks, established in 2018-2027 Federal Arms Program.

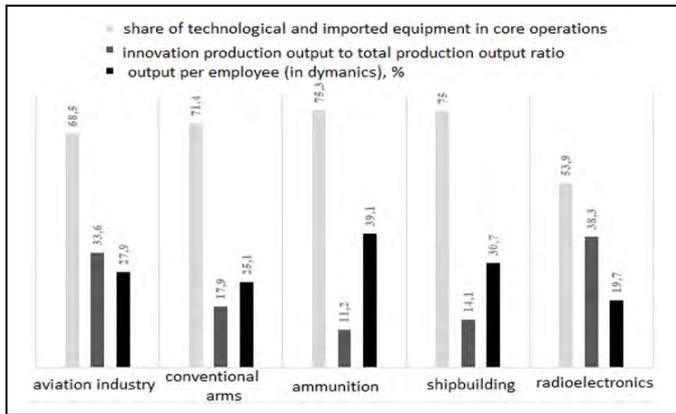


Fig. 2. Production and technological potential of Russian defence industry (%)

Combat and in-use performance can be considered as an essential for evaluation of Russian defence companies. Russian military campaign in Syria proved that Russian-made weapons and military equipment have high level of quality – including communication equipment, avionics etc. Nonetheless, the product quality problem remains [4].

The key causes for insufficiently high quality of defence products can be categorized as technical, legal and organisational (table I).

Basic principles of government policy for defence industry development require that defence contractors have in place efficient quality management systems (QMS). National military standards set up special requirements for public sector customers along with the evaluation forms and procedures for QMS compliance with imposed requirements.

The following specific standards have been developed for Russian defence companies (GOST 0015–002–2012 “Military equipment system of development and launching into manufacturing. Quality Management System. General requirements”. GOST 0015–003–2017 “System of development and launching into manufacturing. Military equipment. Inspection procedure of quality management systems of defence companies”. Standards compliance assures development, commissioning and service of military equipment.

Quality management systems, being developed and implemented nowadays, tend to be a driver for transition to digital production [6]. For instance, during the first research and practice forum named “Quality issues for military and civilian products of defence companies” (“Quality of MIC – 2018”), which was held in Nizhny Novgorod in February, 2018, United Shipbuilding Corporation (USC) presented its real-life experience on building corporate system of quality management. The experience may be seen as unique, since USC’s structure is not vertically-integrated. Therefore, a process model of Quality Monitoring System was introduced. It has certain differences from existing practices in terms of both form and meaning.

TABLE I. KEY REASONS FOR POOR QUALITY OF DEFENCE PRODUCTS

Type	Description
Technical	<ul style="list-style-type: none"> – obsolescence and physical wear of the fixed assets (FA) of defence contractors (DC), including outdated process engineering capabilities and a lack of modern machine-tools and measuring equipment and lab/test facilities; – use of outdated hardware componentry for MME manufacture; a low quality of components and materials; – inexistent state-of-the-art electronic tracking equipment in the development, production and operation of science-intensive MME at all stages of its lifecycle (CALStechologies) which ensures a radical improvement of quality and competitiveness; – a lack of computer aided quality management systems (QMS) at factories and plants of MME exporters; computer aided QMS are systems that are decisive in carrying out a lookback/routine/predictive analysis of causes for and repair costs of defects/failures of elements, components, parts and units of each item individually and all the products collectively throughout their lifecycle stages (a mandatory requirement of the new Russian GOST Standards R ISO 9000, version as of 2000); – a lack, at factories and plants of MME exporters, of state-of-the-art systems of metrological assurance of the quality of MME products and efficient quality management systems (QMS) ensuring production loss minimization at all stages of product lifecycle;
Legal	<ul style="list-style-type: none"> – the framework of standards en force in the area of development, manufacture and operation of weapons and military equipment (WME) was adopted and introduced 25 - 30 years ago and do not conform to the current economic conditions and technical production specifications any longer; – existing standardisation and compliance assessment systems do not comply with the requirements of Federal Law of the Russian Federation "On technical regulations" and international standards; – absence of a mandatory condition to have an effective QMS in place at factories (in developed economies) for procuring government defence contracts; – use of CALStechologies in the process of their development, manufacture, operation and disposal
Organisational	<ul style="list-style-type: none"> – in compliance by contractors with the procedure and methods of WMEs testing for their acceptance for service in the Russian army and for exporting them; – absence of effective QMS at factories and, as a consequence, poorer detection and shooting of troubles and defects in the design, production and operation of products; – violations of previously en-force procedures of control and maintenance of WME's quality in the chain of cooperation among developers, manufacturers and users of defence products; absence of an efficient system of personnel training in the area of quality management.

