Parity of Land Relations Under the Conditions of Growing Agribusiness Economy and Digital Transformation*

Lyubov Y. Adadimova[1], Yriy G. Polulyakh[1] and Anna-Maria B. Zykova[2(*)]

adadimova@inbox.ru, anna.zykova.97@mail.ru

[1] Volga Region Scientific Research Institute of Economy and the Organizations of Agrarian and Industrial Complex, Saratov, Russian Federation

nii_apk_sar@mail.ru, inf-nii-apk-sar@mail.ru

Abstract. The research aims to highlight the need for parity of the parties in land relations in the agricultural industry and develop a mechanism to control it under conditions of digitalization and economic growth. To achieve research goals, we used general economic methods and approaches to assessing income-generating real estate (resource-intensive, profitable, and comparative). The term "parity of land relations" was introduced due to the evidence of its necessity and feasibility. Besides, we developed an approach to control the parity of land relations. The parties to land relationships can be (1) the state as the governing and executive apparatus of cadastral valuation of land, (2) local authorities as recipients of land tax, (3) landowners, (4) tenants, or (5) producers of goods. In addition, we described the conditions of parity at each stage. When choosing the method for calculating land rent from net income, one should proceed from the ratio between the land rent and the entrepreneur's profit. As for the calculation of land rent, we advocate the requirement that the rent be equal to the amount of land rent. As for the land tax considered based on the rate of the cadastral value, we list the cases when it should be equal to the personal income tax on the land rent). The last parity condition is that all three methods of calculating land tax (from cadastral value, land rent, and rental charge) are mutually equal. Basic parity implies that the cadastral value tax and the land rent tax are equal. Such parity is achieved by adjusting the capitalization rate or land rate tax. More than that, we enabled the unique technique to estimate the value of agricultural land based on the economic results of the agricultural process. The results were calculated in a computer-based economic-mathematical model using the financial records of agricultural organizations collected by the Ministry of Agriculture of the regions using the 1C accounting software. Scientific relevance lies in (1) the proposal of the term "parity of land relations in the agricultural sector of the economy," (2) the development of conditions and the scheme of its formation and control.

Keywords: Economic expansion of agricultural land · Land relations ·

Parity · Cadastral value · Land rent · Rental charge · Land tax · Capitalization rate

1 Introduction

The ongoing digital transformation of agriculture implies (1) fundamental modernization of the agricultural process, (2) increase in the volume of products, (3) improvement of the quality and competitiveness of agricultural products by enhancing the organization and management of production, and (4) accelerated introduction of innovative items. Document management will be significantly reorganized. The analog system will be replaced with digital automation of accounting and reporting of agricultural producers, management of the activities of their divisions, and monitoring and control of executing technological operations. The speed of training in "precision agriculture" technologies, the autopilot of mobile machines, and the speed of introducing other innovations will increase. (Petrov & Gregoryv, 2016; Idrisov &. Knyaginin & Kudrin & Rozhkova, 2018; Shibayev. & Azizov, 2005).

Digitalization will fundamentally affect land relations since almost all innovations will influence land use and increase their efficiency. We are convinced that the price of land plots will rise because land in agriculture is inelastic. Currently, the land is expensive due to the volume of production or the volatile cost of other production factors. For these reasons, it is necessary to improve the approach to the valuation of agricultural land. In this respect, the digitalization of the economy provides numerous opportunities. In particular, the transition to automatic formation of financial accounting and reporting of all producers of agricultural goods at the municipal, regional, and national levels allows one to assess the land plot based on the economic results of production, considering market tools and indicators (1C: Agro-industrial, 2020; Adadimova & Polulyakh, 2020). The ability to access Space and GIS technologies (remote sensing of the Earth from space) allows one to make an inventory of all available land and substantially update the location and technological characteristics of all land plots, which will be concentrated in the Unified Federal Agricultural Land Information System (Ministry of Agriculture and Social Development of the Russian Federation, 2018).

