Specialization of agricultural organizations of Chelyabinsk region: analysis and institutional interpretation

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Abstract. The article presents the results of research and analysis of specialization of agricultural organizations of the Chelyabinsk region for the period from 2006 to 2017, which according to the population ecology of organizations has advantages in stable or specific environments. To study the specialization of the organizations of the agro-industrial complex of the Chelyabinsk region, a three-part coefficient of specialization was used, which characterizes the total share of the three values of the studied trait in the total population. Empirical research of agro-industrial complex of Chelyabinsk region allowed performing the analysis of 294...194 organizations for the period 2006...2017. It was found that the arithmetic value of a share of the first three types of products, ordered descending, in the structure of realization of products of agricultural organizations of territories of the region made up 78.09...85.08 % and in the structure of sales organizations of the region amounted to 89.71...96.86 %. It was shown that the analysis of the shares of the first three types of products, ordered in descending order, in the structure of sales of agricultural products can be reduced to the analysis of the shares of the first of the three types of products in this ordered structure. It was found that during the study period, the share of organizations of the agro-industrial complex of the region with the share of proceeds from the sale of grain and leguminous crops in the total revenue of organizations 20 ... 80 % amounted to 45.92...29.61 %.

1 Introduction

The modern economic sociology includes two main directions – sociology of markets and sociology of organizations [1–4]. Within these two directions complementary research programs are created and developed, for example, population ecology of organizations [5–7].

Population ecology of organizations transfers many biological laws to a set of organizations. This science studies a set of organizations that have a homogeneous organizational form, and therefore are relatively homogeneous in terms of their vulnerability to environmental changes [8]. Otherwise, the population ecology of organizations equals the set of organizations in biological populations and studies them, as well as changes in organizational forms of populations for the chosen set of observable characteristics which are known to affect the degree of compliance with its surrounding external environment [9, 10].

Empirical research in the framework of the population ecology of organizations revealed that the selection mechanism is the leading mechanism of changes in organizations and sectors of the market economy. "Organizational forms are probably failing to evolve – "write M.T. Hannan and J.T. Smith. Freeman – in certain environmental conditions because other forms compete successfully with them for basic resources. As long as the resources that sustain organizations are limited and populations have unlimited capacity to expand, competition is inevitable" [11].

M.T. Hannan remarks: "If two populations of organizations supported by identical environmental resources differ in some organizational characteristic, then a population with a characteristic less corresponding to the variables will tend to disappear. Stable equilibrium will then include only one population which can be said to be isomorphic to the environment" [8].

More generally, the upper bound of a variety in a system is determined not only by specific resources but also by additional growth constraints. Thus, the expansion of markets and government regulation mechanisms may, for example, cause a reduction in the number of restrictions for local environments. M.T. Hannan and J. Freeman write: "... the process of expanding the economic and political center must, therefore, have a tendency to replace some local restrictions with more unified restrictions more uniform" [8].

Population ecology of organizations postulates that a single population of organizations occupies its market niche in an unstable environment in which the population has a stable competitive advantage. "Faced with unstable environments," – write researchers M.T. Hannan and J. Freedman, – organizations need to develop a generalist structure that is not best adapted to

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any of the configurations of the external environment but is optimal for the entire set of configurations" [8].

Population ecology of organizations states that specialization will always have advantages in stable or defined environments and generalism is not always optimal in uncertain environments.

"If the environment varies between the states in unpredictable manner imposing very different requirements to the organization, and the duration of the state of the external environment is negligible relative to the lifespan of the organization... populations of organizations that have chosen the specialization will be in a better position than those who chose generalism" [8, 12, 13].

The study of specialization of organizations reveals the result of competition for resources between organizations of different populations.

The purpose of the study is to analyze the specialization of the organizations of the agro-industrial complex of the Chelyabinsk region which is characterized by the industrial type of the structure of the gross regional product.

In accordance with the purpose of the study the following tasks are set:

- to carry out a comparative analysis of the normalized values of the arithmetic means of shares of the first three types of products, ordered descending, in the structure of realization of products of agricultural organizations of Chelyabinsk region for the period from 2006 to 2017;
- to carry out a comparative analysis of the distribution of agricultural organizations by the share of proceeds from the sale of grain and leguminous crops in the total revenue of agricultural organizations of the Chelyabinsk region for the period from 2006 to 2017.

