Need for supporting laboratory for testing agricultural and forestry tractors

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Abstract. The paper describes the relevance of the creation of a supporting laboratory for testing compliance with the Organisation for Economic Co-operation and Development (OECD) Tractor Code for agricultural and forestry tractors in conditions of international integration. The paper provides the international requirements for tractor products according to the OECD Tractor Code regulations. A set of activities for the creation of a supporting laboratory is presented. The study lists which methodologies need to be developed for testing tractor units and assemblies. It shows the procedure for validating tests at the OECD. It is pointed out that the development and use of digital services is necessary to ensure a leap forward in the development of integration in the field of technical regulation.

1. Introduction specifying the purpose of work

On 21 May 2020, the official website of the Eurasian Economic Commission (EEC) published the results of the meeting of the Presidium of the Business Council of the Eurasian Economic Union (EAEU). There was a discussion about the ways of development of the Eurasian integration in the sphere of technical regulation [1]. The working meeting was held as a video conference. The following main points to remove the technical barriers for the business community were highlighted:

- Creation of uniform requirements to products and procedures for their evaluation;
- Regular updating of the common market protection system against products that do not meet safety requirements;
- Updating requirements and technologies to improve the quality and competitiveness of EAEU products.

It was pointed out at the meeting that it is necessary to accelerate the development and implementation of new technical regulations (TR) of the EAEU. The Minister of Technical Regulation of the EEC noted that the analysis of the implementation of the plan of the development and updating of the EAEU TR/CU TR showed a big lag in the work in this area. Since 2014, only 12 out of the planned 23 draft documents have been developed, and only 11 out of 37 draft amendments to them. The development of standardization is also an acute problem. At the same time, there is still no agreement between the EAEU member countries on joint financing of the development of interstate standards. During the meeting of the presidium of the EAEU Business Council, the participants offered the business...
and industry representatives to take an active part in addressing this issue and control the progress of its implementation.

Considering the situation in the area of technical regulation, from the side of certification bodies and testing centers, the participants of the meeting noted the growing problems. Despite the current restrictions related to the spread of the coronavirus in the world, many certification bodies have provided certificates of field inspections to the states that are not members of the EAEU, where mass issuance of certificates for serial deliveries of foreign goods takes place. However, state control authorities often do not respond to such messages from EEC. Also, there is no positive dynamics from the pilot project on the interaction of government agencies of the EAEU countries to prevent hazardous products from entering their domestic market. As noted by the meeting participants, many supervisory authorities simply withdrew from participation in this project.

Speaking about the future, the participants of the meeting noted that a leap in the development of integration in the field of technical regulation can and should be achieved using digitalization. Digital services will provide substantial assistance in all areas of activity: from product requirements and safety confirmation to government supervision. Introducing digitalization will increase the transparency of all market participants, including the bodies for accreditation and conformity assessment of manufactured products.

In 2017, the Government of the Russian Federation approved the “Strategy for export development in agricultural engineering industry through 2025” [2]. It formulates the following target: “...accelerated growth of exports in the agricultural engineering industry...” In the same year, the Order of the Government of the Russian Federation adopted the “Strategy for development of agricultural engineering industry of Russia through 2030” [3]. Its goal is to achieve for Russian agricultural machinery manufacturers a domestic market share of at least 80 % and an export share of at least 50 % of the shipments to the domestic market.

The implementation of these goals based on socio-economic results shall provide:
- Execution of the Food Security Doctrine of the Russian Federation [4] in terms of reducing the dependence of the Russian agricultural sector on imported machinery and technologies by increasing the share of Russian agricultural equipment in the domestic market up to 80 %;
- Increase in agricultural machinery production in monetary terms by 3 times - by 2030 up to about 300 billion rubles;
- Increase in production capacity loading up to 80-90 % (including the commissioning of new production facilities);
- Increase in the number of employees engaged in the agricultural engineering industry by 1.5 times;
- Increasing the average salary level in the agricultural engineering industry up to 55 thousand rubles by 2030 (in constant prices);
- Achievement of positive budget effect — additional revenues to budgets of all levels and non-budgetary funds shall reach at least 100 billion rubles, and considering the multiplier effect in related industries - up to 200 billion rubles;
- Increase the export of Russian products of agricultural engineering industry to 100 billion rubles by 2030.