All these possibilities create conditions for the formation of *parity of land relations* in the agricultural sector of the economy. *Parity of land relations* is a *sustainable relationship between actors with the authority and ownership of land* (right to use, own, and dispose of land) *regarding the attribution of land use results as the primary means of production in agriculture*. In modern agriculture, the subjects of relations are the government with local authorities, direct owners of land plots, and their tenants. The economic content of land relations is expressed using indicators-criteria: cadastral and market value, land rent, land tax, and rental charge.

2 Materials and Methods

To achieve the research goals, we used general economic methods and our own approaches to assessing income-generating real estate (resource-intensive, profitable, and comparative). Also, we referred to federal standards and systematic recommendations, such as (1) Federal Valuation Standard "Real Estate Valuation (FVS No. 7)" (Ministry of Economic Development and Trade of the Russian Federation, 2014); and (2) the standards of International Valuation Standards Council (IVSC 1–4) (International Valuation Standards Council, 2017; International Valuation Standards Council, 2019). Besides, we applied the information repositories to obtain data, such as (1) annual accounting of agricultural organizations; (2) "National Report on the Status and the Land Exploitation in the Russian Federation" (Federal Service For State Registration, Cadastre, and Cartography [ROSREESTR], n.d.); (3) Federal State Statistics Service of the Russian Federation (Federal State Statistics Service [ROSSTAT], n.d.); (4) land lease, market value, and rent from land markets, including BEFL publications (ROSREESTR, n.d.; BEFL, 2015; BEFL, 2018).

3 Results

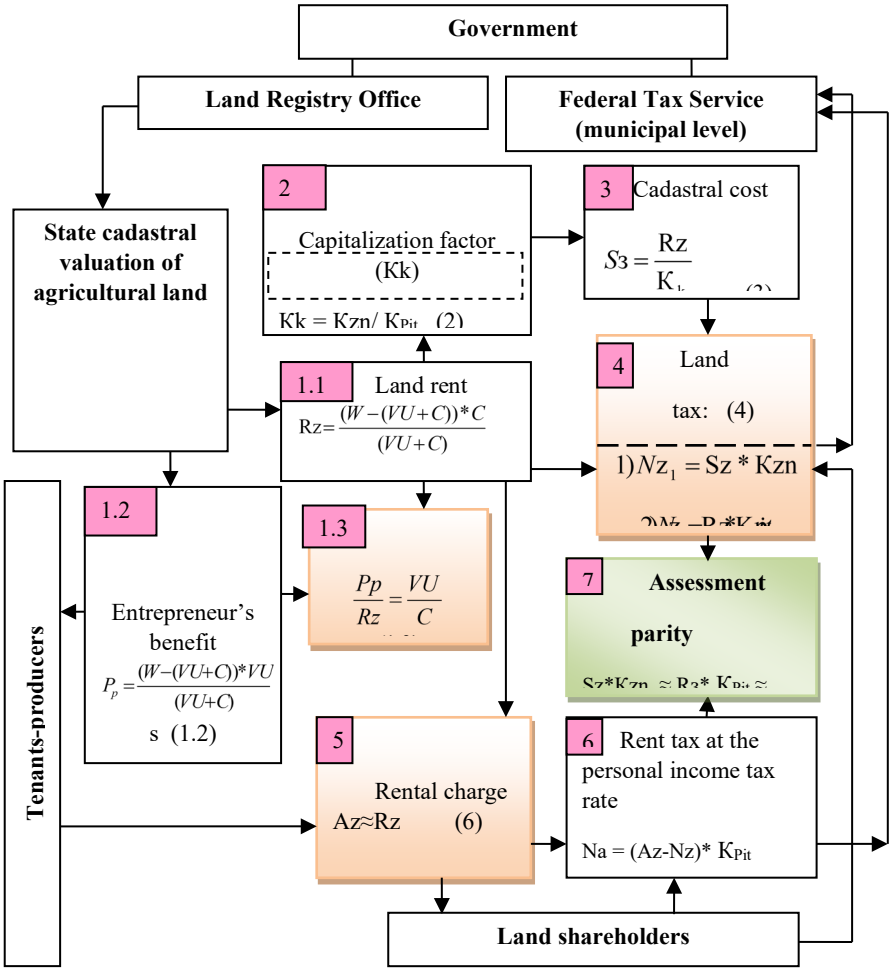
On the one hand, the government, represented by the Federal Land Cadastre Service and the Federal State Budget Institution "Center for Real Estate Valuation," is the organizer of land relations among the subjects of land relations. Moreover, since 2017, due to the new methodological guidelines, the government has become the executor of agricultural land valuation. On the other hand, the government, represented by the Tax Service (at the municipal level), is the beneficiary of the results of such relations. Consequently, the government is interested in increasing the cadastral value of the land; it can satisfy this interest. Therefore, in the valuation process, the government seeks to obtain excessive land rents and apply the lowest capitalization rate. Additionally, the government receives benefits when the land tax rate is high. Nonetheless, due to the low solvency of agricultural landowners (especially land shareholders) and tenants (producers), preferential taxation should be applied. We should note that farmland has a specific feature: it is challenging to compare farmland with real estate land, which requires lower land tax rates.