III. COMPLEX APPROACH TO QUALITY PRODUCTION OF DEFENCE COMPANIES

Russian federal government and its departments pay constant attention to deteriorating quality of products of Russian defence enterprises taking part in Defence Procurement Program (DPP), despite their QMS certification [7]. This can be explained by the following reasons:

- „tick box“ approach to audit of compliance with certain requirements (some QMS inspectors are not qualified enough in respective technical aspects);
- random inspections for fulfilling requirements, which does not enable to evaluate development and production quality in full;

- some standards do not contain KPIs to evaluate development and production quality.

Departmental inspections combined with QMS may be seen as a way to evaluate whether these enterprises are capable of developing and producing the items of relevant quality [8].

High quality of the products is determined by technical, economic and social factors, which are supposed to be provided at all stages of the product life-cycle [9].

Development and production stages are of great importance for DPP-companies. Hence, requirements formulation can be seen as the initial stage of a product life-cycle. That is why below-mentioned sections should be included into a report for Evaluation Commission.

Resources (item 6 of GOST RV 0015.002). This section includes evaluation of human resources, availability of advanced equipment, test equipment, instrumentation and measurement, funding procedures for development and production, as well as implementation of safety regulations [10].

Development quality (items 7.1-7.4 GOST RV 0015.002). This section embraces development quality assurance including technical control of development documentation, new technological processes evaluation, analysis of amendments to development and technical documentation resulting from pilot batch, quality of equipment etc. [11].

Quality assurance for pilot and batch production (item 7.5 GOST RV 0015.002) includes amendments to development and technical documentation, certification, manufacturing accuracy inspection, level of equipment, quality control department reports, products reliability evaluation, warranty and technical supervision etc.

Quality assurance for technological processes of production (items 7.3.1, 7.5.1. GOST RV 0015.002). The quality assurance is provided via technological instructions and operation flow-charts, properly functioning and aligned equipment, qualified personnel, sound materials [12].

Arrangement and implementation of quality control throughout production. Testing procedures. Products acceptance procedures (items 7.3, 7.5, 7.6, 8.2.4. GOST RV 0015.002). Quality control throughout production process refers to semi-finished products (materials, half-finished products, components, technological processes, development and technical documentation) [13]. For quality control assurance, incoming, operational and acceptance inspections must be executed, and control tests must be done (customer acceptance tests, acceptance tests, periodic tests, conventional tests) [14].

Information required to evaluate the ability of an enterprise to develop and produce products of assured quality and relevant reporting forms must be sent in advance [15]. Conclusions concerning the ability should be based on evaluation of an enterprise QMS performance given the information provided. QMS performance is supposed to be improved over time.

IV. DEFENCE PRODUCTS QUALITY ASSURANCE RECOMMENDATIONS

For the purposes of overcoming the existing problems in the defence industry sector and creating conditions for maintenance of the quality of defence products the following is to be implemented:

- fundamental replacement of fixed production assets and experimenting/testing facilities at the industry's key companies and organisations;
- maintaining unique materials technologies used for modern weapons;
- protecting the defence potential of the weapons industry from unreasonable process re-engineering and dissolution of the production facilities that have strategic significance for the manufacture of end products with desired properties;
- maintaining the talent pool at defence companies and organisations; attracting young specialists and workforce, their training and qualification testing;
- increasing the role of company leaders in ensuring systems management and quality management in particular;
- improving the methods of defence products quality control by the state client and of certifying by authorized certification systems;
- ensuring appropriate work load for defence companies and organisations above the limits that are necessary for maintaining steady and sustainable production processes;
- a systematic development and improvement of the legal framework in the area of defence industry operation and state order fulfilment.

As of today, in order to solve the issues of military equipment and materials quality, what we need is not simply certification and control by the state client: we also need a comprehensive system of ensuring and guaranteeing the quality of defence products that (system) could unite in itself both the military technical policy and state procurement requirements, control and supervision over compliance with technical specifications and defence standard requirements, appropriate metrology methods and testing procedures, along with independent compliance assessment procedures. A visualisation of such a system can be seen on Fig. 3.

V. FINDINGS AND INFERENCES

The paper reveals severe problems in quality assurance of defence products in Russia. Apart from the identified issues and the causes of poor quality of products, it is worth paying attention to insufficient skills of the personnel.

