Relationships between Investment Support and Production in Latvian Agriculture

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Abstract. The purpose of investment support is to promote investments in the agricultural industry. In 2007-2008, Latvian farmers have received an investment support of almost LVL 126 million for increasing the efficiency and competitiveness of farms. The lack of territorial criteria for granting support in Latvian agriculture is subject to criticism. The research sets forth a hypothesis on attracting investment support in the most active Latvian farms. Relationships between the activity of agricultural production and the attraction of investment support in Latvian regions are identified applying the method of cluster analysis to verify the hypothesis.
Key words: investment support, clusters, activity of agricultural production.

Introduction

The EU Common Agricultural Policy (CAP) shapes a framework for agricultural and rural development measures in the EU member states. Historically, the introduction of investment support was determined by the formation of structural policy within the EU CAP. Initially, physical capital support for farms and related industries was in the centre of attention to increase production efficiency and productivity. Nowadays, investments in human capital, technological modernisation and restructuring of production, reduction of production costs, introduction of new and innovative techniques, and quality in the food chain are emphasised among structural activities.

The purpose of investment support is to promote investments in the agricultural industry to increase the sector's competitiveness. The use of investment support has been analysed by several researchers (Saktiņa D., Meyers W.H., 2005, Vēveris A., Krieviņa A., 2006, Vēveris A., et al., 2007, Špoģis K., Radžele A., 2007, Upīte I., 2009b) who found that it concentrated in the most economically active regions and farms of Latvia. In Latvia, the funding of investment support is distributed across the regions according to their area of agricultural land. Latvian farms being able to prove their economic viability in accordance with the criteria set in the legislation (the Cabinet Regulations No. 1209) can apply for investment support. Saktiņa D. and Meyers W.H. (2006) believe that the lack of rinciples of territorial differentiation in granting support is the main reason for the unequal distribution of funds.

According to D. Saktiņa (2000b) the differentiation of financial support is one of the main goals in regional classification. Various types of regions, with their potential or problems, are classified by special methods of regional grouping, for instance, agriculturally specialised, industrial, or other ones having a special economic feature. Further, based on the specifics of each type of regions, the government may introduce differential distribution (direct or indirect) of funds or measures according to how critical is a problem to be solved and outline the development nature of each region in a development programme of any industry. According to D. Saktiņa's research, different classifications of rural regions are possible, and each type of rural regions differs in the significance level of achievable goals. Different or even similar goals can be defined in a development strategy of any classified region, however, the priorities of support, which promote development, might be arranged in a different sequence and the planned activities can be financed according to a different distribution of funds. D. Saktiņa regard s the following goals as the main ones:

- to increase the competitiveness of rural territories by boosting investments in the economic development;
- to provide a possibility for rural residents to enjoy the quality of life as much as urban residents do it;
- to preserve and develop the natural environment and cultural heritage;
- to retain the density of population and to prevent residents from moving to towns;
- to raise the income of agricultural enterprises;
- to diversify and create employment possibilities in proportion to jobs lost in agriculture as well as to develop the economic environment comprehensively;
- to shape landscapes, and to preserve the natural and traditional cultural life (Saktiņa D., 2000b).

It is important to identify the main reasons for territorial differentiation in attracting investment support in Latvian agriculture by taking into account the large role of investment support in modernising farms and increasing their performance efficiency. Therefore, the following **hypothesis** was set forth in the research - investment support for increasing the efficiency and competitiveness of farms is attracted by intensive Latvian farms.

The research aim is to identify relationships between the indicators of investment support for

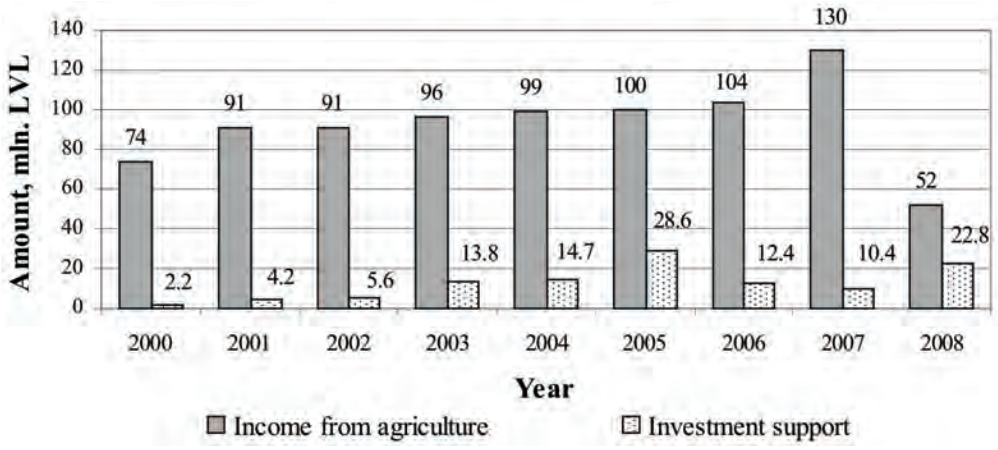
increasing the efficiency and competitiveness of farms (hereinafter – investment support) and those of agricultural production.