The tenant-producer holds the opposite position; they need good land plots but low rents. A market category, such as rent, is highly dependent on the cadastral value of the rented land because the size of the rent has reasonable lower and upper limits. Rent cannot be less than the land tax, and the landowner strives for the maximum possible rental income, which is the primary result of the cadastral valuation of agricultural land exploitation, calculated by capitalizing their cadastral value.

Landowners want to have a high cadastral value of their land to explain the amount of rent and the offer price in the event of a land sale. However, landowners do not want to pay a large land tax. They are interested in a high cadastral value and a low land tax rate. Based on these characteristics of the subjects of land relations,

the establishment of full parity requires (1) the improvement of the valuation technique, (2) significant conciliation procedures, (3) business games, and (4) application of optimization models according to the criterion of maximum economic growth. However, on a formal level, it can be achieved as follows (Fig. 1).

Parity formation should begin with the analysis of the methodology and results of the cadastral valuation of agricultural land. The first step is to determine the net income and its distribution between the land rent and the entrepreneur's income. The first and most important condition of parity of relations between the landowner and tenant of the land plot is fixed at this stage. The long-standing residual principle of distribution, which has begun to change recently, is used to give preference to the tenant (entrepreneur), establishing the first income, providing the land rent with residual funds from the net income. We believe that it is possible and even necessary to use the principle of distribution of the final economic result proportional to the share of participation of the landowner and its tenant. In turn, the participation of the landowner and tenant can be assessed using the following ratios (respectively): (1) natural soil fertility and induced soil fertility; (2) constant costs and variable costs in the total estimated cost; and (3) cost index and yield index, which form the intensification efficiency factor (Adadimova, 2018).



W – production value (revenue from sale), thousands of rubles/ha; U – crop yields, cwt/ha; V – constant of variable costs, thousands of rubles/ cwt; C – constant of fixed costs, thousands of rubles/ha; Rz – rent to owners of the land, thousands of rubles/ha; Pp – income of an entrepreneur, thousands of rubles/ha; Kk – land rent capitalization rate, items; S_3 – cadastral value, thousands of rubles/ha; Nz – land tax, thousands of rubles/ha; Na – rent tax at personal income tax rate, thousands of rubles/ha; Kzn – land tax rate on cadastral value, items; K_{Pit} – personal income tax rate, items.; Az – land rent, thousands of rubles/ha.

Fig. 1. The scheme illustrating the formation of parity of land relations between the government, landowners, and tenants-producers. *Source:* Compiled by the authors.

We suggest considering the following version: an economic result divided in proportion to the ratio of constant and variable costs in their total cost. Land rents and profits of the entrepreneur are considered according to formulae (1.1) and (1.2); they are displayed in cells 1.1 and 1.2. In particular, the formula in cell 1.1 is:

$$R_z = \frac{(W - (VU + C)) * C}{(VU + C)} \quad (1)$$

where:
W – production value, thousands of rubles/ha;
U – crop yields, cwt /ha;
V – constant of variable costs, thousands of rubles/ cwt;
C – constant of fixed costs, thousands of rubles/ha.