2 Materials and methods

When solving the tasks set in this study, two approaches to the empirical study of the specialization of organizations of the agro-industrial complex of the Chelyabinsk region were formulated, to the analysis of its results.

In the first approach, the specialization coefficient is calculated for the three, four, six or eight largest units of the set of values of the studied trait. For example, CR_3 is a three-part index of specialization that characterizes the total share of the three values of the studied trait in the total population:

$$CR_3 = \sum_{i=1}^{3} p_i , \qquad (1)$$

where p_i – is a proportion of *i*-value of the studied trait.

The second approach calculates inequality indicators which properties are determined by the axioms of inequality measurement, namely: redistribution, scale independence, duplication of observations, anonymity and additivity [14]. Only one class of indicators namely generalized entropy indicators satisfies all the above requirements (*GE*):

$$GE(\alpha) = \frac{1}{\alpha^2 - \alpha}\left[\frac{1}{n}\sum_{i=1}^{n}\left(\frac{x_i}{\bar{x}}\right)^{\alpha} - 1\right], \qquad (2)$$

where α – is a parameter that takes any value from $-\infty$ to $+\infty$
n – is a population size;
x_i – is a *i*-value of the studied trait.;
$\bar{x}$ – is the arithmetic mean of the studied trait.

If the parameter α is 0, the index of the logarithmic mean deviation, which gives greater weight to the differences of the studied trait at the bottom of the distribution, has the form:

$$GE(0) = -\frac{1}{n}\sum_{i=1}^{n}\log\left(\frac{x_i}{\bar{x}}\right) = \frac{1}{n}\sum_{i=1}^{n}\log\left(\frac{\bar{x}}{x_i}\right). \qquad (3)$$

If the parameter α is equal to 1, then Theil index [15], which gives equal weights to the observations over the entire distribution scale, has the form:

$$GE(1) = \frac{1}{n}\sum_{i=1}^{n}\left(\frac{x_i}{\bar{x}}\right)\log\left(\frac{x_i}{\bar{x}}\right). \qquad (4)$$

If the parameter α is 2, the total entropy index, which gives greater weight to the differences in the studied trait at the top of the distribution, has the form:

$$GE(2) = \frac{1}{2}\left[\frac{1}{n}\sum_{i=1}^{n}\left(\frac{x_i}{\bar{x}}\right)^2 - 1\right] = \\ = \frac{1}{2\bar{x}^2}\left[\frac{1}{n}\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2\right] = \frac{1}{2}V^2 , \qquad (5)$$

where V – is a coefficient of variation.

The Atkinson index [16, p. 244-263] has the form:

$$A_{\varepsilon} = 1 - \left[\frac{1}{n}\sum_{i=1}^{n}\left(\frac{x_i}{\bar{x}}\right)^{1-\varepsilon}\right]^{1/(1-\varepsilon)}, \qquad (6)$$

where ε – is a parameter of inequality deviation.

If $\alpha = 1 - \varepsilon$, the generalized entropy indices become conditionally equivalent to the Atkinson index for the values $\alpha < 1$ [17]. The Atkinson index satisfies the requirement of additivity, that is, it decomposes without remainder in the sum of inequality within groups and intergroup inequality [18].

Popular in the theory of industrial markets Gini index does not meet the requirement of the axiom of additivity, if the subvectors of the studied trait intersect [18]. However, despite some limitations, it contains useful information about the form of distribution of the studied trait [19], and has the form:

$$G = \frac{1}{2n^2\bar{x}}\sum_{i=1}^{n}\sum_{j=1}^{n}\left|x_i - x_j\right|. \qquad \mathbf{(7)}$$

Besides, methods of decomposition of this indicator have been proposed [20–22], but it is possible to decompose it without a residue only if the subvectors of the studied trait do not intersect [23].

For an empirical study of the specialization of the organizations of the agro-industrial complex of the Chelyabinsk region for the period from 2006 to 2017, a

three-part index of specialization (CR_3) was used, methods of regression analysis and nonparametric statistics were used.

The information base of the research is represented by scientific economic literature, statistical data and analytical information of the Ministry of agriculture of the Chelyabinsk region, in particular, the data of forms 9 and 13 of the annual financial statements of organizations of the agro-industrial complex of the Chelyabinsk region for the period from 2006 to 2017.

