# The Importance of the Cluster Interaction for Increasing the Availability to the Creative Products and Services

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**Abstract:** The work is supposed to discuss the importance of the cluster interaction for increasing the availability the creative products and services in Georgia, which could have a comprehensive purpose for activating academic circles, corporations and state institutions, because the manufacturing of the creative products and services is a joint effort of these entities. The goal of the research is to reveal the statistically significant relationship between the creative idea implementation and sufficient industrial performance, because the role of the cluster interaction is to make the work environment creative and innovative. In the research process, the statistically significant relationship between the cluster creative activation and the complexity of the human resource management has been presented by the Structural Equation Modeling (SEM), which has been obtained the research data set from 2014 to 2024. To reveal the statistical significance relationships, the parametric ANOVA method had been used, which emphasizes the statistical significance importance of the variation analysis. The findings of the research, which are relevant for academic circles, corporations and state institutions of Georgia, could be relevant also for the same entities in European countries, because the human resource management is crucial for establishing successful and profitable business, also, for high qualified academic personal, who are able to create business innovations and strong state institutions, which are involved in the business activities and need effective solutions for human resource management.

**Key Words:** Cluster, Human Resource, R&D expenditure, Creative Business.

## Introduction

The government of Georgia is relying on the experience of the Scandinavian and Baltic countries, which involves the creative activation of the industries and scientific – research centers through the financing of the R&D expenditures from the budgets of the ministries or self-government bodies (Dervojeda, Nagtegaal, Lengton, & Datta, 2013). In 2014 the ministry of economy and sustainable development of Georgia, begun the same program as "Enterprise Sweden" and "Enterprise Estonia", which has been called "Enterprise Georgia". The program aims to support creative business ideas in the SME sector, which should be reflected in the industry 4.0 formation (Suleiman, Shaikholla, Dikhanbayeva, Shehab, & Turkyilmaz, 2022).

Since 2014, more than 500 creative business ideas had been implemented in the several sectors of the economy (including industrial, agricultural, hotel and real estate sectors). The mentioned creative ideas had been enhanced more than 19 thousand new jobs in totally. Therefore, in this condition, the study is focused on the manufacturing creative products and services, which are based on the creative business ideas and were funded from the state budget and now are supposed to develop creative entrepreneurial activities.

The subject of the study is how much the cluster creative activations impacts on the increasing the availability to the creative products and services, when SME sector is interacting with state institutions and scientific – research centers (Delgado, Porter, & Stern, 2010). The work enhances discussion about the possibilities of the creative business ideas through the cluster interaction and serves to find the ways to strengthen the availability to the creative products and services. Therefore, the research assumed the well – known literature about the cluster interaction. In addition, to study the importance of the cluster interaction, the structural equation model had been used and the appropriate methodology was developed.

According to the methodology, the research samples was selected and the equational variables were determined through the observation on the selected samples, also, the research data set was

formed to obtain the relevant results. The data set was tested for normality, because the normally distributed data is crucial for model accuracy. The flexibility of this model defines its actuality in the management and corporation strategies.

## 1. Literature Review

### 1. Diversification and Specialization

The clusters are providing unique opportunities for creative entrepreneurial activity and are increasing the innovative capabilities of SME, which is conditioned by the process of continuous dissemination of knowledge from scientific – research centers (Delgado, Porter, & Stern, 2012; Delgado, Porter, & Stern, 2010; Sölvel, Lindqvist, & Ketels, 2003; Dervojeda, Nagtegaal, Lengton, & Datta, 2013). The clusters ensuring diversified production by the spreading of the knowledge and innovation technology into the enterprises, which ensures the dynamic actions of the convergence effect (Delgado, Porter, & Stern, 2012; Sölvel, 2008; Sölvel, 2009).

The convergence effect is provided by the geographical concentration of the clusters, which is reflected in the reduction of the production costs (Delgado, Porter, & Stern, 2012; Sölvel, 2008; Sölvel, 2009), which makes possible to increase the variety of the products and services and diversify the specialization directions (Dervojeda, Nagtegaal, Lengton, & Datta, 2013). In additions, clusters are main strategic areas for industry 4.0 and green transformation (Mackiewicz & Kuberska , 2024; Sölvel, Lindqvist, & Ketels, 2003).

The works of the recent authors, emphasize the fourth industrial revolutions, which will be leading by state institutions and scientific – research centers (Mackiewicz & Kuberska , 2024; Tsakalerou & Akhmadi , 2021; Suleiman, Shaikholla, Dikhanbayeva, Shehab, & Turkyilmaz, 2022). This is the cyber revolution and state institutions have their specific role to manage innovations that scientific and research centers will create in the SME sector.