In this formula, the expression consisting of the numerator in parentheses (VU+C) is the production cost. There is a difference between the cost of products (W) and production costs (VU+C); it is the net income. We think that it should be distributed between the owner and the entrepreneur as land rents and net income. The number C/ (VU+C) is the share of constant costs in their total amount, taken as a share of land rent in the distributed income.

The fraction in formula (1.2) VU/ (VU+C) is the ratio of the variable part of the costs to their total sum. This number means that the share of the entrepreneur's income is equal to the share of the variable costs in the total amount. The entrepreneur's contribution is determined by the amount of costs associated with the use of seeds of high-yield varieties, doses of mineral fertilizers, plant protection agents, and other intensification factors that form artificial fertility and create rents of the second type (rent II). Constant cost is related to technological properties and natural fertility of land plots; it forms a land rent of the first type (rent I) and an absolute rent. *The first parity condition* is expressed as the equality of two indicators in formula (1.3) in cell 1.3 in Fig. 1. The process has two directions.

First, we should dwell on cell 2 – "capitalization factor." This set can be as large as the Land Cadastral Assessment Guidelines set. We can divide the land rents by capitalization factor and move to cell 3 – "cadastral value," then we can multiply the result by "land tax rate," and thus, determine the amount of this tax in cell 4 under number 1).

Second, we should proceed to cell 4.2 ("land tax"). In formula (5), we can multiply the land rent by the personal income tax rate and find the second value of the land tax (under the number 2). If all formulae are written correctly, and the land tax rates and personal income tax comply with the law, the total tax must be equal. The calculations given above comply with *the second parity condition*. The cadastral value is the basis for taxation only because the taxation of real estate is specific; also, it is a material economic category, while land rent is a financial source of land tax, but its form is unacceptable for taxation. In other words, the land tax on the cadastral value of the land plot is just a more convenient form for calculating and collecting. However, the amount should be equal to the tax on land rent and the tax on income received from the land plot by its owner, regardless of business activity. Since this is the case, we can write formula (9) (formulas 6−8 are placed in Fig. 1 cells 5–7):

$$N_z = S_з * K_{zn} = R_з * K_{Pit}; \quad (9)$$

and formula (10):

$$S_z * K_{zn} = R_z * K_{Pit}, \quad (10)$$

if condition 11 is met:

$$S_z = \frac{R_z}{K_k}, \quad (11)$$

formula (10) may be:

$$\frac{R_z * K_{zn}}{K_k} = R_z * K_{Pit}, \quad (12)$$

alternatively:

$$\frac{K_{zn}}{K_к} = K_{Pit}. \quad (13)$$

If the value of the land tax obtained by formula (1) is not equal to the value obtained by formula (2), there is no parity:

$$\frac{R_z * K_{zn}}{K_k} \neq R_z * K_{Pit}, \quad (14)$$

Therefore, the capitalization factor ($K_к$) is incorrect; it must be overridden by expression (15):

$$K_k = \frac{K_{zn}}{K_{Pit}}, \quad (15)$$

This formula (2) is written in cell 2 ("capitalization factor"), but it was not used. The capitalization factor is subject to adjustment to restore parity (formula 14). This situation is due to the fact that the current cadastral land valuation technique does not have clear criteria and standards for determining the factor. If the capitalization factor is fully justified or established by law, the land tax rates can be adjusted. In any case, formula (15) expresses *the second condition of parity of land relations,* in this case, *between local self-government bodies and the owner of the land plot.* The scheme (Fig. 1) contains another route: from land rents down to the rent, and from it, the path goes to the rent tax, which is calculated according to formula (7). The tenant and the landowner use these factors to trade between them to establish an acceptable rent for both. Cell 5 contains settings on *the third condition parity* according to formula (6). Parity on the third condition requires equality between rent and land rent (calculated rental income). We also check that any of the land tax formulae give the same result. If the rent is equal to the land rent (ideally, it should), then personal income tax from the rent, defined by formula (16):

