



## Cluster Analysis of the Relationship Between Traditional and Innovation Economies

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### ABSTRACT

Under contemporary conditions, programmes for the socio-economic development of Russian regions are increasingly relevant due to the necessity of a coordinating element between the Federal target programmes that operate on the territories of Federal Subjects and the target programmes of the Federal Subject itself. When creating an effective system for managing the development and implementation of regional socio-economic development programmes, it is necessary to proceed according to a unified method that is in conformity with government socio-economic development priorities. Regional economic policy essentially depends on a particular region's innovative potential, which, in turn, predetermines its further socio-economic development. In order to determine specific influence of socio-cultural factors involved in traditional approaches to the economic management of regions where the indigenous peoples are predominantly supported through innovative development, the authors conducted a cluster analysis of the regions of the Russian Federation. The study revealed the relationship between indicators of support for traditional activities and those aimed at supporting innovation activities. The amount of funding for ongoing programmes that support traditional activities affects the birth rate in the corresponding region. It is precisely among indigenous people, who are closely associated with traditional activities, that one of the main values is marriage and children. As might be expected, efforts to support this part of the region's population lead to a reduction in the divorce rate. However, along with this, a certain "inhibition" of economic and innovative development can be detected. Therefore, when designing support for these regions, it is necessary to direct additional efforts to support precisely these problem areas. The studied regions were combined into three clusters. The regions of the first cluster are characterised by the extent to which social and economic development indicators are harmonised. Regions of the second cluster (in which only organisations supporting traditional livelihoods are developed) are characterised by high birth rates and low divorce rates. Regions of the third cluster (regions in which only organisations supporting

innovation are developed) are characterised by positive innovation and economic development indicator values. It is also worth noting that this corresponds to the highest value of the “number of people with higher education” indicator. Along with the positive points, this cluster is also distinguished by negatives: the largest number of divorces per 1000 people and the lowest birth rates. The cluster analysis of traditional and innovative economies allows us to formulate the directions of development of economic systems for the formation of harmonious relations between traditional structures and innovative approaches to conducting economic activity.

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## INTRODUCTION

Staying ahead of the innovation development curve is the most important contributing factor in the achievement of technological breakthroughs – and, consequently, a leading position. According to many economists, the cluster approach is one of the primary tools for implementing the development of an innovation economy. The contemporary cluster concept of organisational structure at the macro-, meso- and micro- levels is a source of technological breakthrough in the digital economy and “Industry 4.0” (Polozhentseva, 2012).

The purpose of the present study is to determine the relationship between traditional and innovative methods of management through cluster analysis of the regions of the Russian Federation.

## 1. FEATURES OF CLUSTER ANALYSIS OF ECONOMIC ACTIVITY

Today, cluster analysis methods are widely used by many leading economists (Rollnik-Sadowska and Dąbrowska, 2018; Tatarczak and Boichuk, 2018). In published scientific research, this cluster analysis approach is exemplified by the following representative sample. K. Xie et al. (2018) analysed the incubation of enterprises of science and technology, the effect of interaction between innovation and entrepreneurship, the synergistic effect between science and technological innovation and systemic innovations based on cluster analysis. It was cluster analysis that allowed E. Roszko-Wojtowicz and J. Bialek (2018) to form an objective statement of the subdivision of EU member states based on their innovative features. The final result of their research comprises a two-dimensional map illustrating the structure of innovation. The cluster analysis additionally allowed the authors to calculate the differentiation in technological development on the spatial map of groups of EU member states from the point of view of innovative development.