The following **research tasks** are set forth in relation to the research aim:

1) to ascertain the role of investment support for increasing the efficiency and competitiveness of farms in Latvian agriculture;
2) to determine the significance of indicators of agricultural production and investment support in characterising the relationships by means of factor analysis;
3) to form clusters for identifying relationships between the indicators of agricultural production and those of investment support in the regions of Latvia through the k-means cluster analysis.

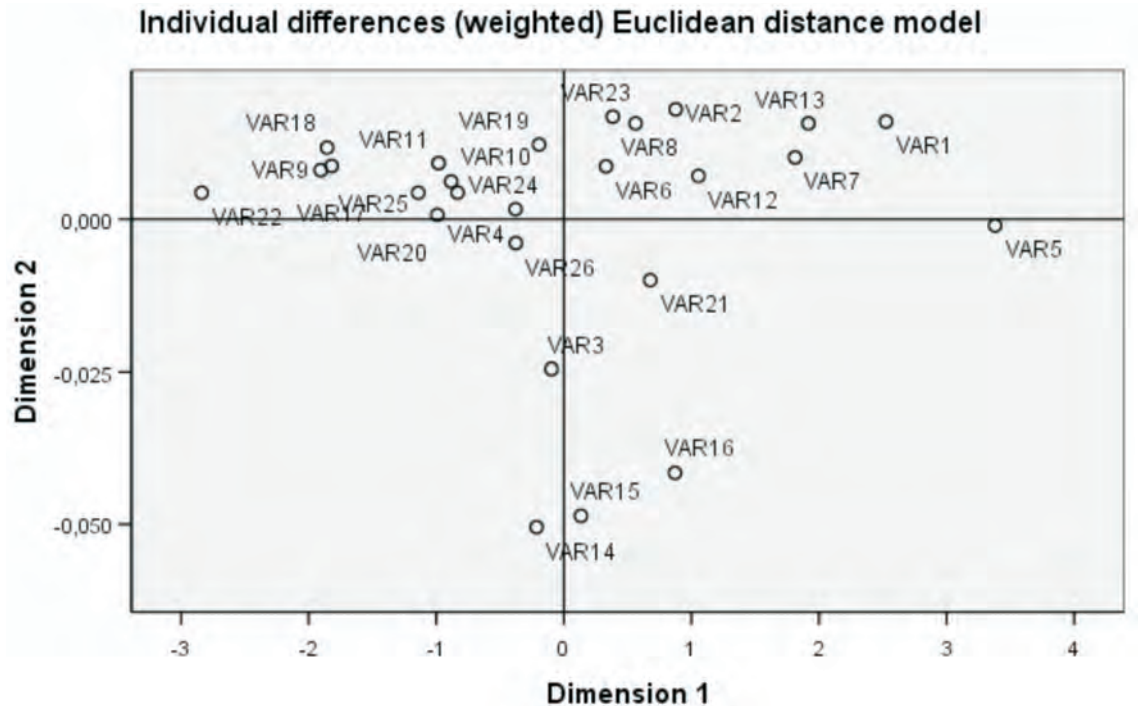
The monographic, inductive and deductive ***methods*** and the ***methods*** of analysis and synthesis were ***applied*** to perform the research tasks.

Cluster analysis was performed to identify the relationships between the intensity of attracting investment support and various indicators of agricultural production. Cluster analysis is a group of research methods, the main and primary purpose



Source: made by the author according to the RSS data

Figure 1. **Farm incomes and the investment support paid for increasing the efficiency and competitiveness of farms in 2000-2008, million LVL**



Source: made by the author according to SPSS package

Figure 2. **Derived configuration of stimuli: a model of Euclidian space**

of which is to categorise the objects and individuals that are researched into subgroups or clusters based on the comparisons of certain parameters. Each object is included only into one cluster. In case of cluster analysis, objects are grouped in a way that objects of one cluster, according to their characteristics, are similar to each other, whereas objects belonging to different clusters are diverse. A positive feature of cluster analysis is the fact that objects are categorised not only by one parameter, but by a group of parameters. Besides, there are no restrictions to objects researched in cluster analysis, which allows studying various random, in practice, data (Rivža B., et al., 1999).

