

**ARMENIA.**

**INNOVATIVE AND  
INSTITUTIONAL  
DEVELOPMENTS**

**“INNOVATIVE AND INSTITUTIONAL  
RESEARCHES” SEL**

**ATOM MARGARYAN  
HARUTYUN TERZIAN**

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**ATOM MARGARYAN, HARUTYUN TERZYAN**

**“Armenia: innovative and institutional developments”  
is an electronic periodical which aims to analyze and briefly  
represent the overall view and trends of main innovation  
and institutional developments of Armenia.**

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## 1. THE ISSUES OF INNOVATIVE CONVERGENCE OF THE ECONOMY OF ARMENIA: EEU CONTEXT

In the article are studied questions linked with modernization and innovative development of economy of Armenia. The situation is changing extensively as Armenia became a member of Eurasian Economic Union. The opportunities for new horizons of the economic growth are being opened in the new economic environment. The markets of republics of union open their doors towards Armenian goods and services.

Meanwhile, the competitive struggle is getting stronger inside Eurasian union economics and only competitive goods can entered into the new areas of the total union market. In this situation Armenia needs in clever and clear policy for organizing competitive export volumes. Knowledge of the importance of rapid actions in creating competitive export forms the issues and challenges of the technological development in Armenian economy which have been examined in details in the article.

It is analyzed the global innovation index, which lets us understand the level of Armenian Economy technological development. In the article it is discussed the speed of changes of the innovative development in term of  $\beta$  and  $\sigma$  convergences. Econometric models are used to understand the speed of the technological changes in three major areas: Eurasian Economic Union, European Union and CIS which help to find out factors having impact on the real export of goods and services from Armenia to union republics. In the end of the article important conclusions are existed, they will help targeted act in the

field of innovation development of the Armenian economy in the new economic environment.

On the ruins of the Soviet Union the situation was formed, when the post social-block states lost their old economic ties and for making up new one's they needed a new competitive economy. Of course, for example Armenia has got many social-economic relations with such top developed counties of the world as France, USA and Canada in these 20 years.

There is a narrow set of goods from Armenia in the markets of these developed nations, but for further growing of the export of the goods and services from Armenia we need to have competitive products. On the other hand, there are open doors for Armenian goods in the markets of European Union, but also here we notice the tough struggle and only competitive commodities can have privilege.

The overcoming of the chronic lack of competitiveness of the national production is the main task for both Armenia and other post-soviet nations. It is essential to mention, that the 20 years post - soviet development of Armenia shows that for the massive transformation of the economy or for a new trajectory of the growth there are needed huge amount of financial resources and strong rank on the political map. On this point of view, the participation of Armenia in the variety regional integration projects will give a chance to get closer to the new markets and import the newest technologies.

## Results and discussions

In this paper three major areas or economic growth paths of Armenia are described. The first reason for the division of these areas is the territorial closeness of Armenia and the member states, secondly existed mutual social – economic ties, and finally different level of the technological development of Armenia and member states inside these areas. The position of the Armenia in these technological clubs is studied in details. For understanding the origin of the technological development first of all it should be defined the indicator which will help us to describe the technological differences in the mentioned areas. The Global Innovation Index (GII)<sup>1</sup> is chosen as the proper one. The letter is calculated with use of about 80 other figures<sup>2</sup>. GII shows the position of the country by the technological development among the other countries in the world. This index consists of two principal components:

- Innovation Input Index (III)
- Innovation output Index (IOI)

Innovation Input Index combines indicators that will help to analyze the potential or readiness of the country to the innovative changes. For instance, the first subcategory in this index is called institutions which consists of the indicators

like political stability and government effectiveness, rule of law and ease of starting a business.

Innovation Output Index shows the results of the innovative transformation of the economy. The list of indicators that form Innovation Output Index include such variables as: knowledge creation, knowledge impact and knowledge diffusion on one hand, and intangible assets, creative goods and services and online creativity on the other hand.

Three main issues are discussed in this research:

- How are the member countries of these three areas distributed by the GII?
- What is the level of the speed of the transformation of the economies of the member states by means of improving GII?
- What kind of common difficulties do the countries with the low speed of the transformation of the economies have?