The evolutionary findings of the cluster theory, are especially well recognized by the publications of the Stockholm School of Economics, which was leading European Cluster Mapping Project around the EU member countries. Today European Cluster Mapping Project is called European Cluster Observatory, which provides the information about all of the innovative initiatives, which were implemented in EU member countries and in addition, in Norway, Israel and Turkey, those are not EU member countries.

The reports of the European Cluster Observatory describe the specialization directions and development areas of the regional clusters. For example, the regional clusters of the Scandinavian and Baltic countries are specialized in the innovative sectors of the economics, among them are: ICT, food technology, bio – science, artificial intelligence, micro and Nano – technologies, electronics, transportation, energy and maritime (Altonen, 2007; Burger, 2015; Jürgenson, 2007; Klasová, 2015; Korobaničová, 2015; Kristinsson, 2007; Vangas, 2007).

It is no coincidence that reports from all international organizations point to unprecedented human resource development indicators in the Scandinavian and Baltic countries, which is also reflected in the availability of the creative products and services, which defines high quality of the life in these countries (Herre & Arriagada, 2023). The high qualified employees and the knowledge – based specialization ensures manufacturing of the affordable high-quality and diverse products and services (Krause, 2016; Špička, Smutka, & Selby, 2017; Foray & Lundvall, 1998), including free medical service, food, chemicals, electronics, transports and etc.

## 2. Increasing the Availability of the Creative Products and Services

According to the most widely accepted definition, all new products and services are considered creative, that enter into the market and become widely available to the consumers as a result of the emergence of the new technologies or the improvement of the old ones (Laureti, Costantiello, Leogrande, & Leogrande, 2022). For every country that pretends to advance in terms of

innovation criteria, it is important to create a branded mark for creative products and services that simplifies identification (Laureti, Costantiello, Leogrande, & Leogrande, 2022).

The diversity of the creative products and services determines the successful activity of the clusters. The greater the number of new products and services and the more widely available they are, the more successful the clusters are (Laureti, Costantiello, Leogrande, & Leogrande, 2022). In this conditions, the neoclassical model of the economic growth, which had been developed in 1956 by Solow – Swan becomes relevant (Guerrini, 2006).

The adaptation of Solow – Swan economic growth model (where the population growth is considered as a negative condition, capital accumulation is considered positive and technological progress is also considered positive (Guerrini, 2006)) to the cluster interaction phenomenon, makes possible to establish the new model for manufacturing creative products and services. This model will have the following structural equation shape.

$$\gamma_{t;t-k} = \alpha + \beta_1 \gamma_{t-k} + \beta_2 inv_{t;t-k} + \beta_3 \Delta pop_{t;t-k} + \varepsilon$$

Where, $\gamma_{t;t-k}$ is GDP per capita, $inv_{t;t-k}$ is the average growth rate of the investment and $\Delta pop_{t;t-k}$ is average growth rate of the population, $\varepsilon \sim N(\mu; \sigma^2)$ is the standard deviation from the regression curve.

In case of the cluster interaction, the number of the highly qualified employees is increasing. Under such conditions, population growth could no longer be considered as a negative factor in the model and could be ignored. However, investments can be replaced by R&D expenditures. As a result, it could be obtained the model that could be depicted by the following equation.

$$\varphi_{t;t-k} = \rho + \delta_1 \varphi_{t-k} + \delta_2 RD\,exp._{t;t-k} + \delta_3 \Delta empl._{t;t-k} + \omega$$

Where, $\varphi_{t;t-k}$ is the creative products and services volume per capita, $RD\,exp._{t;t-k}$ is the average growth rate of the R&D expenditure and $\Delta empl._{t;t-k}$ is average growth rate of the highly qualified employees, $\omega \sim N(\mu;\sigma^2)$ is the standard deviation from the regression curve.

Therefore, it can be concluded that the growth of the creative products and services volume per capita depends on the development of the human resources, also, on the increasing of the R&D expenditure and on the strengthening of the interaction between the state institutions, industries and scientific research centers.

## 2. Research Methodology and Hypothesis

The subject of the study is how much the cluster creative activations impacts on the increasing the availability to the creative products and services, when SME sector is interacting with state institutions and scientific – research centers, in this case, the indicators that should be recognized in the structural equation modeling process are the creative products and services volume per capita, the growth rate of the R&D expenditure and the growth rate of the highly qualified employees number, which are structural parameters for statistical relationship. This relationship could be reflected in the following empirical hypothesis.