K-means cluster analysis was used in forming clusters where the number of clusters can be defined by the researchers themselves. The task of k-means cluster analysis is to form a k-number of various clusters that have to be different from each other as much as possible. Cluster centres are identified at the first step of algorithm. Objects are divided into clusters according to the following principle: each object is attributed to a cluster, the centre of which has the closest distance to this object. Therefore, all objects are divided into a k-number of clusters. At the next steps, the centres of clusters, which are equal to the average values of coordinates of objects, are calculated again. Objects are regrouped, thus minimising the internal differences of objects and maximising the external differences of objects. New centres of clusters are determined and objects are regrouped until the centres of clusters become stable (Grabusts P., 2006).

Factor analysis was applied to ascertain the significance of the selected indicators in forming clusters. Factor analysis is one of the general methods of statistical analysis, the primary task of which is to define a structure in a data matrix. It is a statistical approach allowing the analysis of interrelations among a lot of variables (indicators) and characterisation of variables in common dimensions (factors). The main goal of it is to transform a large number of original variables (statistical data) into a smaller group of variables, i.e. mixed dimensions or factors, by having a small loss of information (Saktiņa D., 2000b).

Results and discussion

1. The role of investment support in Latvian agriculture

The goals of granting investment support might be various. Upīte I. (2009a) classifies investment support by source of financing, object of financing, and purpose. One of the main types of investment support – support for increasing the efficiency and competitiveness of farms, according to the classification developed by Upīte I., belongs to a group of investment support that is classified by purpose. The large impact of this investment support is proved by the fact that during 2002-2008 in Latvia, 30-40% of all the funds (SAPARD, Structural Funds in 2004-2006, and Rural Development Programme for 2007-2013) allocated for the structural changes in agriculture and fisheries under the support programmes co-financed by the EU were spent on this type of investment support.

Investment support for increasing the efficiency and competitiveness of farms has been granted to Latvian farmers since 1997. In total, Latvian farmers have received more than LVL 126 million for this purpose between 1997 and 2008, of which 65% is the investment support co-financed by the EU. The significance of investment support for increasing the efficiency and competitiveness of farms is proved if compared to the farm income (Figure 1).

The investment support for increasing the efficiency and competitiveness of farms is only one type of support available to farms, and its share in the total agricultural support was only 10.8% in 2000-2008. However, its amount equals to 3% of total income of farms in the year 2000, while in 2008 it reached even 44%. A substantial increase in the share of support in 2008 can be explained by a 60% decrease in the farm income as compared with the year 2007. On average, the amount of investment support in the period of 2000-2008 equals to 15% of farm income, which proves that it has an essential role in increasing the efficiency and competitiveness of farms.

2. Determining the significance of indicators of agricultural production and investment support using factor analysis

Both absolute and relative (per ha of agricultural land in a district) indicators will be used in forming clusters. The absolute indicators characterise the overall situation in a district; whereas the relative indicators, calculated per ha of agricultural land, exclude an impact of quantitative factors and show the objective situation in agricultural production and attracting investment support in a district. Table 1 shows a description of the indicators used in the cluster analysis.

Factor analysis is one of the possibilities to determine the significance of various variables in forming clusters. All the available indicators and the calculations show the possibility to outline four groups of factors explaining 87.5% of the data dispersion (Table 2).

The results of the factor analysis arranged in Table 2 show that the interpretation of these factors is not unambiguous. The groups of factors can be conditionally divided by specialisation in production. The main group characterising 42% of total factorial explanation (87.5%) is related to the grain output, the area of land, and the amount of support received. The second group of factors includes various indicators characterising agriculture, such as the area of agricultural land in districts, the share of agricultural land in total area, and the number of farms. However, the third and the fourth groups characterise the specialisation in producing meat and milk.