3 Results

The empirical study of agro-industrial complex of the Chelyabinsk region made it possible to perform analysis 294…194 for the period from 2006...2017, and also to assess the areas of specialization of the region according to the share of the first three types of products, ordered descending, in the structure of realization of products of agro-industrial districts of the Chelyabinsk region. As a result, it was found that the average arithmetic values of the shares of the first three types of products, ordered in descending order, in the structure of sales of products of agricultural organizations of the region amounted to 78.09...85.08 % (standard deviation is 7.53...12).

The empirical study of specialization of the organizations of agro-industrial complex of the region has allowed establishing that the arithmetic value of shares of the first three types of products, ordered descending, in the structure of sales organizations of the region amounted to 89.71...96.86 % (standard deviation is 2.35...4.15) (Appendix A and Figure 1).

A comparative analysis of the normalized values of the arithmetic means of shares of the first three types of products, ordered descending, in the structure of realization of products of agricultural organizations of the Chelyabinsk region (Figure 1) has allowed using the nonparametric Mann-Whitney U-test to identify three periods, the average of the ranks which amounted to 69.42 and 136.35 and also 173.74 respectively (Table 1).

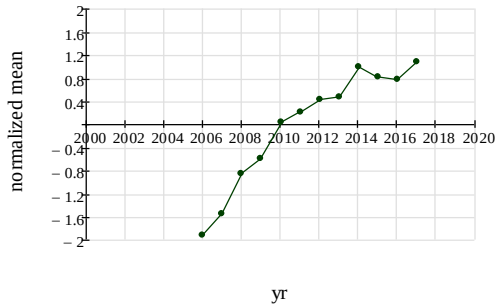

Fig. 1. Normalized values of the arithmetic means of shares of the first three types of products, ordered descending, in the structure of realization of products of agricultural organizations of the Chelyabinsk region (from 2006 to 2017).

The first period is from 2006 to 2009. The arithmetic mean of the shares of the first three types of products, ordered in descending order, in the structure of sales of products of agricultural organizations of the Chelyabinsk region was 91.31 %. The minimum value of this indicator in this period is 89.71 %, and the maximum value is 92.78 % (Table 1).

The second period is from 2010 to 2013. The arithmetic mean of the shares of the first three types of products, ordered in descending order, in the structure of sales of products of agricultural organizations of the Chelyabinsk region was 94.84 %. The minimum value of this indicator in this period is 94.25 %, and the maximum value is 95.28 % (Table 1).

The third period is from 2014 to 2017. The arithmetic mean of the shares of the first three types of products, ordered in descending order, in the structure of sales of products of agricultural organizations of the Chelyabinsk region was 96.37 %. The minimum value of this indicator in this period is 96.01 %, and the maximum value is 96.86 % (Table 1).

Table 1. Comparative analysis of the normalized values of the arithmetic means of shares of the first three types of products, ordered descending, in the structure of realization of products of agricultural organizations of the Chelyabinsk region (nonparametric Mann-Whitney U-test).

ranking

Period	**2006…2009**	**2010…2013**	**2014…2017**
2006…2009	–		
2010…2013	H_1 (α=0.000)	–	
2014…2017	H_1 (α=0.000)	H_1 (α=0.000)	–
$\bar{X}$	**69.42**	**136.35**	**173.74**

Notes:

H_0 – the hypothesis of equality of the mean values of two independent samples is confirmed;

H_1 – the hypothesis of equality of the mean values of two independent samples has not been confirmed.

Sources:

Ministry of agriculture of the Chelyabinsk region

Using regression analysis, we get the equation of classical pair linear regression, where: y is the normalized value of the arithmetic means of shares of the first three types of products, ordered descending, in the structure of realization of products of agricultural organizations of the Chelyabinsk region; x is the normalized values of arithmetic means of shares of the first three types of products, ordered descending, in the structure of realization of products of agricultural organizations of the Chelyabinsk region (Figure 2).