***Hypothesis 1:*** *There is positive relationship between the cluster interaction and the growth of the creative products and services volume per capita.*

To confirm the hypothesis, it is necessary to conduct the variance analysis, for which the parametric ANOVA test should be used. The ANOVA test, according to its capability to divide

total variance into between – group components and within – group components, provide to estimate that the increasing of the creative products and services volume per capita is conditioned by the growth of the R&D expenditure and the number of the highly qualified employees and these structural parameters define the character of the cluster interaction.

The ANOVA procedure compares the variance of the between groups to the variance of the within groups. If the variance of the between groups is greater than the variance of the within groups, this means that there is positive relationship between the cluster interaction and the growth of the creative products and services volume per capita. The ANOVA test requires that the data should be normally distributed. Therefore, it is necessary to test the null hypothesis about the equality of the mean values of the samples to the mean value of the population.

***Hypothesis $_0$:*** *The mean values of the selected samples are not equal to the mean values of the whole population.*

The normal distribution implies that the variances of the selected observable samples is equal to variance of the whole population. The normal distribution shows that in a bell-shaped probability distribution, most of the data is concentrated in the center of the distribution and decreases away from the center. The normal distribution is one of the most commonly used models of the real world. The following equation is used to test the null hypothesis:

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma 2}}$$

where, $\mu$ is the expected value of the mean and $\sigma^2$ is the variation. For the large number of the samples (n>30), it is necessary to consider a distribution where $\mu = 0$ and $\sigma^2 = 1$, for which the data should be standardized according to the following equation:

$$Z = \frac{X - \mu}{\sigma} \sim N(0; 1)$$

The positive z-score indicates that the mean value of the sample is above the mean value of the population. The negative z-score indicates that the mean value of the sample is below the mean value of the population and the z-score close to zero indicates that the mean value of the sample is close to the mean value of the population and the null hypothesis must be rejected.

## 3. Data Collection

The empirical data about the R&D expenditure, the number of the high qualified employees and creative products and services output volume are collected directly from the 37 SME (n = 37), those are clustered through all regions of Georgia. SME clusters are specialized in food, agriculture, ICT, textile, construction and transportation service sectors. According to the population number of Georgia had been calculated the creative products and services volume per capita. The empirical data belongs from 2014 to 2024 period.

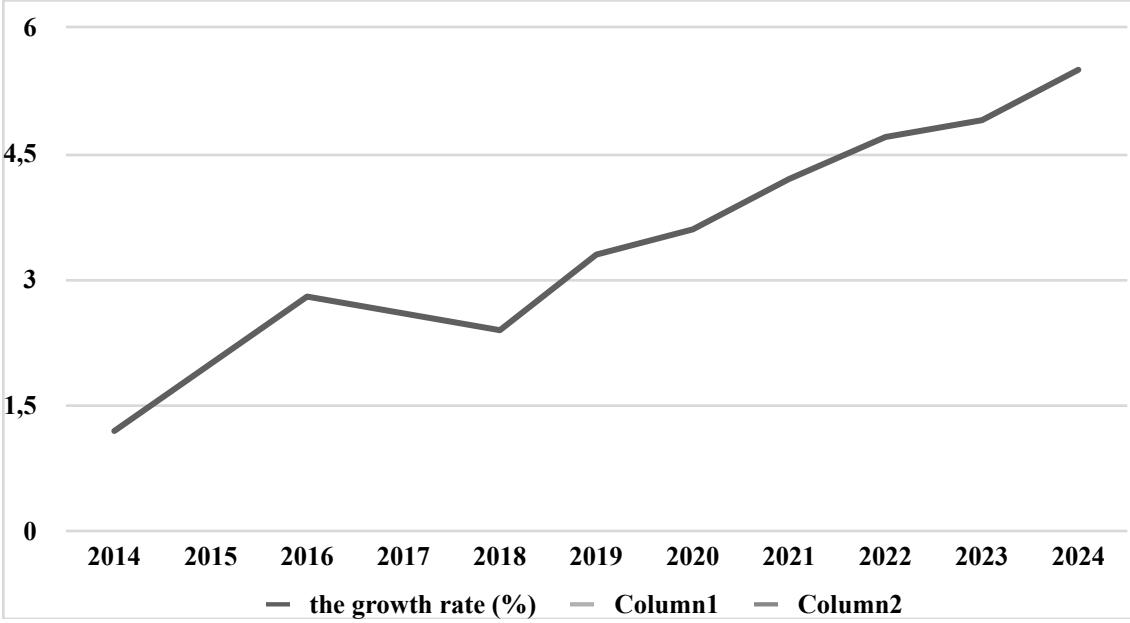
As the results of the study had been shown, it was more relevant to collect the data from the SME, because the size of the samples defines the accuracy of the model, also, it is more appropriate to consider that the structural equation modeling did not contained the statistically important sampling errors in case of the small size samples.