The indicators of the first two groups of factors, which explain 62.6% of the data dispersion, can be used for the formation of clusters. The second option is to integrate the most significant parameters from

Table 1

Description of the indicators used in forming clusters

Indicators	Unit of measurement	Description of indicators
Districts	-	Districts according to Latvia's administrative and territorial division till August 2009
Area of agricultural land	ha	Total area of agricultural land in a district, according to the Land Service data of the Republic of Latvia
Share of agricultural land	%	Share of agricultural land in the total area of a district, according to the Land Service data of the Republic of Latvia
Number of farms	units	Number of farms in a district, according to the CSB data
Average area of agricultural land of farms	ha	Average area of agricultural land of farms in a district, according to the CSB data
Market-oriented farms	%	Share of farms selling more than 50% of their produce in the total number of farms in a district, according to the CSB data
Grain produced	thou. t	Quantity of grain produced in a district in the period of 2000-2008, according to the CSB data
Milk produced	thou. t	Quantity of milk produced in a district in the period of 2000-2008, according to the CSB data
Meat produced	thou. t	Quantity of meat produced in a district in the period of 2000-2008, according to the CSB data
EU support received	thou. LVL	Investment support, co-financed by the EU, for increasing the efficiency and competitiveness of farms, which is received in a district in the period of 2000-2008, according to the RSS data on projects
Subsidies received	thou. LVL	National investment support subsidies received in a district in the period of 2000-2008, according to the RSS data
Grain per 1 ha of agricultural land	t ha^{-1}	Quantity of grain produced in a district in the period of 2000-2008, according to the CSB data, calculated per ha of agricultural land of a district
Milk per 1 ha of agricultural land	t ha^{-1}	Quantity of milk produced in a district in the period of 2000-2008, according to the CSB data, calculated per ha of agricultural land of a district
Meat per 1 ha of agricultural land	t ha^{-1}	Quantity of meat produced in a district in the period of 2000-2008, according to the CSB data, calculated per ha of agricultural land of a district
EU support per 1 ha of agricultural land	LVL ha^{-1}	Investment support, co-financed by the EU, received in a district in the period of 2000-2008, calculated per ha of agricultural land of a district
Subsidies per 1 ha of agricultural land	LVL ha^{-1}	National investment support subsidies received in a district in the period of 2000-2008, calculated per ha of agricultural land of a district

Source: estimated by the author according to the data of the CSB and the RSS

all the four groups. In general, the results of factor analysis show that all the selected indicators are sufficiently significant and they can be used in the further analysis.

3. Results of the cluster analysis

The approach of multidimensional scaling can be applied to predict the number of possible clusters (Figure 1). Multidimensional scaling deals with instances mapped in a multidimensional Euclidian space (in this case – two dimensional), thus offering a visual guide in data dimensions, which is based on differences and inequalities of the data.

The districts are marked in "VAR" in Figure 2. Particular clusters do not explicitly emerge, except for instances No. 14, 15, and 16 (Jelgava, Dobele, and Bauska) as well as No. 3 and No. 21 (Saldus and Tukums). One can conclude from such a configuration that the number of clusters obtained from the data is obviously random.

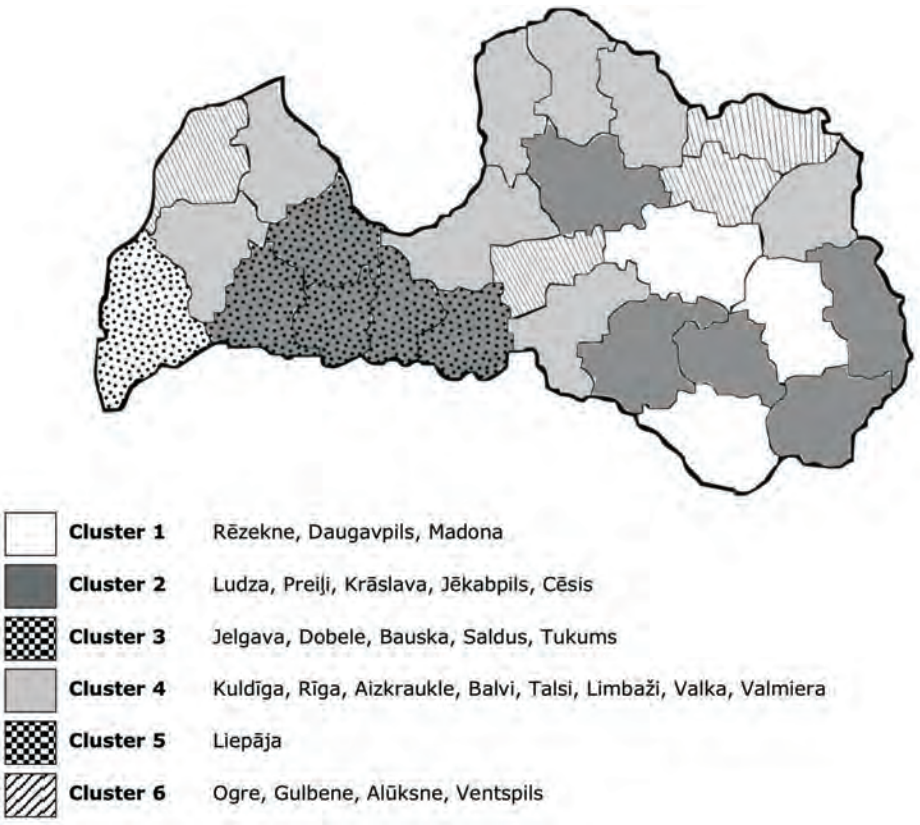
K-means cluster analysis was used in forming clusters where the number of clusters can be defined by the researchers themselves. A model of six clusters was admitted as the most optimal one, the results of which are presented in Table 3.