The aim of the article by L. Farinha et. al. (2018) is to examine the relationship of innovation and entrepreneurship to economic growth in countries having different levels of development, including in countries where a traditional economy is dominant. Here, the primary methodological tool used was hierarchical cluster analysis. In their article, K. C. Fung et. al. (2018) argue that the present merger of technology and the Great Silk Road does not represent a new phenomenon. At the time of the ancient Great Silk Road, innovations and technologies were only disseminated among traditional economies located along it. Again, is precisely the clustering of advanced development that can be seen to form the basis for innovation and digital technologies. Under contemporary conditions, it is by means of the New Great Silk Road that China can bring about a second process of disseminating innovation to regions with traditional economies. In order to analyse the dissemination of digital innovations in the regions inhabited by indigenous people with traditional economies, the authors constructed a descriptive model based on cluster analysis.

In the article by J. Shang et. al. (2018) it was shown that technological innovation plays a key role in urbanisation. Previous research carried out by the authors had demonstrated how the relationship between technological innovation and traditional economics is concentrated at the points

of urbanisation. At the same time, according to the authors, the relationship between technological innovation and the indigenous peoples of traditional economies at the urbanisation concentration points remains unknown. It is here, in the changes in the patterns of interaction between indigenous peoples working in the traditional economy and innovation in urban development, that the main problem of the further development of the innovation economy arises.

The influence of regional factors on Schumpeterian entrepreneurship is discussed in the article by P. Adler et. al. (2019). Research in the field of Schumpeterian entrepreneurship identifies the launch of new high-growth companies to as key factors in technological innovation and economic growth. While economists have tended to focus on high growth, high-tech firms as a unit of analysis, there has also been interest in economic geography and urban planning, especially the rise of entrepreneurial groups in regions with traditional economies, in which the geographical distribution of entrepreneurship is explored. The results of the research suggest that local diversity and specialisation can simultaneously potentiate innovation. Under such contemporary economic conditions, a multi-scale approach to cluster analysis of entrepreneurship is required.

According to G. Pronestì (2019) the desire to increase the economic performance of regions has led to a recognition of the importance of clustering and the policy of Smart Specialisation of regions as a catalyst of innovation and competitiveness. According to N. Saha, T. Sáha and P. Sáha (2018), the use of cluster analysis as part of a smart regional specialisation strategy forms the cornerstone of processes of developing unique entrepreneurship skills and ensuring innovation centre knowledge management in regions where a traditional economic structure still prevails.

## 2. ON THE INNOVATION MODEL OF THE ECONOMY

Currently, the economies of virtually all regions are transitioning to a new stage of development associated with economic growth and the quality of life of the population. Under these conditions, issues of strategic planning and forecasting the socio-economic development of territories are of particular importance. These arise in connection with the need to find ways to create conditions for increased regional competitiveness and investment attractiveness. In such a situation, it is necessary that regional authorities implement a systematic and scientifically based programme for concentrating resources in more promising areas of socio-economic development across the territories they administer (Bilan et al., 2017; Wierzbycka, 2018).

Z. A. Vasilieva and T. P. Likhachyova (2012) notes the significance of each region having its own innovative policy when making the transition to an innovation-based model of economic development. Such a model includes the innovative potential of the region as well as existing mechanisms for the development of innovation. The regional socio-economic development plan is the primary document that sets out the direction of activities in the medium term (3-5 years) aimed at the development of the economic, social, cultural, innovation potential, infrastructural spheres and other areas, whose state determines the level and quality of life of the population, in accordance with the relevant strategic development goals:

- ensuring the implementation of the Development Strategy of the Russian Federal Subject or municipality in terms of mechanisms and resources;
- ensuring the implementation of the strategic goals of the federal level in the region; for the municipality, implementing the goals of the federal and regional levels in the municipality;
- effective use of the economic potential of the territory.

All major regional development strategies are additionally required to make provision for the following objectives:

- The achievement of an innovative orientation of economic development of the region;

- The creation and maintenance of a favourable living environment;
- An increase in the welfare of the population of the region (Il'ina et. al., 2016).