## 4. Data Analysis

After obtaining the data required for the varivariation analysis, it became necessary to organize the data in order to identify statistical relationships between the variables. At first, data analysis

begun from the calculation of the highly qualified employees number growth rate, after that, it had been calculated the growth rate of the R&D expenditure according to the certain period of time. Figure 1. presents the results of the aforementioned data analysis.

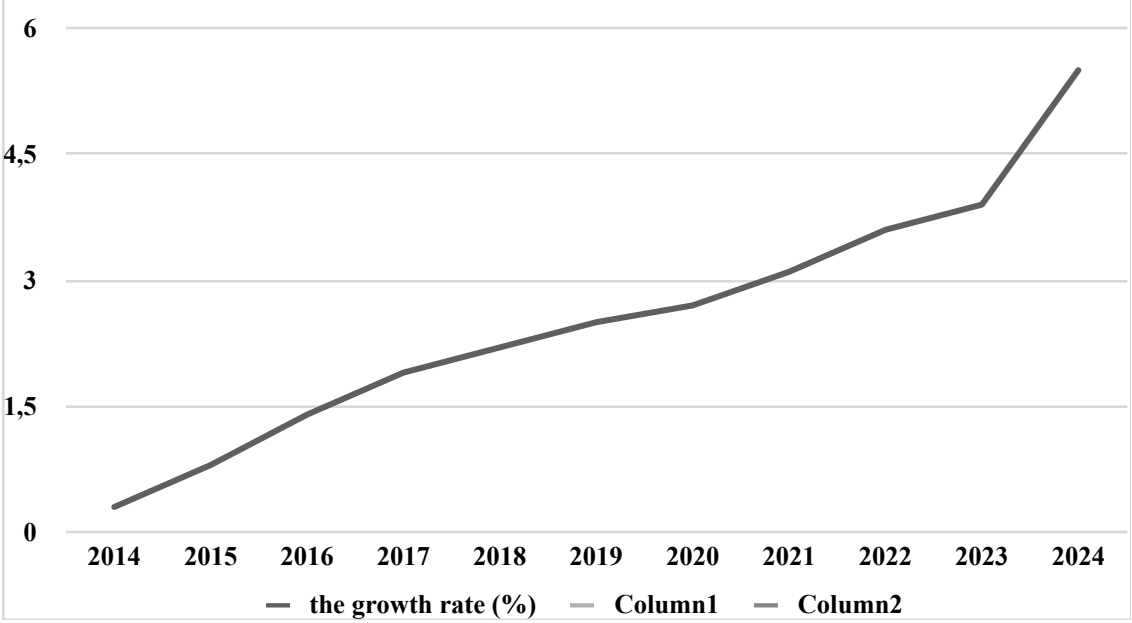
**Figure 1. The dynamics of the highly qualified employees number growth rate**




Source: Author's own elaboration

The diagram shows that in 2024 the number of the highly qualified employees has been increased almost to 6 %, that means the positive trend in terms of the cluster interaction. However, if this statement to be confirmed, the growth rate of the R&D expenditure must also be expressed with the increasing trend.

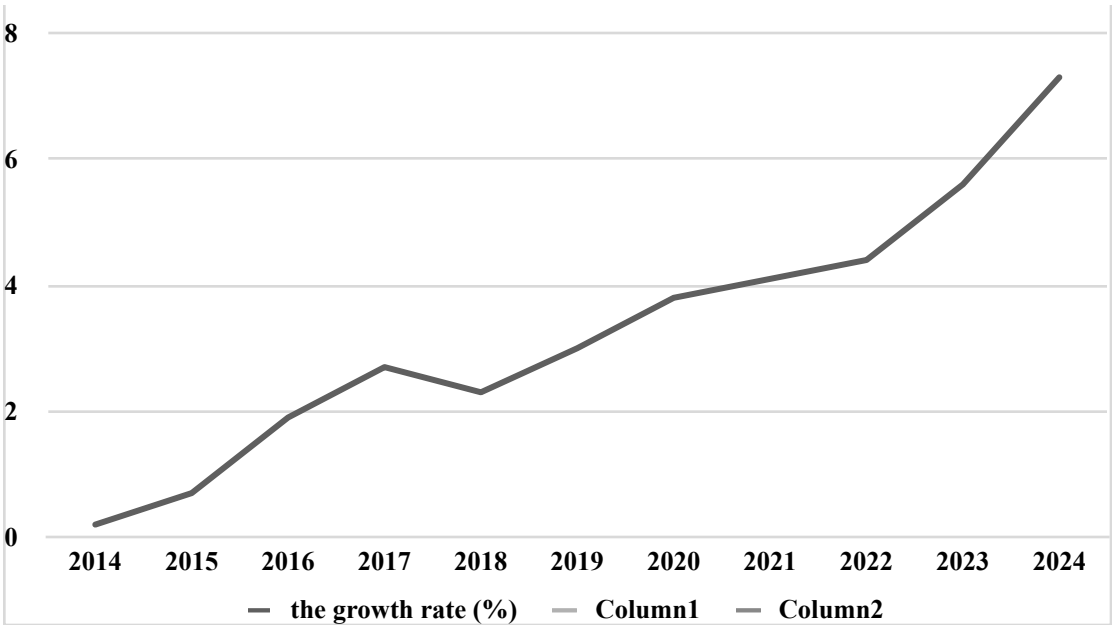
**Figure 2. The dynamics of the R&D expenditure volume**