Table 2

Rotated Component Matrix

Indicators	Factorial burden of components			
	1	2	3	4
Share of factorial explanation, %	42.0	20.6	13.8	11.1
Districts	0.136	-0.680	-0.145	0.281
Area of agricultural land	0.076	0.919	-0.014	0.057
Share of agricultural land	0.601	0.662	-0.169	-0.047
Number of farms	-0.266	0.894	0.109	0.062
Average area of agricultural land of farms	0.719	-0.332	-0.290	0.133
Market-oriented farms	0.630	0.000	-0.137	-0.536
Grain produced	0.972	0.173	0.031	-0.040
Milk produced	0.202	0.566	-0.052	0.756
Meat produced	0.176	0.154	0.954	-0.031
EU support received	0.873	0.091	0.370	0.160
Subsidies received	0.942	0.062	0.188	0.149
Grain per 1 ha of agricultural land	0.980	0.006	0.016	-0.045
Milk per 1 ha of agricultural land	0.154	-0.304	-0.018	0.878
Meat per 1 ha of agricultural land	0.116	-0.018	0.982	0.008
EU support per 1 ha of agricultural land	0.828	-0.235	0.418	0.172
Subsidies per 1 ha of agricultural land	0.875	-0.289	0.195	0.131

Source: made by the author according to SPSS package *(Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in 5 iterations)*



Source: researched and made by the author

Figure 3. **Territorial location of clusters in Latvia**

The districts were rated as follows due to the comparison of indicators of agricultural production and those of investment support:

- *Group 1*: defined as ***very good*** – districts of Cluster 3 (5 districts);
- *Group 2*: defined as ***good*** – districts of Cluster 4 (8 districts);
- *Group 3*: defined as ***average*** – districts of Cluster 6 (4 districts);
- *Group 4*: defined as ***poor*** – districts of Clusters 1 and 2 (8 districts);
- *Group 5*: defined as ***extreme*** – Cluster 5 (1 district).

The best results are observed for the districts of Cluster 3, which is located in Central Latvia and includes the most appropriate agricultural land for grain farming. An extensive specialisation in grain farming is characteristic of these districts, and they have attracted, on average, twice as large support both in absolute figures and if calculated per ha of agricultural land as compared with the other districts.

High values of the indicators of agricultural production and investment support are characteristic of the districts of Cluster 4. The districts of Cluster 4 have no extensive specialisation in production.

The lowest intensity of attracting investment support and the smallest agricultural output per ha of agricultural land is characteristic of the districts of Clusters 1 and 2. If analysed by specialisation, dairy farming dominates in the districts of these clusters. The values of the indicators of agricultural production and investment support per ha of agricultural land are very similar for the districts of both clusters. One can conclude that the districts of various clusters are grouped by differences in formal features (area, and number of farms).

The districts of Cluster 6 in which the smallest absolute amounts of support are attracted and the smallest absolute quantities of agricultural products are produced cannot be evaluated unambiguously.