The first question can be answered if we give the exact explanation of the above pointed so called the three major areas. In this research the nations have been separated among three clusters. The formation of the letters is explained by existent of the 3 real political unions those surrounds Armenia. In this contest there are 3 political unions such as: EU, EEU and CIS. Armenia is a member of the two letter unions and has strong relations with EU member states. Armenia has deep links with post – soviet countries and especially allied

<sup>1</sup> Official web page of The global innovation index // electronic resource - <https://www.globalinnovationindex.org/content/page/GII-Home>

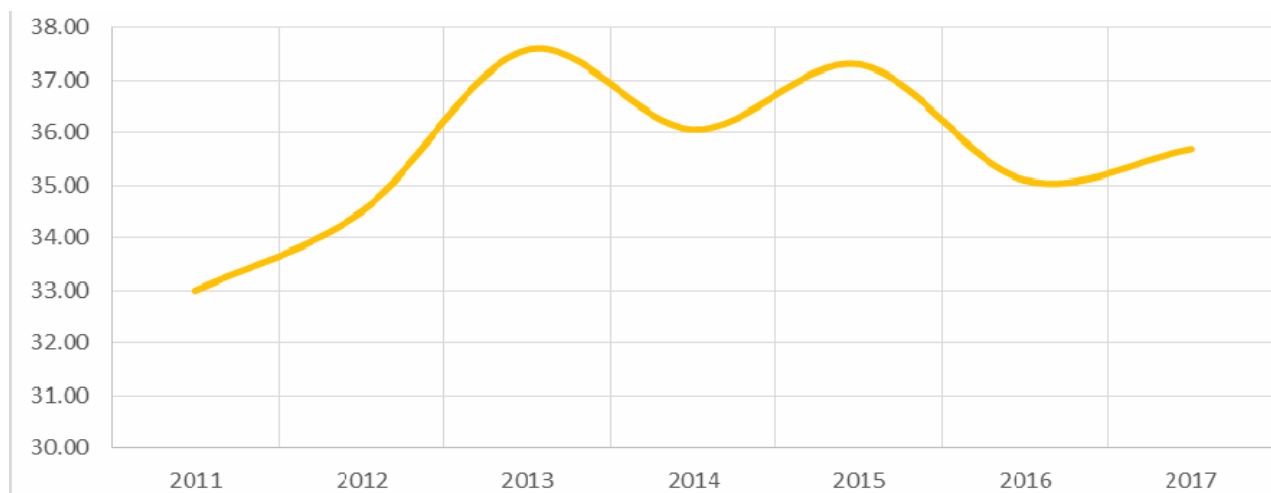
<sup>2</sup> Official web page of Expert network on public administration // electronic resource - <http://www.gosbook.ru/node/57981>

relations with Russian Federation in the global arena. Meantime, a multivector policy gives a chance to have closest ties with such a great European country as France. Counted three formats of cooperation has a deep influence on the GII of Armenia.

It can be stated that after the crush of the Soviet Union neoliberal concepts were the base for the changes from planning to market economy for all the states of the former union. The essential experience of

the EU in some areas gave a way for innovative development. It can be supposed that in the closest future these three unions can be integrated, as it can be the path for the changes of economic development for the all economies already acting in the common economic, political and cultural spheres.

Now let's get to know the dynamic of GII of Armenia for the period of 2011-2017 years.