Under contemporary conditions, programmes for the socio-economic development of Russian regions are increasingly relevant due to the necessity of a coordinating element between the so-called federal target programmes that operate on the territory of federal subjects and the target programmes of the federal subject itself. At the same time, these programmes are multi-purpose, directed at practically all aspects of the economic and social life of the region while considering the main influencing factors and geostrategic directions of its development. For the creation of an effective system for managing the development and implementation of regional socio-economic development programmes, it is necessary to proceed according to a single method that is in conformity with government socio-economic development priorities.

In the transition to programme-targeted methods of government, provision for the preparation and execution of budgets in the “programme” format, as well as the regulation and support of economic development, is carried out within the framework of state programmes. At the present time, regional economies are highly susceptible to changing trends. The process of globalisation tends to transform regions into economic agents. Thus, under the influence of globalisation, regions become subjects of the world economy. In being integrated into the world economy, they are increasingly dominated by a new development strategy based on a globally-oriented regional policy and competition based on the formation, accumulation and use of a particular region's innovative potential. As O. V. Ostimuk (2016) rightly notes, economists should not overlook the important role played by small businesses in the development of the national and regional economy since their development predetermines the competitiveness of the region. For the integrated innovation and economic development of the region, this element should therefore be given close attention.

There is a prevailing opinion that contemporary regions often behave as complex socio-economic systems, entailing increased competition between particular regions. While the elements of this system have a multipurpose developmental focus, at the same time, they also wield various competitive advantages allowing them to stimulate endogenous factors of regional development. This factor can be significantly determinative of economic growth and establishing the conditions for the sustainable regional economic development. Here, one of the most important factors in the competitiveness of a region becomes its innovative economic development. On the other hand, the cultural characteristics of the ethnic groups inhabiting it should not be ignored when discussing regional economic development. As well as comprising possible factors in the development of a particular territory, cultural differences can function as factors of potential conflict. Culture has now ceased to be considered solely as an “expenditure part of the budget”, also playing an important role in increasing a territory's economic potential and thus proving its worth as a contributing factor in the real sector of the economy.

According to Y. Zhao (2010), China's attempts to achieve technological leadership in digital technologies continue to limit traditional economic relations between indigenous peoples in the domestic economy who do not perceive the significance of new digital technologies. The burgeoning of social and societal phenomena affecting people's lives, involving such concepts as multicultural education, tolerance, intercultural communication, the dialogue of cultures, interaction and penetration of cultures, conduces to erase formerly distinct boundaries between different cultures. Thus, cultural competence becomes an increasingly significant factor in dealing with the contemporary globalised world. Under such conditions, the implementation of intercultural communication, involving inter-ethnic and multicultural interaction in the economic sector, acquires a paramount significance (Sulkowski, 2017).

Therefore, in order to implement any economic and innovative changes in a particular region, close attention should be paid to studying the cultural foundations of that region's population. The interaction between various economic subjects of the region is determined by its cultural environment (Farinha et. al., 2018). Innovative development (research) can also affect migration flows in

the region, since influencing the cultural environment of the region (Guiso, Sapienza and Zingales, 2009; Machnacek et al., 2015). Regional economic policy essentially depends on a particular region's innovative potential, which, in turn, predetermines its further socio-economic development. The socio-economic development of a region can be based on three sources:

- factors of production (extensive growth type);
- investments (medium level of development, extensively-intensive type of economic growth);
- innovations (highest level, intensive type of economic growth) (Vertakova and Alpeeva, 2009).

While each region uses these three sources of development simultaneously, nevertheless, as a rule, one of these types is predominant, making it possible to classify regions both by level and by quality of economic growth. Under contemporary development conditions of global competition, the priorities and efforts of the executive should be directed towards innovative development, enhancing innovation in basic knowledge-intensive industries, which are the engine of sustainable and accelerated economic development.

Studying the source of innovation development is a complex problem that requires analysis and synthesis of the already formed innovation potential of the region, which in turn reflects the possibilities of this development. Consequently, the assessment of innovation potential is becoming an increasingly important factor. In order to carry out this assessment, various techniques can be used. On this basis, it is revealed that the effectiveness of the socio-economic policy of the region is assessed by socio-economic development indicators, with the methodologies only differing in terms of the set and grouping of relevant indicators. This prevents the transformative and enabling functions of the factors for its implementation from being considered.