Source: Author's own elaboration

The diagram shows that in 2024 the volume of the R&D expenditure has been increased almost to 5 %, that means that in parallel with the increase in the volume of the R&D expenditure, there was an increase in the number of the highly qualified employees. The mentioned positive trend must be reflected in the creative industrial performance, which means increasing in the creative products and services volume per capita. Figure 3. shows the growth rate trend of the creative products and services volume per capita.

**Figure 3. The dynamics of the creative products and services volume per capita**




Source: Author's own elaboration

The diagram shows that in 2024 the creative products and services volume per capita has been increased more than 7 %, which means that cluster interaction reflects the positive statistical relationship with the growth of the creative products and services volume per capita. However, in order to finally prove the ***Hypothesis*$_1$**, the variation analysis is required using of the parametric ANOVA test. To perform the ANOVA test, the data must be normally distributed.

## 5. Research Results and Discussions

To reject the ***Hypothesis*$_0$** that the mean values of the selected samples are not equal to the mean values of the whole population, the standardized equation of the normal distribution should be used, since the number of samples is 37. The z – score is calculated separately for all of the mentioned variables and the results are presented in the Table 1.

**Table 1. The normality test results**

| *Parameters* | *high qualified employees (growth rate)* | *The volume of the R&D expenditure (growth rate)* | *the creative products and services volume per capita (growth rate)* |
|---|---|---|---|
| *Test statistics* | **0,957** | **0.989** | **0,980** |
| *Indicator of deviation from normality* | **0.889** | **0.678** | **0,747** |
| *z score* | **0.098** | **0.068** | **0,053** |
| *Prob > z* | **0.068** | **0.123** | **0, 145** |

Source: Author's own elaboration

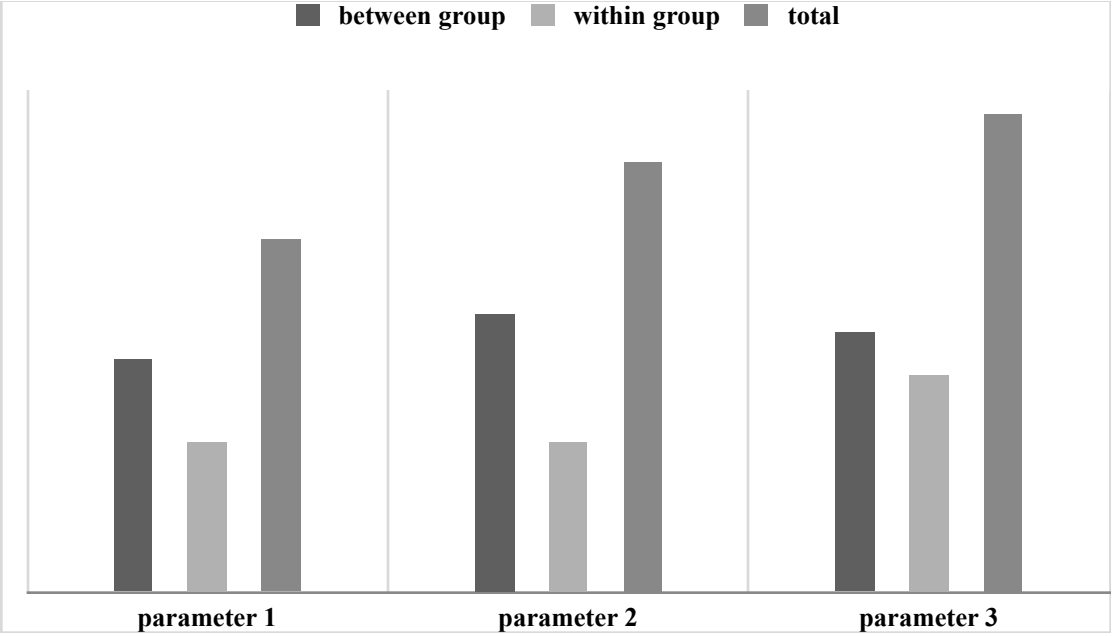
The test statistics belongs to the meaning from 0 to 1. The closer this meaning is to 1, the more the distribution becomes normal. In this case, the test statistics of the three parameters are close to 1, that means the data does not deviate significantly from a normal distribution. The indicator of deviation from normality calculates how much the empirical data deviates from normal distribution. In this case, the indicator of deviation is small for all of three parameters, that confirms the data does not deviate significantly from a normal distribution again.