Table 3

Cluster centres determined by using k-means analysis with six clusters

Indicators	Clusters					
	1	2	3	4	5	6
Districts included in a cluster	Rēzekne Daugavpils Madona	Ludza Preiļi Krāslava Jēkabpils Cēsis	Saldus Jelgava Dobele Bauska Tukums	Kuldīga Rīga Aizkraukle Balvi Talsi Limbaži Valka Valmiera	Liepāja	Ogre Gulbene Alūksne Ventspils
Area of agricultural land	125068	103256	97702	82638	144642	61740
Share of agricultural land	43.9	41.5	51.3	32.2	40.3	30.1
Number of farms	7495	5281	3676	3696	5721	2706
Average area of agricultural land of farms	13.9	15.1	23.9	18.0	19.4	17.7
Market-oriented farms	24	25	28	25	27	25
Grain produced	224.47	170.00	882.89	242.73	510.30	122.46
Milk produced	353.88	287.11	317.75	263.82	383.15	194.84
Meat produced	19.44	24.27	32.72	29.03	42.53	9.61
EU support received	8509.83	7305.73	20518.63	11264.23	16229.13	6195.04
Subsidies received	861.63	750.25	1995.18	985.84	1284.95	682.97
Grain per 1 ha of agricultural land	1.80	1.64	9.12	2.93	3.53	2.04
Milk per 1 ha of agricultural land	2.83	2.80	3.27	3.21	2.65	3.14
Meat per 1 ha of agricultural land	0.16	0.23	0.33	0.36	0.29	0.16
EU support per 1 ha of agricultural land	68	71	210	137	112	101
Subsidies per 1 ha of agricultural land	6.93	7.32	20.64	11.98	8.90	11.35

Source: author's calculations using SPSS package

Table 4

Advisable support measures for agricultural and rural development in the districts of various clusters in Latvia

Cluster	Districts included in a cluster	Advisable support measures for agricultural and rural development
Cluster 3	Saldus, Jelgava, Dobele, Bauska, Tukums	Support measures for developing agricultural production are regarded as priorities
Cluster 4	Kuldīga, Rīga, Aizkraukle, Balvi, Talsi, Limbaži, Valka, Valmiera	
Cluster 6	Ogre, Gulbene, Alūksne, Ventspils	Along with support for agricultural production, significant attention has to be paid to diversifying the rural economy, afforestation, increasing economic activity in a region, thus creating new jobs in other industries
Clusters 1, 2, and 5	Rēzekne, Daugavpils, Madona, Ludza, Preiļi, Krāslava, Jēkabpils, Cēsis, Liepāja	

Source: made by the author

However, the intensities of production and attraction of support are quite high in these districts – the indicators of production and undertaking of support per ha of agricultural land prove it. These districts are located between the districts of the best clusters.

Classifications of Latvia's territory into agricultural districts have been carried out by several researchers (Saktiņa D., 2000b, Boruks A., a.o., 2000, Boruks A., 2004). Based on various formal and economic indicators characterising agricultural production, all the researchers have distinguished the territories as follows: the region of Pierīga, areas favourable for agriculture, average rural areas, and less favourable areas for agriculture. The results of cluster analysis reveal similar trends in attracting investment support. Therefore, the following support measures are advisable to promote agricultural and rural development based on adequate indicators characterising the intensity of agricultural production and that of attracting investment support (Table 4).

The districts of Cluster 3 and 4 include the most appropriate lands for agricultural production. Therefore, it is of great importance to maintain agricultural activity in these territories by such agricultural support measures as investment support, premature retirement, and support for new farmers. According to Saktiņa D. (2000a), the main attention has to be paid to supporting the specialisation and capitalisation of farms in these districts.

Agriculture plays an essential role in the districts of Clusters 1, 2, 5, and 6. However, in these regions, a much larger attention has to be paid to tackling problems of low income farms by appropriate policy measures. Therefore, various compensatory payments, support measures for diversifying the rural economy and for afforestation are of great importance in these territories.

Conclusions and recommendations

1. Investment support plays a significant role in developing Latvian farms. Investment support for increasing the efficiency and competitiveness of farms has accounted for 3-44% of total income of Latvian farms between 2000 and 2008.
2. The grouping of indicators of agricultural production and investment support, using cluster analysis, indicates strong positive relationships between the intensity of agricultural production and the attraction of investment support.
3. The highest values of indicators of agricultural production and investment support are observed in Latvia's central districts specialising in grain farming – Jelgava, Dobele, Bauska, Saldus, and Tukums.
4. It is advisable to outline two main approaches for territorial differentiation in granting investment support based on the results of cluster analysis regarding analogous indicators of agricultural production and investment support:
   - investment support for increasing the efficiency and competitiveness of farms (districts of Clusters 3 and 4);
   - increasing economic activity in other industries (districts of Clusters 1, 2, 5, and 6).

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