Various institutions exist at the regional level, which support innovation and economic development, as well as social and traditional activities. Here the concept of "institution" may be very different from that applying to the representatives of various fields of scientific knowledge "economists, lawyers, historians and others". Such diversity arises due to the complexity of the "object" itself. In terms of Russian economists, the majority of authors are united and inspired by the definition of an institution according to D. North, who interprets the concept of "institution" in terms of "*rules of conduct*" and "*rules of the game*" (Tyugashev, 2010). In this case, the concept of a support institution should be understood in terms of a formal functional tool for supporting, introducing and creating economic and social benefits associated with innovative and economic development, as well as supporting traditional activities and improving the social conditions of the inhabitants' lives.

### **3. RESEARCH PROCEDURES**

In order to compile a cluster analysis, data on the programmes being implemented were taken from the official websites of the regional governments. These include the following:

- institutions for supporting innovative development;
- institutions for supporting traditional activities;
- business support institutions;
- institutions for supporting the development of industry;

To determine the effectiveness of the impact of the provided support programs, various regional development indicators were drawn upon:

- number of women per 1000 men;
- number of births per 1000 people;
- number of divorces per 1000 marriages;
- number of people having higher education qualifications;

- index of scientific and technical potential;

Data were analysed from 10 regions of Russia. For comparison, regions were selected having different proportions of the titular population. These regions included the Republic of Mari El, Sakha (Yakutia), North Ossetia – Alania, Karachay-Cherkessia, Kabardino-Balkaria. The following oblasts were also subjected to analysis: Vladimir, Sverdlovsk, Lipetsk, Samara, Yaroslavl. Based on the results of previous studies, the following hypotheses were proposed:

H1: Institutions supporting traditional activities impede the development of innovation and economic development institutions;

H2: Institutions supporting traditional activities have a positive impact on the social development indicators of the region;

These hypotheses received the most empirical confirmation and have stable correlation dependencies. In order to determine the effectiveness of the existing support institutions, a correlation analysis was conducted between the number of programmes implemented and indicators of the social and economic development of the region.

The main task of the correlation analysis is to identify the relationship between random variables by means of point and interval estimates of pairwise (partial) correlation coefficients, as well as the calculation and verification of the significance of multiple coefficients of correlation and determination. In addition, the following tasks are solved using the correlation analysis: selection of factors that have the most significant impact on the resultant feature, based on measuring the degree of connection between them; detection of previously unknown causal relationships. The applied procedure is a generally accepted means of investigating the interrelationship of various factors.

Data on social indicators were taken from the official site of the Federal State Statistics Service (<http://www.gks.ru>).

## 4. RESULTS OF THE STUDY

Table 1 presents the correlation relationships between the indicators of socio-economic development of the studied regions.

**Table 1.** Correlation matrix of the volume of financing institutions of traditional activities and indicators of socio-economic development

	<i>Amount of financing (thousand rubles)</i>	<i>number of women per 1000 men</i>	<i>number of births per 1000 people</i>	<i>index of scientific and technical potential</i>	<i>number of divorces per 1000 marriages</i>	<i>number of people with higher education qualifications</i>
Amount of financing (thousand rubles)	1.00					
number of women per 1000 men	-0.20	1.00				
number of births per 1000 people	0.68	-0.68	1.00			

