Digitalization of agriculture as priority direction of increase of management efficiency of the agricultural organizations

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1 Introduction

The agriculture is the difficult multilevel branch, uniting economic subjects of the various organizational and legal forms which are engaged in production and processing of agricultural production.

Introduction of digital technologies in agriculture will lead to receiving positive results of activity, reduction of expenses and will give economic effect at introduction of a comprehensive administrative approach (drawing 1) [1, p.7].

Fig. 1. Dynamics of volumes of agricultural production.

According to the Analytical center of the Ministry of Agriculture of Russia the actual volume of production of animal husbandry has made in 2017 of 2 620,8 billion roubles, and plant growing of 3033,2 billion roubles. On preliminary forecasts, at the expense of IT – technologies introduction for the beginning of 2019 the total amount of production of agriculture will reach 6 015,4 billion roubles that will make about 6.5 % or 361,4 billion roubles, thus the greatest growth is planned on plant growing production.

The main problem which the branch faces at introduction of digital technologies, is connected with shortage of highly skilled experts of the IT sphere which, it is important to notice, not only deficiency in agriculture, but also as a whole in national economy.

In the Russian Federation according to statistical data in agro-industrial complex about 112,9 thousand IT specialists that makes 2,4 % from all population of the country occupied in agriculture (Drawing 2).

For achievement of a share of experts of the digital sphere as in the USA, Great Britain and Germany, Russia in agriculture not less than 90 thousand IT specialists are necessary.

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Today on 1000 people occupied in agriculture, about one IT specialist that is rather low indicator is necessary.

![Fig. 2. The Share of IT specialists in agriculture](image)

Growth of the qualified experts of the IT sphere in agriculture will allow to solve problems of quality of the agricultural production which growth rates have an insignificant positive tendency for the last 3 years. The greatest growth is observed on the plant growing production which greatest share is the share of production of grain.

Quality of grain depends on a set of the factors one of which is introduction of elements of a digitalization of agriculture, such as exact agriculture.

2 Methods and materials

Materials of the international, All-Russia and regional scientific and practical conferences, publications in periodicals and Internet editions, and also scientific works of domestic scientists-economists act as a basis for research. Works are devoted to problems of digitalization of economy as a whole, and agriculture, in particular. Various methods of the system analysis and statistical methods; method of comparisons, analogies and generalizations; method of the structurally functional analysis; methods of supervision, comparison, synthesis; method of expert evaluations, a system, logic and sociological approach have found application in the course of work.

3 Results

The agricultural organizations introducing modern technologies of exact agriculture, first of all, plan to use the innovative forms of government agricultural production for the purpose of increase of its efficiency which finally will allow increasing management efficiency the agricultural organization as a whole. Application of new digital technologies will allow reducing the main costs connected with acquisition of seeds and fertilizers, ядохимикатов and other costs of production of agricultural production. It will lead to growth of productivity of agrarian cultures [4, page 123].

In different regions of Russia processes of introduction of exact agriculture are not identical. First of all it is connected with feature of climatic conditions and rates of introduction of digital technologies. Sverdlovsk region by quantity of the farms applying elements of exact agriculture, takes the 15th place from 49 with quantity of farms equal 47. And it is practically in 4 times less, than in leading Krasnodar Krai with number of farms – 189 (table 2).
Table 1. Use of elements of exact agriculture by quantity of farms

| Region                  | Quantity of the farms using elements of exact agriculture | Place in the all-Russian rating |
|-------------------------|----------------------------------------------------------|----------------------------------|
| Krasnodar Krai          | 189                                                      | 1                                |
| Voronezh region         | 182                                                      | 2                                |
| Nizhny Novgorod Region  | 144                                                      | 3                                |
| Sverdlovsk region       | 47                                                       | 15                               |
| Moscow region           | 3                                                        | 32                               |
| Chechen republic        | -                                                        | 49                               |

The total area, where various elements of exact agriculture in Sverdlovsk region are used, makes 214,950 hectares. It makes 19% from the area in a region rating – the Voronezh region. Our area takes only the 17th place. And it is an average value in comparison with the 36th place of the Moscow region (table 2).

Table 2. Use of elements of exact agriculture on the area

| Region                  | Total area on which elements of exact agriculture, are used by hectare | Place in the all-Russian rating |
|-------------------------|-----------------------------------------------------------------------|----------------------------------|
| Voronezh region         | 112,9164                                                              | 1                                |
| Krasnodar Krai          | 96,2981                                                               | 2                                |
| Omsk region             | 92,1293                                                               | 3                                |
| Sverdlovsk region       | 214,950                                                               | 17                               |
| Moscow region           | 7160                                                                  | 36                               |
| Chechen republic        | -                                                                     | 51                               |

Generalizing information on use of elements of exact agriculture on quantity of farms, Krasnodar Krai (189 farms), the Voronezh region (182 farms), the Nizhny Novgorod Region (144 farms) are in leaders. On total area on which elements of exact agriculture are used – the Voronezh region (112,9164 hectares), Krasnodar Krai (96,2981 hectare), the Omsk region (92,1293 hectares). Total absence of elements of exact agriculture is observed in the Chechen republic that is probably connected with feature of national customs.