2. Problem setting
To show the activities undertaken by the Government of Russia to overcome some key barriers that negatively affect the development of export supplies, as well as directions and planned activities for the development of the industry through the application of international regulatory requirements for tractor industry products. Describe the activities to be taken to organize the supporting laboratory for testing the technical parameters of tractors for compliance with the international safety standards.
3. Results
The research was carried out using the analytical method [5-7] through monitoring of government documents, information bulletins, and websites of international organizations on machinery export.

Products of domestic tractor construction have a significant potential for export, which was noted in [2]: “...In the Russian Federation, tractors of universal type are produced, which are used in all ranges of agricultural work. Such product characteristics as traction, fuel efficiency, low specific ground pressure, and others remain at or exceed the level of world analogues. Russian models of tractors are produced in the most demanded power range and meet strict environmental requirements. Traction parameters, transmission, and hydraulic system meet international industry standards. At the same time, the price of products and cost of operation (technical inspection, repair, fuel, depreciation) is lower compared to global competitors...”.

Based on the survey of agricultural machinery exporters, a number of promising markets for products were identified. This includes both existing markets (the Commonwealth of Independent States and partly the European Union), and new markets: South America (Argentina, Venezuela, Brazil), African countries (Algeria, Tunisia, Sudan, Egypt, Ethiopia, South Africa, Angola, Kenya, Senegal, Mozambique), North America (Canada, the United States), South Asia (India, Iran, Bangladesh, Pakistan).

In 2016, the bulk of exports (about 60%) was made up of harvesting machines. Tractors (18%) followed it. From 2012 to 2016, the growth of agricultural machinery exports in monetary terms was 163.8%, accompanied by an increase in production volume. In 2018–2019, there was a negative dynamics of export of tractors, despite the advantages of Russian tractors over foreign analogues [8].

![Table 1. Export of tractors, produced in Russia in 2018–2019.](image)

| Name          | 2019, pcs. | 2019, $  | 2018, pcs. | 2018, $ | Change, % from pcs. | Change, % from $ |
|---------------|------------|----------|------------|---------|---------------------|-----------------|
| New tractors  | 112        | 5230835  | 212        | 12148   | - 47                | - 57            |
| below 25 hp.  | 45         | 191088   | 28         | 101983  | + 61                | + 87            |
| from 25 to 50 hp. | 3        | 22897    | 0          | 0       | 0                   | 0               |
| from 50 to 102 hp. | 24       | 547781   | 71         | 1757079 | - 66                | - 69            |
| from 102 to 122 hp. | 3        | 96250    | 21         | 864041  | - 86                | - 89            |
| over 122 hp.  | 47         | 4720577  | 92         | 9424977 | - 49                | + 50            |

One of the main reasons for the weak use of production potential for export of agricultural engineering industry products is the group of main obstacles: “...homologation and certification of products for foreign markets. Inconsistency of products manufactured to the requirements of other countries, lack of the certificate or long and expensive process of obtaining a certificate...”. Another important reason is “...administrative and political barriers. Economic sanctions to Russia...” [1].

The removal of these barriers will be contributed by activities that improve the reliability of test results and guarantee producer compliance with rules and procedures that promote trade based on mutual benefit. The Organization for Economic Cooperation and Development (OECD) is an international organization “...which works to create more effective policies to improve people's lives, share best practices and consult on public policy and international standard-setting...”. The OECD Certificate is recognized in 37 countries. The OECD network includes 30 test stations located in Europe, Asia, and America. They ensure compliance of testing methods with OECD procedures and codes. In average, it takes less than 5 days to get a certificate.