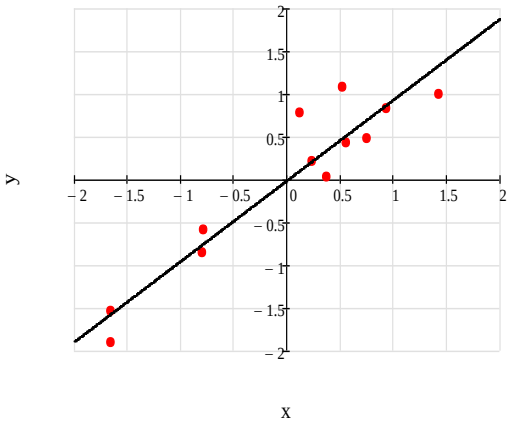

Fig. 2. Equation of classical pair linear regression.

The equation of the classical pair linear regression has the form:

$$y = 0.943\,x. \quad (8)$$

The coefficient *b* of the linear regression equation is statistically significant, as indicated by the values of the *t*-statistics (Table 2).

Table 2. Variables of empirical research model

Model	Coefficients		t	α	*CI*	
y	b	s_b			*A*	*B*
a	0.000	0.101	0.000	0.999	-0.22	0.225
b	0.943	0.105	8.945	0.000	0.708	1.178

Notes:

s_b – standard error of parameters of pair linear regression;

t – Student's criterion;

α – significance level ($\alpha = 0.05$).

The conclusion is valid in respect of the equation in general, this is indicated by the value of Fisher-Snedecor criterion (Table 3).

Table 3. Summary for the pair linear regression model

Model	*R*	R^2	S^2	*F*	α
y	0.943	0.889	0.350	80.012	0.000

Notes:

R – correlation coefficient;

R^2 – determination coefficient;

S^2 – the standard error of estimation;

F – Fisher-Snedecor criterion;

α – significance level ($\alpha = 0.05$).

Thus, the characteristics of the model of the empirical study allow concluding that the increase in normalized values to the average value shares of the first of the three types of products, ordered descending, in the structure of realization of products of agricultural organizations of the Chelyabinsk region on 1.00 % of their average values leads to increased normalized values of the average proportion of the first three types of products, ordered descending, in the structure of realization of products of agricultural organizations of the Chelyabinsk region on average 0.943 %.

Consequently, the analysis of the share of the first three types of products, ordered descending, in the structure of realization of products of agricultural organizations of the Chelyabinsk region can be reduced to the analysis of the shares of the first three types of products, ordered descending, in the structure of realization of products of agricultural organizations of the Chelyabinsk region.

The empirical study of agro-industrial complex of the Chelyabinsk region with the mountain forest, the Northern forest-steppe, the Southern forest-steppe and the wall of climatic zones made it possible to perform distribution of organizations by share of revenue from sales of grain and leguminous crops in the total revenue of the organizations (Appendix B).

For example, the first group includes organizations of the agro-industrial complex of the region with a share of proceeds from the sale of grain and leguminous crops 0 %. During the researched period 2006-2017, the average share of organizations in this group was 16.45 %. The minimum value of this indicator in this period is 6.46 %, and the maximum value is 22.85 % (Figure 3).

To the eleventh group we refer the organizations of agro-industrial complex of area with a share of proceeds from realization of grain and leguminous cultures of 90...100 %. During the researched period 2006-2017, the average share of the Chelyabinsk region organizations in this group was 24.57 %. The minimum value of this indicator in this period is 16.85 %, and the maximum value is 34.08 % (Figure 3).

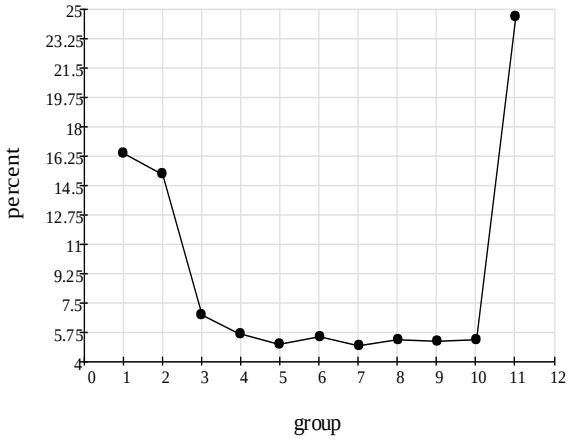

Fig. 3. Distribution of agricultural organizations of the Chelyabinsk region by the share of proceeds from the sale of grain and leguminous crops in the total revenue of agricultural organizations (from 2006 to 2017).