The z – score determines how many standard deviations are below or above from the mean value. The small z – scores describe the proximity of the mean values of the selected samples to the mean values of the whole population. In this case, the z – scores are close to zero for all of three parameters, which indicates that the mean value of the samples is close to the mean value of the population and the null hypothesis must be rejected.

Another reason to reject the null hypothesis is the p – value, which is the probability that the research data would hold if the null hypothesis is true. The small p – value provides strong evidence to reject the null hypothesis. In this case, the p – values are close to zero for all of three parameters, which means that the null hypothesis must be rejected and the alternative hypothesis must be accepted, which determines that the data is normally distributed.

According to the results of the normality test it is possible to perform parametric ANOVA test and compare the variance of the between groups to the variance of the within groups. If the variance of the between groups is greater than the variance of the within groups, this means that there is positive relationship between the cluster interaction and the growth of the creative products and services volume per capita. Figure 4. presents the results of the parametric ANOVA.

**Figure 4. The results of the parametric ANOVA.**




Source: Author's own elaboration

According to the parametric ANOVA results, the value of the between group variations are higher than the values of the within group variations for all of three parameters, which indicates that ***Hypothesis*** $_1$ is true and there is positive relationship between the cluster interaction and the growth of the creative products and services volume per capita.

The results of the study enhance the discussions about the importance of the cluster interaction for changing the human resource management process in Georgia. The findings of the research could be relevant also for Central European countries, because the study emphasize the positive

relationship between the cluster interaction and the growth of the creative products and services volume per capita in the certain period of time.

When the number of the highly qualified employees and the volume of the R&D expenditure have positive growth trends, that are reflected in the sufficient industrial performance of the SME clusters and the output volume of the creative products and services is growing with higher rate then the population of the country. Finally, it means that the quality of the life begins to improve for all of the social group in the country and the population irreversibly has increased availability to the creative products and services.

**Limitation and Conclusion**

The research is related to one of the most pressing problems of modern times, which is gaining the crucial importance for all countries in the context of industry 4.0. Thus, the research emphasizes the importance of the cluster interaction for changing the point of view of the human resource management process, in which state institutions and scientific – research centers must be involved and in addition, it is focused on the ability to enhance sufficient industrial performance, which provides increasing the availability to the creative products and services.

As the results of the study shows, there is positive relationship between cluster interaction and the growth of the creative products and services volume per capita, which means that the importance of the cluster interaction for increasing the availability the creative products and services could have been the emerge finding for academic circles, corporations and state institutions, because they are able to lead the business processes that meet modern requirements. Therefore, they could be able to implement the new adaptation of Solow – Swan economic growth model (Guerrini, 2006) to the cluster interaction.

This structural equation model shows, that the growth of the creative products and services volume per capita is positively depended on the development of the human resources (highly

qualified employees), also, on the increasing of the R&D expenditure. To study the statistical significance relationship, the massive direct survey was conducted in 37 SME, which are clustered through all regions of Georgia. The small size samples had been chosen for accuracy of the variation analysis, which were applied by the parametric ANOVA test.

To emphasize the importance of the statistically significant relationship between cluster interaction and the sufficient industrial performance, three parameters had been studied according to dynamics of the growth rates from 2014 to 2024. First parameter was the number of the highly qualified employees, second parameter was the volume of the R&D expenditure and third parameter was the output volume of the creative products and services per capita.

These parameters are supposed to describe the phenomenon of the cluster interaction, which enhance the convergence effect through the cluster structural entities. The parametric ANOVA results, had been shown the statistically significant relationships between these parameters, which confirms that there is positive relationship between the cluster interaction and the growth of the creative products and services volume per capita.