The OECD Tractor Code is equivalent to EU directives. The tractor tests are carried out in member countries, and their results are necessarily checked and confirmed by the OECD Coordination Centre. The OECD Tractor Code is regularly updated with measures to improve machine operational characteristics, work safety, and environmental protection. The number of members in the OECD
Tractor Code network is constantly growing and opens up new prospects and markets. Countries that recognize the OECD certificate have noted an increase in the export of tractors to an average of 30%.

At the moment, Russia does not have a testing laboratory that meets modern requirements for international tractor certification procedures. Accordingly, it is difficult to integrate Russian products in international consumer markets. Since 2014, with the introduction of international sanctions against Russia, the procedure for joining the OECD was suspended, but in early 2020, Prime Minister Mikhail Mishustin commissioned to intensify Russia's accession to the OECD.

Anticipating the trend with decreasing export volumes of agricultural and forestry tractors and special purpose machines, the Government of the Russian Federation has taken a number of effective measures. Following the results of the meeting of the Presidium of the Presidential Council for Strategic Development and National Projects on 24 December 2018, the passport of the national project “International Cooperation and Export” was approved. The National Project passport identifies the key objectives: increase of exports of non-resource non-energy goods, increase of the share of process industry products, agricultural products and services in the gross domestic product of the country, form of an effective system of division of labor and production cooperation within the EEC to increase the volume of trade between the Union member states and to ensure the growth of accumulated mutual investments. The National Project implementation period: from October 2018 to 2024 inclusive.

Implementing the Presidential Decree No. 204 of 7 May 2018 “On National Goals and Strategic Objectives of the Russian Federation through 2024”, the Ministry of Industry and Trade of the Russian Federation has developed a passport for the national project, which includes five federal projects “Industrial Export”, “Export of Agricultural Products”, “International Trade Logistics”, “Export of Services” and “Systemic International Cooperation and Exports Development Measures”.

Paragraph 4.1 of the passport of the project “Industrial Export” indicates its purpose: the orientation of industrial and trade policy, including the applied mechanisms of state support, on achieving achieve international competitiveness of Russian goods (works, services) to ensure their presence in foreign markets.

Paragraph 2 of the passport of the project “Systemic International Cooperation and Exports Development Measures” stated its purpose: the implementation of a set of measures to create a favorable regulatory environment, reduce the administrative burden, and improve the mechanisms to stimulate export activities.

According to the above documents, the Network of Supporting Laboratory is being established in Russia. The core of the supporting laboratory's activities is to work towards meeting the regulatory requirements of the OECD codes for Russian products in order to ensure the confidence of international markets in Russian products.

Tractor safety requirements are regulated in the OECD Code of Standards for the official testing of agricultural and forestry tractors established on 21 April 1959 by the Council of the Economic Commission for Europe of the United Nations, later reorganized into the OECD. Since then, this Code has been updated to include data on forestry tractors and other performance, safety, and noise characteristics.

Tractor operator safety is one of the fundamental principles of the OECD Tractor Code. Certification of the appropriate ROPS and FOPS devices significantly reduces the number of fatal accidents when working with tractors. The laboratory is developing the necessary equipment to conduct the relevant tests, and it is also planned to equip the laboratory to introduce 100% of the recommended methods of testing and product research, providing the possibility of international recognition of the test results without additional testing in importing countries.

International requirements for agricultural and forestry tractor products are reflected following OECD Tractor Codes:

- Code 2 Testing of agricultural and forestry tractor performance
- Code 3 Testing of the strength of protective structures for agricultural and forestry tractors (dynamic test)
- Code 4 Testing of the strength of protective structures for agricultural and forestry tractors (static test)
- Code 5 Noise measurement at the driver's position
- Code 6 Testing of front mounted protective structures on narrow-track wheeled agricultural and forestry tractors
- Code 7 Testing of the rear-mounted protective structures on narrow-track wheeled agricultural and forestry tractors
- Code 8 Testing of protective structures on tracklaying tractors
- Code 9 Protective structures for telehandlers
- Code 10 Testing of falling object protective structures