Aggregation of distribution groups of agricultural organizations of the Chelyabinsk region by the share of proceeds from the sale of grain and leguminous crops in the total revenue of organizations allows distinguishing four groups (Table 4).

Table 4. Distribution of agricultural organizations of the Chelyabinsk region by the share of proceeds from the sale of grain and leguminous crops in the total revenue of agricultural organizations (aggregated variant)

percent

Year	0…20	20…80	80…100	0
2006	22.79	45.92	24.83	6.46
2007	23.96	40.63	26.04	9.38
2008	24.01	35.48	30.47	10.04
2009	23.13	34.52	25.27	17.08
2010	32.21	23.97	20.97	22.85
2011	15.35	35.83	30.31	18.50
2012	24.27	28.87	28.45	18.41
2013	25.54	27.27	26.41	20.78
2014	19.82	22.03	36.56	21.59
2015	18.48	25.59	34.60	21.33
2016	17.53	30.41	35.05	17.01
2017	17.32	29.61	39.11	13.97
$\bar{X}$	22.03	31.68	29.84	16.45

Sources:
Ministry of agriculture of the Chelyabinsk region.

To the second aggregated group we refer the organizations of agro-industrial complex of the region with the share of proceeds from the sale of grain and leguminous crops in the total revenue of organizations

20 ... 80 %. During the researched period, the share of organizations in this group was 45.92...29.61 % (Table 4).

The comparative analysis of distribution of the organizations of agro-industrial complex of the Chelyabinsk region on a share of proceeds from realization of grain and leguminous cultures in the general revenue of the organizations of two periods allowed allocating by means of nonparametric U-test statistically significant changes in distribution of the organizations (Table 5).

The comparative analysis of distribution of the organizations of agro-industrial complex of the Chelyabinsk region on a share of proceeds from realization of grain and leguminous crops in the general revenue of the organizations showed decrease in their share in the second aggregated group from 36.06 to 27.30 % and growth of their share in the third aggregated group from 26.32 to 33.36 % (Table 5).

Table 5. Comparative analysis of distribution of agricultural organizations of the Chelyabinsk region by the share of proceeds from the sale of grain and leguminous crops in the total revenue of agricultural organizations (from 2006 to 2011 and from 2012 to 2017)

Period	$\bar{X}$	$S_{\bar{X}}$	n	s	M_e	CI	
						A	B
0…20							
2006…2011	23.58	2.19	6.00	5.35	23.55	19.16	27.58
2012…2017	20.49	1.45	6.00	3.55	19.15	17.87	23.22
2006…2017	22.03	1.33	12.00	4.62	22.96	19.47	24.50
20…80							
2006…2011	36.06	2.98	6.00	7.31	35.66	30.49	41.55
2012…2017	27.30	1.27	6.00	3.11	28.07	24.81	29.43
2006…2017	31.68	2.03	12.00	7.04	30.01	28.03	36.09
80…100							
2006…2011	26.32	1.47	6.00	3.61	25.65	23.35	29.05
2012…2017	33.36	2.00	6.00	4.90	34.82	29.48	37.16
2006…2017	29.84	1.59	12.00	5.51	29.38	26.87	32.87
0							
2006…2011	14.05	2.59	6.00	6.36	13.56	8.81	18.58
2012…2017	18.85	1.22	6.00	2.99	19.59	16.44	20.86
2006…2017	16.45	1.55	12.00	5.36	17.75	13.57	19.22

Notes:
$\bar{X}$ – arithmetic mean;
$S_{\bar{X}}$ – standard error of arithmetic mean;
n – sample size;
s – standard deviation of the sample;
M_e – median;
CI – confidence interval, where A – the lower value, B – the upper value of the confidence interval with a significance level $\alpha = 0.05$.

Sources:
Ministry of agriculture of the Chelyabinsk region.

4 Conclusion

The empirical studies in the framework of the population ecology of organizations program have shown that the selection mechanism is the leading mechanism of changes in the organization and sectors of the market economy. Population ecology of organizations states that specialization will always have advantages in stable or defined environments, and generalism is not always optimal in uncertain environments.

