Improving the methodology for assessing the level of localization of production of agricultural mobile energy devices

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Abstract. An improving methodology for assessing the level of localization of the production of agricultural mobile energy is presented. The basic methodology has been substantially adjusted with the transition from an arbitrary list of obsolete technological operations to the valuation of modern technologies, the quantitative accounting of the scarcity of manufactured equipment, the volume of after-sales services, the development of research and development, operational provision of spare parts, etc. The localization level sufficient to recognize a particular model as being produced in Russia is calculated as the sum of the shares of the tractor cost, taking into account a number of decreasing coefficients that take into account the progressive effect of localized production: deficiency coefficient of the produced model; service network ratio; R&D financing ratio; coefficient of availability of spare parts warehouse. The implementation of this methodology contributes to solving the problems of developing the Russian economy.

1. Introduction

The economy of the Russian Federation is faced with the task of reducing dependence on industrial imports and the development of domestic production [1-3].

The recognition of products manufactured in the Russia is currently one of the main methods for developing the economies of developing countries by attracting investment in industrial production, including through localization of production of the most advanced international companies.

At the same time, the following tasks should be addressed in developing countries:

1. Job creation;
2. Organization of production of scarce equipment (import substitution);
3. Promotion of innovative technologies;
4. Maintenance;
5. Research and development;
6. Operational supply of spare parts.

2. Materials and methods

Requirements for tractors for agriculture, presented by the Decree of the Government of the Russian Federation of July 17, 2015 No. 719, for recognition of their production in Russia.
Decree No. 719 provides for agricultural tractors "... implementation on the territory of the Russian Federation, including the mandatory implementation of production, assembly and welding (if necessary) of the supporting frame (if available), subframes (if available), production, including cutting and bending of blanks, welding, assembly and painting, cabins, from January 1, 2016 not less than 13, from January 1, 2018 - not less than 14, from January 1, 2020. - at least 15 of the following operations:

1 - production, assembly and welding (if necessary) of the supporting frame (if available), sub-frames (if available);
2 - painting of the supporting frame (if available), subframes (if available);
3 - production, including cutting and bending of blanks, welding, assembly and painting, cabins;
4 - production or use of the bridge (s) made on the territory of the countries - members of the Eurasian Economic Union;
5 - production or use of transmission produced on the territory of the countries - members of the Eurasian Economic Union;
6 - production or use of an engine manufactured in the territory of the countries - members of the Eurasian Economic Union;
7 - assembly of a motor-power plant;
8 - transmission assembly;
9 - assembly of the bridge (s);
10 - production, assembly and painting (if necessary) of exterior elements;
11 - installation and painting of the motor unit, axles and axles, transmission, attachments;
12 - installation of an electrical system;
13 - assembly and installation of hydraulic equipment;
14 - assembly and painting (if necessary) of interior elements;
15 - production of tire fitting;
16 - production and installation of hydraulic tanks and fuel tanks;
17 - production, painting and installation of ballast and balancing weights.

\[\text{Figure 1. Example of calculating the level of localization of production autocars in the Russian Federation.}\]
The calculation of the permissible level of localizations should have a specific value (percent), which determines the basic level of the industry in terms of value, expressed as the sum of the relative costs of the check list of technological operations.

Organization of production of scarce equipment (import substitution) is key for the buyer of agricultural equipment, in whose name the industry with all its characteristics, including localization, should work (Fig.1). In accordance with the experience of leading foreign countries, the state should subsidize farmers who choose the best equipment on the market in competitive conditions for firms. In our case, due to the lack of creditworthiness of agriculture, their financial support goes through industry [4-5].

In this case, manufacturers of scarce equipment should be attracted for production in Russia in the first place (Table 1) [6].

Table 1. The presence and shortage of tractors in agricultural organizations (AO) in 2017 in relation to the optimal technological needs for tractors.