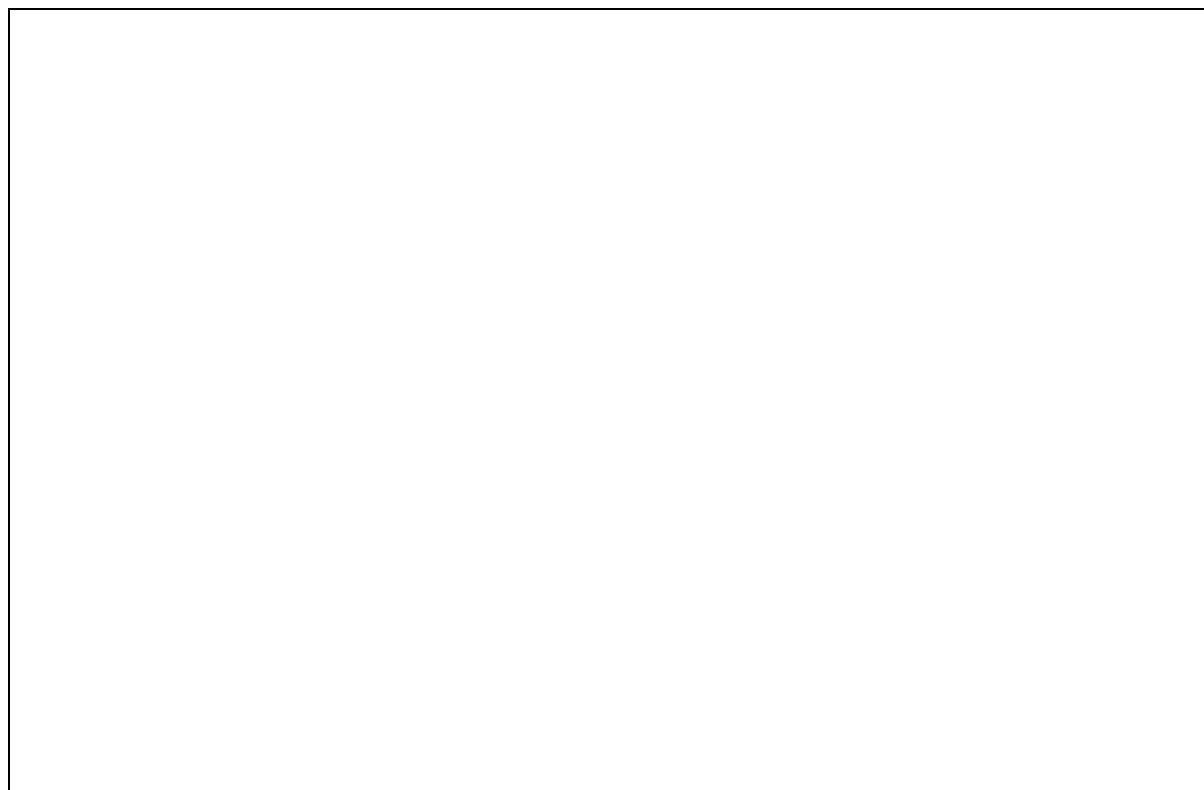
index of scientific and technical potential	-0.39	0.49	-0.42	1.00		
number of divorces per 1000 marriages	-0.91	0.00	-0.63	0.39	1.00	
number of people with higher education qualifications	0.26	-0.15	0.31	-0.27	-0.48	1.00

The “amount of funding” indicator of development of traditional activities correlates with the “number of births per 1000 people” indicator of social development (value 0.68) and back-correlates with the indicator “Number of divorces per 1000 marriages” (-0.91). This suggests a causal relationship between the two.

According to the presented data, it can be concluded that the majority of regions that implement innovative development programmes prefer not to implement programmes supporting traditional livelihoods.

Figure 1 shows the clusters of the selected regions in which innovative development institutions and / or institutions that mainly support traditional activities are developed.

**Figure 1.** Clustering of regions



## 5. RESULTS AND DISCUSSION

Based on the data provided, the following groups of regions can be distinguished:

- Regions developing institutions supporting traditional livelihoods and innovation (Cluster 1);
- Regions developing only organisations supporting traditional livelihoods (Cluster 2);
- Regions developing only organisations supporting innovation (Cluster 3);

Table 2 presents the primary data on programmes implemented in the regions to support traditional activities.