The empirical research of agro-industrial complex of the Chelyabinsk region allowed performing the analysis of 294...194 organizations for the period from 2006 to 2017. As a result, it was found that the average arithmetic values of the shares of the first three types of products, ordered in descending order, in the structure of sales of products of agricultural organizations of the region amounted to 78.09...85.08 % (standard deviation is 7.53...12).

The empirical study of specialization of the organizations of agro-industrial complex of the region has allowed establishing that the arithmetic value of shares of the first three types of products, ordered descending, in the structure of sales organizations of the region amounted to 89.71...96.86 % (standard deviation is 2.35 4.15...). For the period from 2006 to 2009, the arithmetic mean of the shares of the first three types of products, ordered in descending order, in the structure of sales of products of agricultural organizations of the Chelyabinsk region was 91.31 %.

For the period from 2010 to 2013, the arithmetic mean of the shares of the first three types of products, ordered in descending order, in the structure of sales of products of agricultural organizations of the Chelyabinsk region was 94.84 %. For the period from 2014 to 2017, the arithmetic mean of the shares of the first three types of products, ordered in descending order, in the structure of sales of products of agricultural organizations of the Chelyabinsk region was 96.37 %.

The analysis of shares of the first three types of products, ordered descending, in the structure of realization of products of agricultural organizations of the Chelyabinsk region can be reduced to the analysis of shares of the first three types of products, ordered descending, in the structure of realization of products of agricultural organizations of the Chelyabinsk region.

It is important to note that for the period from 2006 to 2017, the average share of organizations of the agro-industrial complex of the Chelyabinsk region amounted to 45.92... 29.61 %.

Table 6. Arithmetic means of shares of the first three types of products, ordered in descending order, in the structure of product sales agricultural organizations of the Chelyabinsk region.

Territory	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	$\bar{X}$
Agapovsky	90.53	89.32	89.79	92.19	94.25	94.27	92.74	96.90	96.95	96.92	97.60	98.09	94.26
Argayashskaya	84.84	85.30	87.63	87.97	90.24	90.66	95.78	93.55	95.78	96.90	92.99	93.01	91.82
Bredy	90.85	95.49	95.43	93.00	94.77	94.36	91.80	91.69	93.93	96.27	98.64	98.16	94.56
Varna	87.58	92.26	95.45	91.39	94.53	91.63	93.16	93.72	95.62	94.83	96.92	96.12	94.12
Verkhneuralsk	93.14	90.89	96.57	96.34	98.14	95.15	96.66	98.15	98.19	93.53	94.73	96.24	96.29
Masculatory	81.99	88.73	86.19	96.07	95.89	96.91	97.27	98.81	96.14	94.07	95.43	93.53	95.66
Kachalsky	91.33	94.43	95.16	91.97	87.52	92.40	93.58	94.17	98.39	99.09	97.22	98.81	94.30
Kasli	83.46	88.24	90.75	93.57	95.24	93.85	96.52	96.99	96.17	90.89	81.08	90.86	92.23
Kizil	91.67	93.62	93.08	91.36	95.01	97.28	96.35	96.72	97.98	99.58	99.35	99.61	96.53
Krasnoarmeysky	91.36	90.82	91.03	94.42	97.07	93.28	95.43	94.28	97.49	96.50	95.93	96.62	94.92
Kunashakskogo	97.57	94.63	95.55	97.11	97.82	96.34	99.38	99.20	99.96	99.95	99.82	99.45	98.51
Nagaybaksky	89.15	83.13	89.95	89.72	87.46	90.91	90.20	89.73	92.77	95.56	100.00	98.86	90.07
Nyazepetrovsky	93.18	90.32	91.52	88.14	96.61	97.79	98.33	94.86	96.90	98.49	98.04	100.00	96.76
Oktyabrsky	89.50	90.70	93.41	90.97	94.08	95.04	93.42	94.04	96.77	96.83	96.08	96.83	94.06
Sosnovskiy	88.75	88.18	90.04	95.28	96.65	96.23	97.48	96.28	96.00	96.70	97.46	98.91	96.25
Troitsky	93.69	93.30	95.06	95.80	94.84	94.67	94.07	96.42	96.75	94.48	96.83	97.74	94.95
SP	89.12	92.32	93.20	90.75	97.66	98.41	96.26	96.51	99.96	98.92	98.85	94.83	96.39
Uyskiy	87.82	91.17	91.88	93.69	97.91	97.94	97.76	97.96	97.21	97.79	96.37	99.37	97.48
Chebarkul	87.43	87.19	88.19	94.72	93.29	92.61	96.08	95.33	98.07	96.28	96.80	98.07	95.03
Chesmensky	86.10	88.03	89.19	88.06	84.29	90.51	89.24	89.36	89.37	87.74	89.64	90.60	89.21
Chelyabinsk region	**90.49**	**91.21**	**92.92**	**93.20**	**94.58**	**94.61**	**94.91**	**95.27**	**96.52**	**96.11**	**96.84**	**97.44**	**94.76**
$\bar{X}$	89.71	90.57	92.17	92.78	94.25	94.68	95.18	95.28	96.52	96.11	96.01	96.86	94.93
M_e	89.50	90.82	91.88	93.00	95.01	94.67	96.08	96.11	96.77	96.70	96.83	98.07	95.55
$\tilde{X}$	-1.90	-1.53	-0.85	-0.59	0.04	0.22	0.43	0.48	1.01	0.83	0.79	1.08	0.33
$\tilde{M}_e$	-1.66	-1.52	-1.10	-0.66	0.12	-0.01	0.54	0.55	0.81	0.78	0.83	1.30	0.33