The supporting laboratory needs the test methods in accordance with the requirements of OECD codes:
- Power take-off and performance test of the engine and its systems;
- Performance test of the engine and its systems at low temperatures;
- Hydraulic performance tests in working systems (hydraulic transmission, steering, brake system, servo actuators);
- Hydraulic elevator tests for compliance with operational and technical requirements;
- Traction force and fuel consumption tests depending on different types of engines and ground surface characteristics;
- Tests to determine driving performance under various operating conditions when braking, driving, the zone of radius and turning centre;
- Center of gravity tests;
- Brake system efficiency and parking brake system tests;
- External noise level tests;
- Waterproof tests for wheel axles, parts, assemblies, working systems;
- Test of process fluids (motor, transmission, hydraulic system fluids);
- Test of Falling Object Protective Structure (FOPS);
- Test of Rolling Over Protective Structure (ROPS);
- Seat tests;
- Test of protective structures;
- Methods for determining the risk of rollover of wheeled and tracked agricultural, forestry tractors, and telescopic loaders based on them.

To complete the goal of creating the supporting laboratory, it is necessary to carry out a set of the following activities:
- Application and receipt of ILAC mark - International Laboratory Accreditation Cooperation;
- Ensuring compliance with the requirements of the Federal Service for Accreditation Order;
- Annual analysis and making changes in the list of methods required for testing products under the requirements of foreign countries;
- Preparation of proposals for methods and/or other regulations governing the requirements for tractor products in priority countries and requiring official registration as a translation;
- Purchase of the necessary equipment;
- Employee training;
- Providing the necessary infrastructure (test facilities and conditions);
- Development of the missing and implementation of the existing testing methods;
- Ensuring participation in inter-laboratory comparison tests (qualification tests) according to the implemented test methods;
- Translation into Russian of necessary documents for evaluation;
- Reporting on the conducted tests using the combined ILAC mark or within the recognition by foreign accreditation bodies, international voluntary certification systems.
The OECD Tractor Codes for official testing of agricultural and forestry tractors allow the participating countries to test them according to agreed procedures and to issue official OECD certificates to manufacturers, which will facilitate administrative procedures for international trade. Indicators of official approval of OECD codes worldwide:

- Recognized in 37 countries;
- This organization works closely with some of the world's largest economies: Brazil, China, India, Indonesia, and South Africa, which are key partners of the OECD;
- Regular international conferences of test engineers from various OECD member countries are organized on a rotating basis every two years. They ensure compliance with all OECD test procedures and requirements; provide opportunities for regular updates that take into account the improvement of technical characteristics and safety of products, as well as environmental protection.

Tests of tractors and protective structures are carried out by the accredited bodies of the member countries of the organization according to recognized norms. Accreditation of the OECD testing station is carried out by the OECD Secretariat together with the representative of the national authorized body appointed by the applicant country [9]. The material is submitted to the OECD for approval with subsequent verification of the test results by the Coordination Centre, which ensures that the test conditions are met in accordance with OECD Tractor Codes and the special report form. This procedure guarantees the independence and worldwide comparability of test results. This procedure guarantees the independence and worldwide comparability of test results. The general procedure for testing Russian equipment at the OECD is shown in Figure 1.

**Figure 1.** Test validation procedure for Russian machinery at OECD.

4. Conclusion
The creation of the supporting laboratory which has received international accreditation for testing and certification of products will allow:

- Testing agricultural and forestry tractors for their compliance with the international requirements of OECD codes;
- Increasing the level of international integration;
- Raising the volume of exports of manufactured products;
- Giving an impetus to the development of production of trailed agricultural machinery;
- Leading to a positive budget effect and increasing the volume of investments into research and development works for scientific research on the creation of perspective samples of highly automated tractors for agricultural and forestry purposes [10, 11, 12].
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