$$N_z = A_z * K_{pit}, \quad (16)$$

should be equal to the land tax calculated by the two variants presented previously ($N_{z_1} = S_z * K_{zn}$ (4) и $N_{z_2} = R_z * K_{Pit}$ (5)). All results must be equal or have a few differences. There is *the basic condition of parity* of land relations in the agricultural sphere. We should note that all of the above applies to personal income tax on all rents, although to avoid double taxation, this tax must be calculated by the formula:

$$N_a = (A_z - N_z) * K_{pit} \ , \tag{17}$$

The results of the three variants of calculations (formulas 4, 5, and 16) must be equal or have a few differences in cell 7. This cell is the result expressing *the aggregate parity of land relations*, combining *the control results of the three particular conditions listed above*. However, if the land tax rate is 0.3% of the cadastral value and it is privileged, the land tax on the value should be less than the tax on the land rent. The formula (5) of cell 4 and the expression in cell 7 must be adjusted based on the condition (18):

$$N_{\text{zl}} = \text{N}_{\text{a}} * \frac{\text{K}_{\text{znl}}}{\text{K}_{\text{zn pol}}} \ , \tag{18}$$

where:
N_{zl} – amount of preferential tax, rubles. /ha;
K_{znl} – preferential land tax rates, %;
$K_{zn\ pol}$ – land tax rates, %.

4 Discussion

Agricultural land is inelastic. Therefore, currently, the land is expensive and will be even more expensive in the future because of digitalization and the growing economic agricultural business. The land shall be using the operating technique. First, the land should be valued at the lowest interest rate of the bank deposit. Second, there must be additional lowering factors. As a result, the opposite happens: it is recommended to use a technique with sufficiently high bets (Ministry of Economic Development of the Russian Federation, 2017a; Ministry of Economic Development of the Russian Federation, 2017b), and supplement them with discounts on bargaining for land plots of agricultural use from 10% to 20% in the "active market" and from 6% to 30% – in the "passive" market. We should note that the developers of the methodological recommendations indicated in Annex No. 11 that "the selection of the capitalization rate value is carried out on the basis of the analysis of the real estate market for each segment" (Ministry of Economic Development of the Russian Federation, 2017a; Ministry of Economic Development of the Russian Federation, 2017b). The experts also warn, "in case of significant changes in the real estate market, the data are subject to mandatory adjustment" (Ministry of Economic Development of the Russian Federation, 2017a; Ministry of Economic Development of the Russian Federation, 2017b). Besides, BEFL used an "annual rental multiplier" in their study on agricultural land market analysis in several regions of Russia (BEFL, 2015). In the context of this paper, this term refers to the ratio of the value of the land to the annual rental rate. In fact, this is the inverse of the capitalization factor established in the land market. There is a "period of capitalization" of land rents. We have a numerical example with BEFL "annual rental multiplier in Table 1." As for the cadastral value, the capitalization factor ranges from 0.043 (in the Kursk region) with a capitalization period of 23 years to 0.065 (in Mordovia) with a capitalization period of 15 years, with a difference of

1.53 times (BEFL, 2015). In the first round of the cadastral valuation of agricultural land in Russia, the capitalization factor was 0.03 with a capitalization period of 33 years. Consequently, the cadastral value was 33 times higher than the rental income, and the "annual rental multiplier" was 33.

Table 1 presents the results of calculations for several variants to increase the value of the land rent capitalization factor. These results were obtained when assessing the initial data on land rent according to *the author's technique.*[†]. As such, the impact of the land rent capitalization factor, namely, the importance of the factor in the valuation procedure, is visible.

[†] Method and electronic model of updating the cadastral value of agricultural land, based on the use of information of the annual accounting report of agricultural organizations accumulated by the Ministry of Agriculture of the constituent entities of the Russian Federation.

Table 1. Dependence of cadastral value and land tax on the value of land rent capitalization factor when assessing the results of winter grain crop cultivation in agricultural organizations of the Saratov region in 2016.