A significant part of efforts of heads of national corporations and large enterprises should be focused on studying the best practical experience of quality assurance of worldwide leading manufacturers of industrial products and its

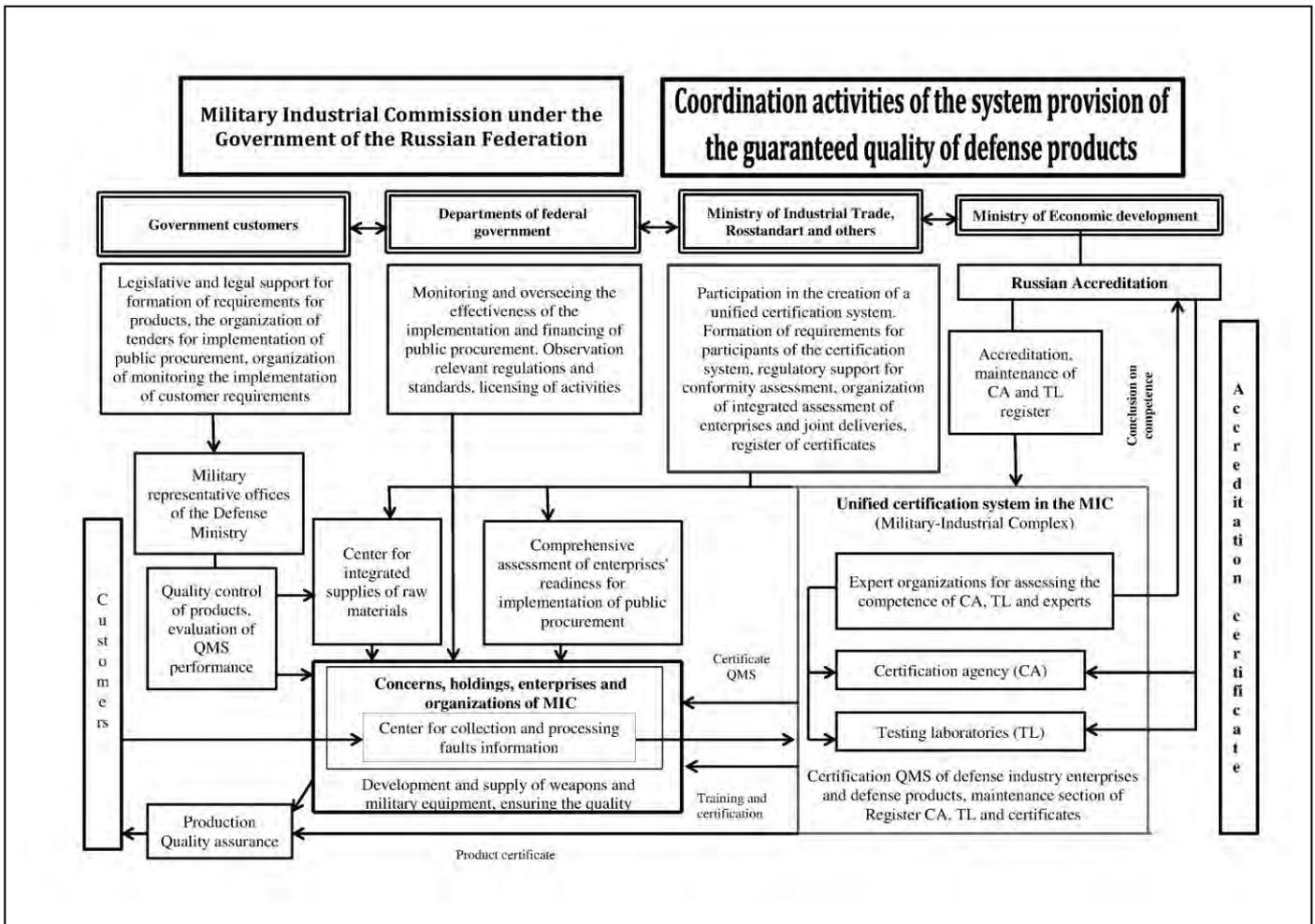


Fig 3. Diagram of System provision of the guaranteed quality of defense products

active application. Great role also should be playing by system of Russian education, which is also interested in the preparation of qualified competitive personnel [16].

As a result, improvement of activities aimed at ensuring higher products quality and bettering customer satisfaction will come from efficient practical management solutions, which, in its turn, will be conducive to an increase in positive outcomes of deployment and operation of quality management systems at Russian industrial enterprises.

VI. CONCLUSION

Underestimation of the issue of industrial products quality and a need for systematic and focused efforts to improve it is what leads Russian industrial companies to a loss of ground in a key sector [2]. Only by facing up to the strategic importance of the problem of quality, by choosing and implementing appropriate systems of quality management at our plants and factories can we come closer to a perspective of ensuring a better competitive strength and sustainability to our business enterprises.

In conclusion, it is worth saying that actions for solving problems identified in this article should have a systemic complex character. The problem is that access to Russian defence companies' data is restricted. However, it is vital to keep on analyzing the situation and paying attention to quality issues.

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