Exact agriculture in regions of Russia takes root in parallel with elements of exact animal husbandry.

Exact animal husbandry is a modern technology of the XXI century, the priority direction in cattle-breeding processes. It forms possibilities of economic efficiency the animal husbandry based on use of modern equipment and technologies, electronic identification of certain animals, registration of information on agricultural processes and about quality of production, the processes of cultivation of animals directed on optimization. Many authors call exact animal husbandry recisely and characterize it as one of the advanced technologies providing optimization of expenses for cultivation of each animal and their contribution to production. Today such digital technology is applicable in exact animal husbandry as a chipping and allowing spending absolutely exact identification of a specific animal [6] becomes actual technology.

Elements of exact animal husbandry gain popularity in Russia the last 2-3 years therefore it is still quite difficult to estimate results of introduction. Sverdlovsk region takes the 1st place by quantity of the farms applying technologies of exact animal husbandry.

In rating information only 45 regions as such technologies do not apply other areas (table 3) is collected.
Table 3. Use of elements of exact animal husbandry by quantity of farms

| Region                  | Quantity of farms | Place in the all-Russian rating |
|-------------------------|-------------------|---------------------------------|
| Sverdlovsk region       | 83                | 1                               |
| Republic of Bashkortostan | 68               | 2                               |
| Udmurt republic         | 67                | 3                               |
| Krasnodar Krai          | 41                | 6                               |
| Moscow region           | 2                 | 33                              |
| Chechen republic        | -                 | 45                              |

In the region the greatest specific weight is the share of animal husbandry production therefore elements of exact animal husbandry take root faster rates, than in agriculture. Basic element of exact animal husbandry is technologies of identification of certain animals or their groups. Therefore, (table 4) is represented the information of use of elements of exact animal husbandry on a number of cattle important.

Table 4. Use of elements of exact animal husbandry (livestock)

| Region               | Livestock (cattle), units | Place in the all-Russian rating |
|----------------------|---------------------------|---------------------------------|
| Omsk region          | 218054                    | 1                               |
| Sverdlovsk region    | 151250                    | 2                               |
| Voronezh region      | 119363                    | 3                               |
| Krasnodar Krai       | 78330                     | 7                               |
| Moscow region        | 1878                      | 34                              |
| Chechen republic     | -                         | 46                              |

Use of elements of exact animal husbandry by quantity of farms prevails in Sverdlovsk region (83 farms), the Republic of Bashkortostan (68 farms), the Udmurt republic (67 farms). As to a number of cattle, on 1 place there is the Omsk region (218 054 units), on the 2nd place Sverdlovsk region (151 250 units) and finishes the three of leaders the Voronezh region (119 363 units).

Leading Krasnodar Krai on introduction of elements of exact agriculture is only on the 6th place by quantity of farms and on the 7th place on a livestock.

The important point providing development of a digitalization of agriculture, the state support is. Programs of development and introduction of elements exact (innovative digital) agriculture should be developed in regions. At the correct realization they will yield the corresponding result. Subsidies within such programs should be allocated taking into account efficiency of activity of the agricultural organizations. Today such programs operate only in 11 regions of Russia (table 5).

Table 5. Programs on development, support and introduction of elements of exact agriculture

| Region                  | Number of programs | Place in the all-Russian rating |
|-------------------------|--------------------|---------------------------------|
| Sverdlovsk region       | 49                 | 1                               |
| Vologda area            | 30                 | 2                               |
| Kaliningrad region      | 11                 | 3                               |
| Perm Krai               | 7                  | 4                               |
| Novosibirsk region      | 5                  | 5                               |
| Chelyabinsk region      | 3                  | 6                               |
| Ivanovo area            | 2                  | 7                               |
| Zabaykalsky Krai        | 2                  | 7                               |
| Krasnodar Krai          | 1                  | 8                               |
| Arkhangelsk region      | 1                  | 8                               |
| Republic of SakhaYakutia| 1                  | 8                               |
Sverdlovsk region is the leader according to programs of development, introduction and support of elements of exact agriculture. It has been confirmed with author's research at calculation of indicators of investment management efficiency. On the 2nd and the 3rd place are Vologda and Kaliningrad region with 30 and 11 programs respectively. In Sverdlovsk region 49 programs on which subsidies are allocated are realized. In other subjects the number of programs is much lower (from 1 to 7) or is absent absolutely.

The personnel problem is an important aspect in digitalization questions, to solve which probably by means of professional development and organizing of training for workers of agriculture. Professional development of workers in this direction was carried out only in 22 regions of Russia. In our region training has not been organized. Moreover, professional development as have shown author's researches is realized poorly that is negatively reflected in management efficiency hanging.

Regions should face a choice of an automation equipment of the agricultural processes, new technologies and programs which appears more and more. Advantages of various technologies it is necessary to study and make carefully the weighed decisions in polls of introduction [7].