| Wheel tractors, thousand units | Traction class | 8 | 6 | 5 | 4 | 3 | 2 | 1,4 | 0,9 | 0,6 | Total |
|--------------------------------|---------------|---|---|---|---|---|---|-----|-----|-----|-------|
| Need, thousand units           |               | 1,0 | 20,0 | 40,0 | 60,0 | 100,0 | 50,0 | 170,0 | 30,0 | 90,0 | 560,0 |
| Availability, thousand tr      |               | 0,4 | 13,2 | 3,9 | 1,8 | 19,6 | 20,4 | 139,2 | 1,3 | 12,5 | 211,6 |
| Shortage, % from needs         |               | 60,0 | 25,0 | 81,0 | 100,0 | 76,0 | 53,0 | 7,0 | 95,0 | 84,0 | 57,0 |

| Caterpillar tractors, thousand units | Traction class | 8 | 6 | 5 | 4 | 3 | 2 | Total |
|--------------------------------------|---------------|---|---|---|---|---|---|-------|
| Need, thousand units                 |               | 2,0 | 4,0 | 52,0 | 90,0 | 170,0 | 20,0 | 340,0 |
| Availability, thousand tr            |               | 0,0 | 0,0 | 0,0 | 0,7 | 4,0 | 0,5 | 5,2 |
| Shortage, % from needs               |               | 60,0 | 34,0 | 90,3 | 97,0 | 80,4 | 59,2 | 18,1 |

The presence of agricultural tractors in 2017 amounted to only 216.8 thousand tractors (average power - 114.1 h.p.). In 2018, the fleet was reduced to 211.9 thousand tractors. The total demand is 900.0 thousand tractors (average power is 125 h.p.), the total shortage is 652.7 thousand tractors with almost 100% availability of 1.4 class wheeled tractors (“Belarus 82.1”) for 90 million hectares arable land required by the Russian Federation. In today's conditions of processing in agricultural enterprises about 70 million hectares of arable land, this presence corresponds to a 5% excess of these tractors [7]. In accordance with the monitoring conducted by the Federal Scientific Agro-Engineering Center VIM, the production of agricultural tractors in Russia for the period under review decreased from 135.9 thousand tractors in 1990 to 5.8 thousand tractors in 2019, i.e. by 23.4 times (Figure 2) [8].
The data presented indicate the practical destruction of the tractor fleet and require the adoption of emergency state measures to restore it. Special attention is required to the caterpillar component of the park, which has a dual purpose and approaches absolute zero, which is extremely dangerous for the soil and climatic conditions of Russia [9-10].

Promotion of innovative technologies. The above list of 17 technological operations was developed on the basis of the existing production of enterprises that are currently monopolists in their industry; therefore, this principle indicates an actual obstacle to competition and violates paragraph 2 of article 34 of the Constitution of the Russian Federation and Clause 1, Article 15 of the Law of July 26, 2006 No. 135 Federal Law «About Protection of The Competition».

Thus, enterprises using alternative technologies and the principle of international cooperation and division of labor are placed in an unequal position, allowing customers to purchase equipment equipped with components and assemblies from the best world manufacturers. Based on the foregoing, the legally enshrined principle of compulsory production operations does not create incentives for the technological development of production and improvement of the technical level of products of enterprises performing mandatory operations, dooming buyers of their products to use technically backward equipment.

Providing uninterrupted service, development of research and development, operational support for spare parts. The principle of compulsory production operations, which is the basis of Decree No. 719, does not take into account the producer’s activities that are important for the agricultural consumer, such as: ensuring uninterrupted service; development of research and development work; operational supply of spare parts.

Figure 2. Production of agricultural tractors manufacturers of Russia from 1990 to 2019
3. Results and discussions

The methodology for determining the acceptable level of production localization that meets the objectives of economic development. As an alternative that eliminates the above disadvantages of the criteria for classifying industrial products as industrial products manufactured in Russia, we propose the following methodology.

The localization level $R_m$, sufficient to recognize a specific model as produced in Russia, should be calculated as a sum $R_m$ (Table 2), taking into account a number of decreasing coefficients, taking into account the progressive effect of localized production, based on the following inequality:

$$\frac{R_m}{R_O - 0.5 \cdot R_O (1 - K_{SH}^M)} \geq 1$$

where $R_O$ – the required industry level, which takes into account the cost characteristics of the performed technological operations;

$K_{SH}^M$ – shortage coefficient of the produced model;

$K_{M}^M$ – coefficient of maintenance;

$K_{R}^M$ – coefficient of financing researches;

$K_{SP}^M$ – coefficient of the stock of spare parts.

The industry base level $R_O$ should be at least 70% calculated on the basis of the price parity of technological operations (Table 2).

The shortage coefficient of the tractor model in the current tractor fleet:

$$K_{SH}^M = \frac{A_R^M}{A_{TN}}$$

Where $A_R^M$ – the number of tractors of a particular model in a real park, recorded as a result of monitoring;

$A_{TN}^M$ – the optimal technological need for this model, determined by the methodology of the Ministry of Agriculture of the Russian Federation (Table 1).