Notes:
$\bar{X}$ and $\tilde{X}$ – arithmetic mean and the normalized value of the arithmetic mean;
M_e and $\tilde{M}_e$ – median and normalized mean of median.

Table 7. The distribution of agricultural organizations of the Chelyabinsk region by the share of proceeds from the sale of grain and leguminous crops in the total revenue of agricultural organizations.

Group	Interval	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	$\bar{X}$
amount														
1	0	19	27	28	48	61	47	44	48	49	45	33	25	40
2	0…10	37	41	44	43	58	28	35	50	36	26	26	25	37
3	10…20	30	28	23	22	28	11	23	9	9	13	8	6	18
4	20…30	31	20	23	13	11	9	17	11	7	13	8	8	14
5	30…40	13	16	10	25	13	16	9	13	10	7	11	8	13
6	40…50	26	21	20	23	11	17	10	9	8	9	4	11	14
7	50…60	18	12	13	7	14	20	12	13	8	7	11	10	12
8	60…70	23	26	15	17	8	14	16	5	10	7	11	8	13
9	70…80	24	22	18	12	7	15	5	12	7	11	14	8	13
10	80…90	12	16	19	13	11	22	12	5	11	13	12	9	13
11	90…100	61	59	66	58	45	55	56	56	72	60	56	61	59
Total		294	288	279	281	267	254	239	231	227	211	194	179	245
percent														
1	0	6.46	9.38	10.04	17.08	22.85	18.50	18.41	20.78	21.59	21.33	17.01	13.97	16.45
2	0…10	12.59	14.24	15.77	15.30	21.72	11.02	14.64	21.65	15.86	12.32	13.40	13.97	15.21
3	10…20	10.20	9.72	8.24	7.83	10.49	4.33	9.62	3.90	3.96	6.16	4.12	3.35	6.83
4	20…30	10.54	6.94	8.24	4.63	4.12	3.54	7.11	4.76	3.08	6.16	4.12	4.47	5.64
5	30…40	4.42	5.56	3.58	8.90	4.87	6.30	3.77	5.63	4.41	3.32	5.67	4.47	5.07
6	40…50	8.84	7.29	7.17	8.19	4.12	6.69	4.18	3.90	3.52	4.27	2.06	6.15	5.53
7	50…60	6.12	4.17	4.66	2.49	5.24	7.87	5.02	5.63	3.52	3.32	5.67	5.59	4.94
8	60…70	7.82	9.03	5.38	6.05	3.00	5.51	6.69	2.16	4.41	3.32	5.67	4.47	5.29
9	70…80	8.16	7.64	6.45	4.27	2.62	5.91	2.09	5.19	3.08	5.21	7.22	4.47	5.19
10	80…90	4.08	5.56	6.81	4.63	4.12	8.66	5.02	2.16	4.85	6.16	6.19	5.03	5.27
11	90…100	20.75	20.49	23.66	20.64	16.85	21.65	23.43	24.24	31.72	28.44	28.87	34.08	24.57
Total		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Notes:
$\bar{X}$ – arithmetic mean.

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