4 Discussion

Introduction of digital technologies in agriculture is process difficult and many-sided, demanding serious investments, both from the state, and from individuals. For understanding of importance and expediency of such investments it is necessary to carry out an appraisal of their efficiency. It is for this purpose offered to use such indicator as investment efficiency or management of investment resources. Dynamics of investment efficiency will allow characterizing development of the agricultural organizations at the expense of the state support and the external investments, which lately has considerably grown and is one of the main sources financing of economic subjects of agriculture.

Investment management efficiency allows to state an assessment of use of the state support (subsidies, grants) and investments of the foreign economic subjects who are carrying out investments in the agricultural organizations on modernization of agricultural machinery, acquisition of the power effective agricultural equipment, on scientific researches in the field of integration and digitalization of production and digital model of development of subjects of agriculture.

Effective use of investment financial resources to allow the agricultural organization to become in the broadest sense to the most competitive in the market of agricultural production the competition on which has considerably increased recently.

The competitive organization grows out of a control system combination with environment factors, in agriculture on which influence, including climatic conditions, consequences from which can be minimized, using elements of exact agriculture and animal husbandry.

The special attention should be given to the state investments on development of the agricultural organization. They are defined by target indicators of activation of investment activity of the agro-industrial complex, provided a state program of development till 2024, containing target indicators of digitalization of branch.

Investment efficiency is offered to be estimated by means of the following factors:
– factor of growth of investments (including state);
– factor of growth of profitability of expenses for digitalization;
– factor of growth of profit on 1 ruble of investments;
– factor of growth of volume of output on 1 ruble of investments.
– factor of growth of expenses for digitalization.
Approbation of a technique of an assessment of investment management efficiency was carried out on an example of activity of the organizations in Alapayevsk and Suburban regions of Sverdlovsk region, nearby with the city of NizhniTagil second for value. In analyzed areas activity carry out 15 the agricultural organizations, including the country (farmer) farms registered as legal entities.

The main objective of activity of the agricultural organizations is not only production of qualitative production of plant growing or animal husbandry, but also its realization at the acceptable prices in the agricultural markets of Sverdlovsk region. The Krasnoufimsky, Talitsky, Artinsky and Beloyarsk areas which are mainly consisting of rural territories, act as the main agrarian regions of area. The Alapayevsk area includes Municipality the city of Alapayevsk and rural territories on which carry out the activity the agricultural organizations.

The analysis of carried-out state support for previous years allows noting expediency of this program. It is directly connected with need of extension of action of the program as a whole across Russia and in Sverdlovsk region till 2024.

The state program in the region is financed from budgets of three levels and off-budget sources (drawing 3).

Fig. 3. The Planned and actual sums of subsidies in Sverdlovsk region in 2018

The volume of expenses within a state program has been planned for 2018 in the sum of 7754,4 million roubles, thus from the federal budget was planned to direct 1659,7 million roubles, from the budget of Sverdlovsk region – 4267,4 million roubles, from local municipal and territorial budgets of 16,8 million roubles 1810,5 million roubles should arrive from private sources. Actually 8899,5 million roubles that has made 114,8 % are spent for January 1 of 2019 g on agriculture financing within a state program. But, if to consider performance on sources, subsidies from the federal and regional budget are mastered not in full, and for 99,8 % and 99,3 % respectively. Budgets territorial and municipalities of Sverdlovsk region, on the contrary, have directed money in 2 times more that has made 214,2 % from the planned sum. Private (off-budget) sources have enclosed within joint financing of 2969,5 million rubles or 164,0 %.

All these actions as approbation of an author's technique of an assessment of management efficiency has shown raise a complex indicator of management efficiency agriculture. But, at the same time, the assessment of a control system of activity of the agricultural organizations has revealed also the problems connected with insufficiently effective use of allocated budgetary funds and investments on development. As have shown
the factors generalized by the author influencing management efficiency by agriculture, they are key and it is important to consider their influence and in due time to make administrative decisions in this part, especially allocating investment group of the factors which integral part is the agriculture digitalization as the main priority direction of increase of its efficiency.

5 Conclusion

Introduction of digital technologies in agriculture is an integral part of its development and allows solving a number of the problems connected with climatic conditions, price barriers, and control of processes. For support of this direction it is necessary to solve a problem of preparation of new professional shots and questions of the state support of digitalization of branch. All this will lead to growth of productivity of the agricultural organizations and as a whole will increase management efficiency agriculture.

Programs of the State support of agro-industrial complex, including agriculture are the important direction of hanging of management efficiency agriculture of Russia.

Programs have versatile character, but the main share (more than 70 %) is the share of the programs connected with updating of material base, updating of equipment and technologies, including digital subsidizing of interest rates on these purposes [8].

Introduction of new digital technologies by the accelerated rates, including modern cloudy technologies, can become primary model of development of agriculture in Russia that will lead to growth of efficiency of investments into branch. The state, in turn, becomes a key link in formation of a system approach of introduction of modern digital technologies in agro-industrial complex that becomes an important component in strategy of development of agriculture.

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