With $A_{R}^M = 0$ - the basic industry level of localization for a 100% model deficit should be reduced by 2 times, thanks to a coefficient of 0.5.

With $A_R^M = A_{TN}^M$, the full value of the basic industry level of localization is preserved for this model.

Table 2. Technological operations for tractors.

| Technological operations                                                                 | Share in tractor cost, percent | $R_{cm}$ |
|----------------------------------------------------------------------------------------|-------------------------------|----------|
| Production, including welding, painting and cab assembly                               | 20                            |          |
| Production, including welding (if necessary), painting and assembly of the supporting frame (if availability) | 8                             |          |
| Production and assembly of the axle (axles)                                           | 10                            |          |
| Production, including painting and assembly of wheels and wheel loads                   | 10                            |          |
| Production, assembly and painting of exterior elements                                  |                               |          |
| Cargo and castings                                                                     | 6                             |          |
| Metal products                                                                         | 4                             |          |
| Plastic products                                                                       | 6                             |          |
| Engine Assembly                                                                        | 4                             |          |
| Transmission assembly                                                                  | 4                             |          |
| Installation of a motor-power plant, axles, transmission, cab and attachment           | 12                            |          |
| Installation of electrical equipment, hydraulic equipment                               | 10                            |          |
| Tractor acceptance tests                                                               | 6                             |          |
| Total:                                                                                 | 100                           |          |
Coefficient of maintenance ($K_M^M$)

An assessment of the industry ($K_M^M$) coefficient taking into account the availability of a service network for servicing equipment is made taking into account the service coefficient determined by:

$$S = \frac{K_{Reg}}{10},$$

where $K_{Reg}$ – the number of regions (regions, territories and republics) in which service centers are located and which have the appropriate legal authority and technical base for this, which must be documented, and who perform maintenance of the supplied Product.

For tractors, combine harvesters and forage harvesters:
- if the value $S < 0,2$, so $K_M^M = 0,9$;
- if the value $S = 0,2...0,4$, so $K_M^M = 0,95$;
- if the value $S > 0,4$, so $K_M^M = 1$.

For to machines:
- if the value $S < 5$, so $K_M^M = 0,95$;
- if the value $S > 5$, so $K_M^M = 1$.

Coefficient of financing researches ($K_R^M$)

Assessment ($K_R^M$) of the amount of funding for research (including through educational organizations, universities), research and development and technological work (R&D) carried out in the Russian Federation in connection with the production of the Product:
- if the costs of sales revenue for the delivered Product for the reporting period is 0,1%, so $K_R^M = 0,9$;
- if the costs of sales revenue for the delivered Product for the reporting period is 0,1% to 0,5%, so $K_R^M = 0,95$;
- if the costs of sales revenue for the delivered Product for the reporting period is 0,5% to 1,01%, so $K_R^M = 0,975$;
- if the costs of sales revenue for the delivered Product for the reporting period is above 1,01%, so $K_R^M = 1$.

Coefficient of the stock of spare parts ($K_{SP}^M$)

Assessment of the industry coefficient ($K_{SP}^M$), taking into account the presence of a central warehouse of spare parts, including in the form of an affiliated structure:
- if the cost of spare parts supplied to the central warehouse from the sales volume of the Product for the reporting period is 0 to 1,0%, so $K_{SP}^M = 0,92$;
- if the cost of spare parts supplied to the central warehouse from the sales volume of the Product for the reporting period is 1,1 to 3%, so $K_{SP}^M = 0,95$;
- if the cost of spare parts supplied to the central warehouse from the sales volume of the Product for the reporting period is 3,1 to 10%, so $K_{SP}^M = 1$.

4. Conclusions

Conducted research, analysis of the scarcity of the tractor fleet and the state of the tractor production market showed:

The list of technological operations contained in the Decree of the Government of the Russian Federation dated July 17, 2015 No. 719 is a fixation of the existing monopoly position of enterprises, creates obstacles to competition and does not create incentives for the technological development of production and the improvement of the technical level of products of agricultural engineering enterprises.
According to the construction methodology, the assessment of the level of production localization, proposed by the RF Government Decree of July 17, No. 719, should be substantially adjusted with the transition from an arbitrary list of obsolete technological operations to a valuation of modern technologies, a quantitative account of the scarcity of manufactured equipment, and the volume service, development of research and development, operational support for spare parts, etc.

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