Name of the administrative district	Land rent, thou. RUB/ ha	Cadastral cost, thou. RUB/ ha	Land tax, RUB/ha :		Versions of the values of land rent capitalization factor, thou. RUB/ha		
			on cadastral value	on land rents	0.05 cadastral cost	0.067 cadastral cost	0.1 cadastral cost
1	2	3	4	5	6	7	8
Standard		**0.0231**	**0.003**	**0.13**	**0.05**	**0.067**	**0.10**
Ozinsky district	0.071	3.076	9.23	9.23	1.42	1.06	0.71
Novouzensky district	0.157	6.802	20.92	20.41	3.13	2.34	1.57
Pitersky district	0.163	7.062	21.72	21.19	3.26	2.43	1.63
Saratovsky district	0.230	9.965	30.65	29.90	4.60	3.43	2.30
Voskresensky district	0.255	11.048	33.98	33.15	5.10	3.81	2.55
Lysogorsky district	0.272	11.785	36.25	35.36	5.43	4.05	2.72
Baltaysky district	0.325	14.081	43.31	42.30	6.51	4.86	3.25
Petrovsky district	0.359	15.555	47.85	46.68	7.18	5.36	3.59
Marxovsky district	0.383	16.594	51.04	49.80	7.66	5.72	3.83
Red Army district	0.392	16.984	52.24	51.01	7.85	5.86	3.92
Romanovsky district	0.923	39.991	123.6	119.9	18.45	13.77	9.23
Kalininsky district	0.935	40.511	124.6	121.5	18.69	13.95	9.35
Sovietsky district	0.977	42.331	130.2	127.0	19.53	14.58	9.77
Total	**0.536**	**23.224**	**71.43**	**69.68**	**10.71**	**7.99**	**5.36**
max	**0.977**	**42.331**	**130.2**	**127.0**	**19.53**	**14.58**	**9.77**
min	**0.071**	**3.076**	**9.46**	**9.23**	**1.42**	**1.06**	**0.71**

Source: Compiled by authors based on (Adadimova & Polulyakh, 2020).

For the numerical example, in the first and second versions, we took such capitalization coefficients that they are in the range of the actual data given by BEFL (2015). In the third version, the capitalization coefficient is close to the level recommended by the 2017 guidelines. (Ministry of Economic Development of the Russian Federation, 2017a). So that the version corresponds to the preferred option, the capitalization coefficient must be equal to 0.115. Then the amount of land tax will be only 20% of the personal income tax on the rent for the land, which will be 5 times less.

Thus, we can get different results of the cadastral value of land and the amount of land tax if we manipulate the value of the capitalization coefficient at the same amount of land rent: the most crucial evaluation criterion. Therefore, the method of determining the capitalization rate of land rent should be carefully justified. In any case, this circumstance requires developing conditions and a mechanism for controlling the parity of land relations in agriculture. Furthermore, *shareholders can use land rent, calling it "imputed income," and if the owner uses the land themselves, call it "alternative costs."*

5 Conclusion

The research results allow one to justify the need to introduce the term "parity of land relations in the agricultural sector of the economy," to develop conditions for the formation and a procedure for ascertainment existence and control. *Parity of land relations* is a *sustainable relationship between actors with the authority and ownership of land* (right to use, own, and dispose of land) *regarding the attribution of land use results as the main means of production in agriculture*. The formation and functioning of parity relations imply several conditions and criteria.

The first condition implies that the parity between the landowner and the tenant is established during the cadastral valuation of land to distribute the net income received from the land plot. The parity between the land rent and the entrepreneur's income is determined so that the land rent and the net income must be proportional to the contribution of each of the entities mentioned above to the creation of the entrepreneur's income. Net income is identified by the following ratios (respectively): (1) natural soil fertility and induced soil fertility; (2) fixed costs and variable costs in the total estimated cost; (3) the cost index and the return index, which form the efficiency coefficient of intensification.

The second condition states that the land tax, which is obtained when calculating the percentage rate of the cadastral value of the land plot, is equal to the tax on personal income from the calculated rent for the land. The parity between the owner of the land plot and the local authorities is regulated by the capitalization coefficient of the land rent if the interest rates of the land tax and the personal income tax cannot be changed; or by the interest rate of the land tax if the capitalization coefficient cannot be objectively changed.