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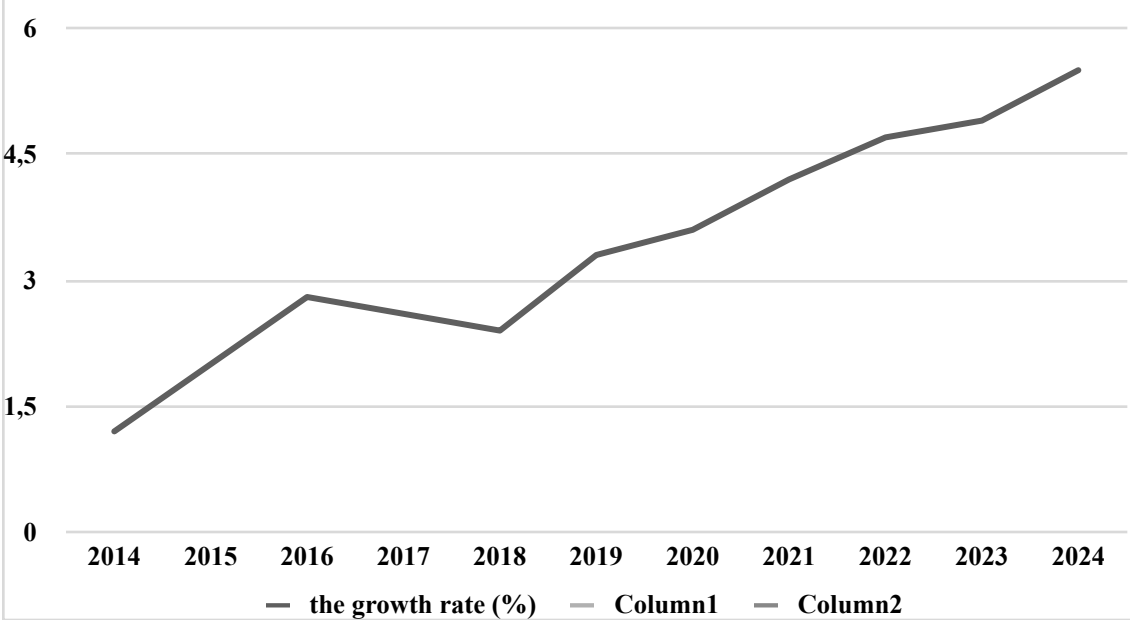
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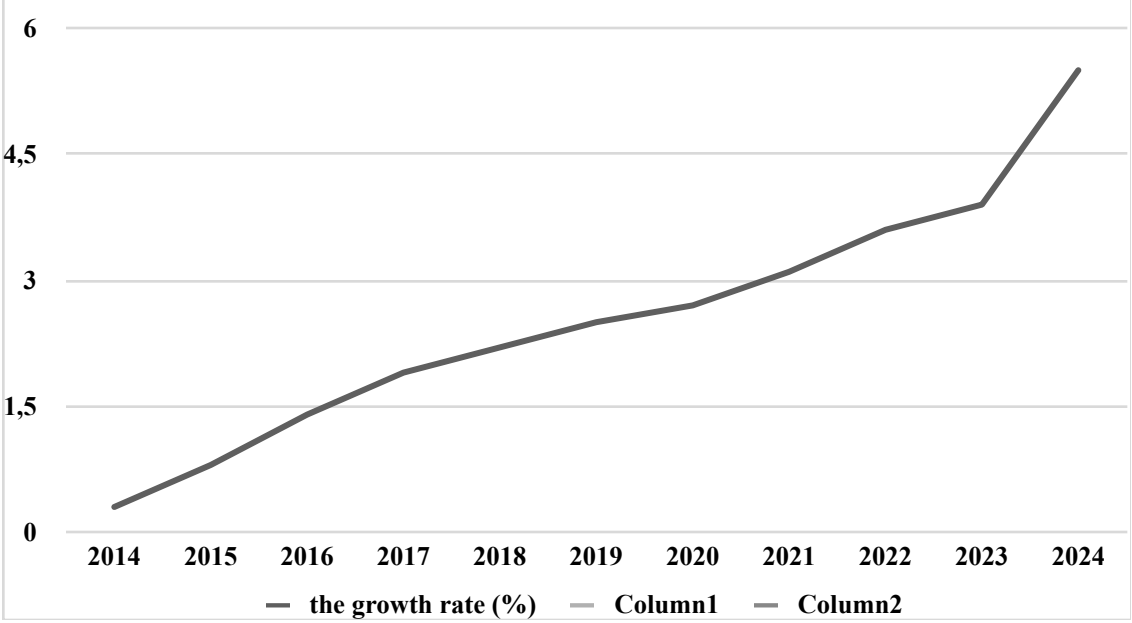
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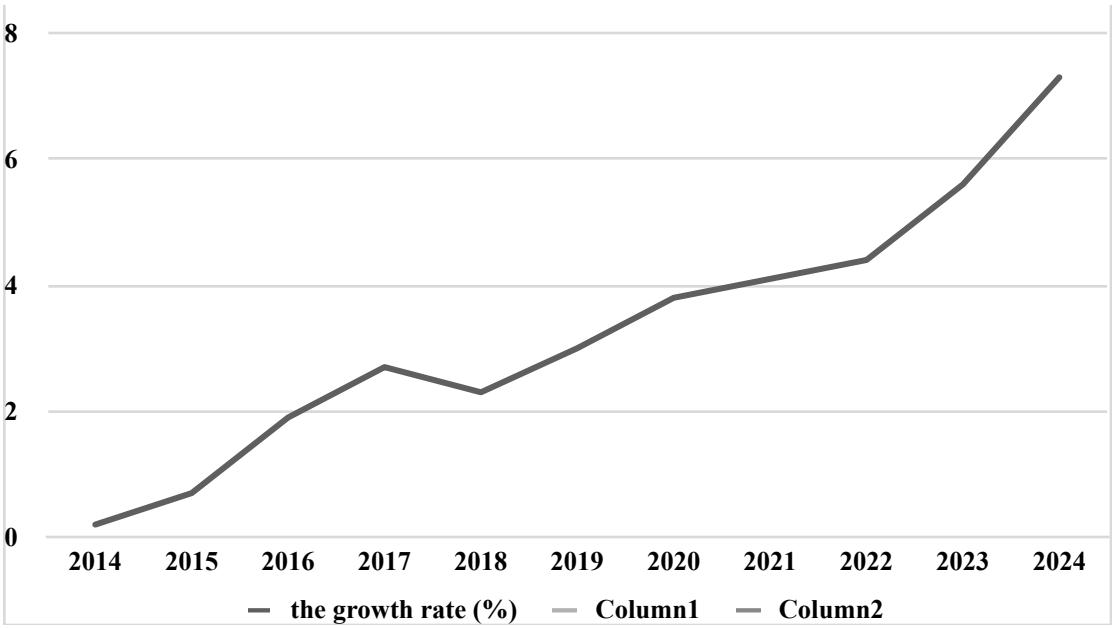
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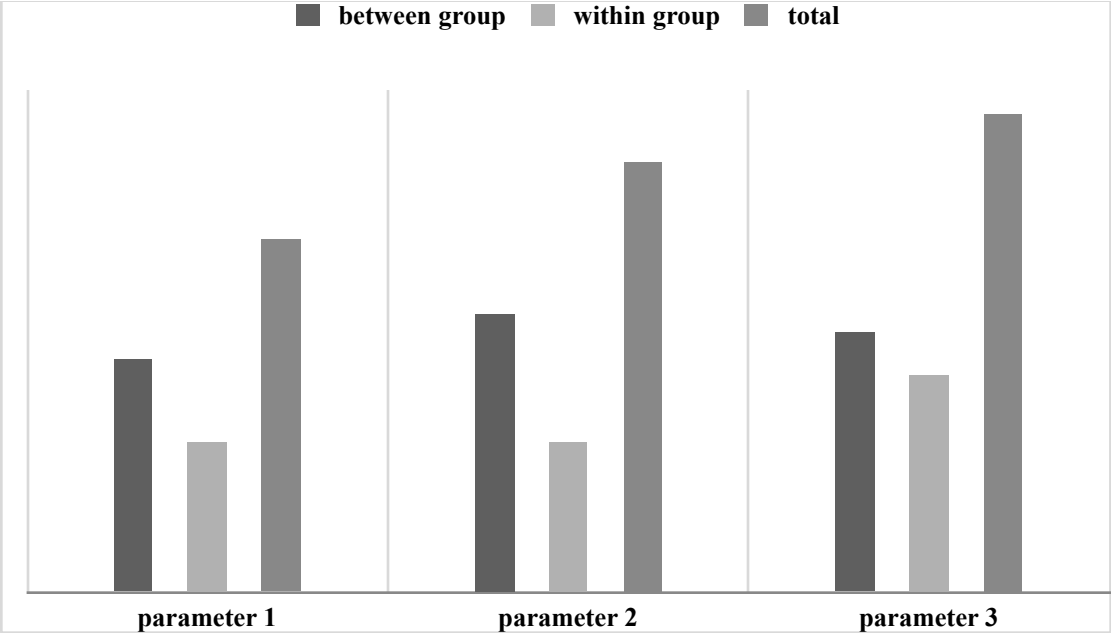
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These parameters are supposed to describe the phenomenon of the cluster interaction, which enhance the convergence effect through the cluster structural entities. The parametric ANOVA results, had been shown the statistically significant relationships between these parameters, which confirms that there is positive relationship between the cluster interaction and the growth of the creative products and services volume per capita.

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