**Table 2.** Amount of financing and names of institutions supporting traditional activities

Region	Amount of financing (thousand rubles)	Peri-od	Name of Programme	Cluster
Vladimir Oblast	-	-	-	0
Republic of North Ossetia – Alania	425 564.40	5 years	“Other activities in the field of culture”	1
Republic of Sakha (Yakutia)	12 790.00	5 years	Development of folk arts and crafts of the peoples of Yakutia	1
Yaroslavl Oblast	-	-	-	1
Samara Oblast	34 021.40	6 years	Development of culture in the Samara region	1
Republic of Kabardino-Balkaria	950 372.40	7 years	Subprogram “Heritage”	2
Republic of Karachay-Cherkessia	298 945.40	6 years	Development of culture of Karachay-Cherkessia	2
Republic of Kalmykia	47 978.70	7 years	Strengthening the unity of the Russian nation and the ethnocultural development of the peoples of the Republic of Kalmykia for 2013-2020”	2
Sverdlovsk Oblast	-	-	-	3
Lipetsk Oblast	-	-	-	3

The data in Table 2 demonstrate that in regions with an indigenous population of more than 70% – these are regions such as the Republic of Kalmykia, the Karachay-Cherkessia Republic, the Republic of Sakha (Yakutia) and others – financial support is provided for traditional activities, while in those regions where the indigenous population does not make up the majority, such support is absent. However, in the latter regions, innovation is actively supported.

Cluster 1 regions are characterised by the extent to which social and economic development indicators are harmonised.

Cluster 2 regions are characterised by high birth rates and low divorce rates. However, at the same time, there is a noticeable lag in innovation and economic development.

Cluster 3 regions are characterised by positive innovation and economic development indicator values. Also noteworthy is the highest value of the “number of people with higher education” indicator. Along with the positive points, this cluster is also distinguished by negatives: the largest number of divorces per 1000 people and the lowest birth rates.

In general, the most positive state of socio-economic development is observed in the Cluster 1 regions. Regions ranked by Clusters 2 and 3 are susceptible to socio-economic threats. In order to counter these threats, it is possible to use an algorithm for assessing the socio-economic development of a region.

Assessment Algorithm Development of the region to counter socio-economic threats should include the following stages:

- Assessment of the level of regional socio-economic threats;
- Assessing the region and determining the optimal development cluster;
- Reallocation of funding institutions for eliminating socio-economic threats.

## CONCLUSIONS

In support of the aim to determine relations between traditional and innovative economic management methods through cluster analysis of the regions of the Russian Federation, the following theoretical and practical results were obtained.

The study revealed the relationship between indicators of support for traditional activities and indicators of support for innovative activities. The amount of funding for ongoing programmes that support traditional activities affects the birth rate in the corresponding region. It is precisely among populations closely associated with traditional activities that one of the primary values is marriage and children. Efforts to support this part of the region’s population leads to a reduction in the divorce rate. However, along with this, a certain “inhibition” of economic and innovative development can be detected. Therefore, when designing support for these regions, it is desirable to direct additional efforts to support precisely these problem areas.

The studied regions were combined into three clusters.

The regions of the first cluster are characterised by the extent to which social and economic development indicators are harmonised.

Regions of the second cluster (in which only organisations supporting traditional livelihoods are developed) are characterised by high birth rates and low divorce rates.

Regions of the third cluster (regions in which only organisations supporting innovation are developed) are characterised by positive innovation and economic development indicator values. It is also worth noting here the highest value of the “number of people with higher education” indicator. Along with the positive points, this cluster is also distinguished by negatives: the largest number of divorces per 1000 people and the lowest birth rates.

The cluster analysis of traditional and innovative economies allows us to formulate the directions of development of economic systems for the formation of harmonious relations between traditional structures and innovative approaches to conducting economic activity.

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