The third condition claims that the landowner and its tenant must maintain parity in the amount of rent. Thus, the rent is equal to the estimated rental income (land rent) that cadastral officers use when calculating the cadastral value of land plots.

Finally, according to the basic condition of parity of land relations in the agricultural sector of the economy, the results of both versions of land tax calculation should be equal to the tax on income of individuals from the rental charge (with land tax in it). Therefore, the land tax calculation results for the three options should be equal, justifying compliance with the three primary conditions of parity.

References

1C: Agro-industrial complex. (2020). Retrieved from https://solutions.1c.ru/catalog/erpapk/features

Adadimova, L. Y. (2018) Estimation of land value and effect of agricultural technologies in the reproduction process. *Scientific Review: Theory and Practice*, *5*, 33-41.

Adadimova, L. Y., Polulyakh, Y. G, (2020). Methodology of updating the cadastral valuation of land in the conditions of digitalization of the agricultural economy. *Agricultural Economics of Russia*, 1, 73-81.

BEFL. (2015). Analytical review of the fair value of agricultural land on the example of the southwestern part of Orlovsky district, Retrieved from http://www.befl.ru/upload/iblock/2c4/2c494043fe5e3dad53581cce70bddf72.pdf

BEFL. (2018). The largest owners of agricultural land in Russia for 2018. Retrieved from http://www.befl.ru/press/list.php?sID=45 (last accessed date 18.06.2019).

Federal Service for State Registration, Cadastre, and Cartography [ROSREESTR]. (n.d). State Cadastral Valuation Data Fund. Retrieved from https://rosreestr.ru/wps/portal/cc_ib_svedFDGKO

Federal State Statistics Service [ROSSTAT]. (n.d.). List of publications that characterize the socio-economic situation of the constituent entities of the Russian Federation. Retrieved from https://www.gks.ru/publications-plans

Idrisov, G. B., Knyaginin, V. N., Kudrin, A. L., Rozhkova, E. S. (2018). A new technological revolution: Challenges and opportunities for Russia. *Voprosy Ekonomiki, 4*, 5-25

International Council on Evaluation Standards (2019) International Valuation Standard 2019. Retrieved from https://sabbureau.ru/company/articles/mso-ivs-2019.html

International Council on Evaluation Standards. (2017). International Valuation Standards 2017. Retrieved from http://profiocenka.ru/mezhdunarodnyye-standarty-otsenki-mso-1-4

Ministry of Agriculture and Social Development of the Russian Federation. (2018). Unified federal information system on agricultural land and land used or provided for agriculture in other categories of land (EFIS). Retrieved from http://efis.mcx.ru/opendata

Ministry of Economic Development and Trade of the Russian Federation. (2014). *Federal Valuation Standard "Real Estate Valuation" (FSO No. 7)* (September 25, 2014 No. 611). Retrieved from http://www.ceae.ru/FCO7.htm

Ministry of Economic Development of the Russian Federation. (2017a). *Order "On approval of methodological instructions on state cadastral assessment*." (May 12, 2017 No. 226) Retrieved from https://sudact.ru/law/prikaz-minekonomrazvitiia-rossii-ot-12052017-n-226/metodicheskie-ukazaniia-o-gosudarstvennoi-kadastrovoi/

Ministry of Economic Development of the Russian Federation. (2017b). *Order "On Approval of Methodological Instructions on State Cadastral Assessment*." (May 12, 2017 No. 226), p. 111-112

Petrov, I. A., Gregoryv, N. S. (2016) Organizational and economic mechanism for the cost of implementing precision farming technologies. *Agrarian Scientific Journal*, *10*, 96-100.

Shibayev, A. I., Azizov, Z. M. (2005). Resource-saving receptions and systems of basic soil

treatment in agrocenoses of the Volga region. *Journal of the Russian Academy of Agricultural Sciences, 3*, 28-30.