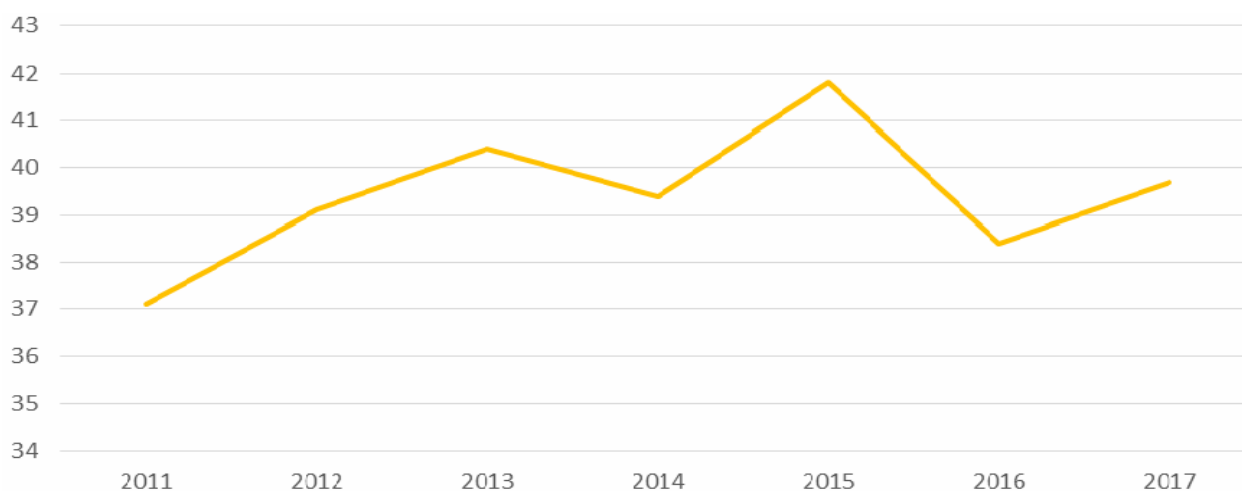


**FIGURE 1.** *Dynamic of GII in Armenia for the period of 2011-2017 years<sup>3</sup>*

From the Figure 1 it can be declared that the trend of the growth of the GII is clear. In 2014 and 2016 we can notice some decline and in 2015 already the growth of GII which is higher than in 2017. For example, the GII value is 37.37 in 2015 and 35.70 in 2017. The average value of the index for the mentioned interval of time is

35.61. From these results we can resume that Armenia is not in a good position, but it is still early to give final opinions, as we should compare the member states of the three unions by the GII. For such purposes we need to understand the behavior of the sub-categories of the GII of Armenia in the period of time 2011-2017.

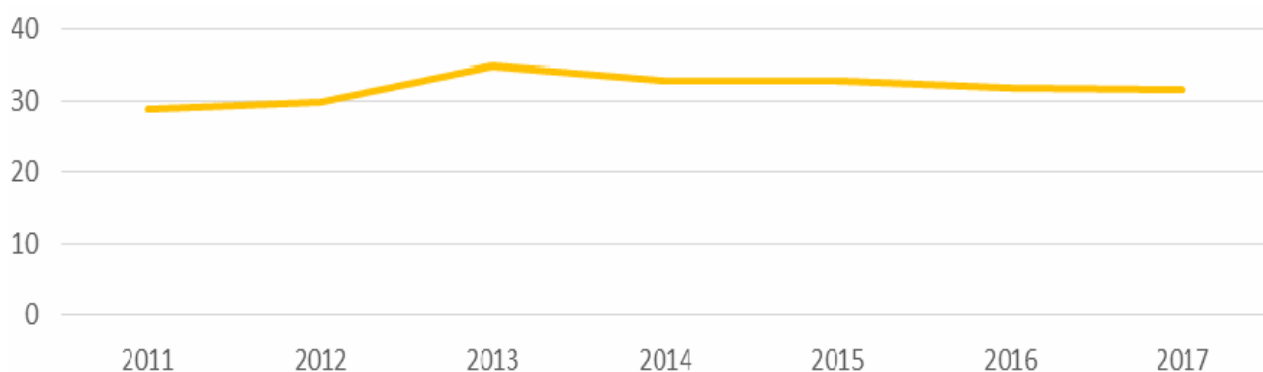
<sup>3</sup> Official web page of The global innovation index // electronic resource - <https://www.globalinnovationindex.org/content/page/GII-Home>



**FIGURE 2. Development of the III for the period of 2011-2017<sup>4</sup> [1]**

The behavior of III shows that the growth trend is available. The maximum level of the index is pointed in 2015 and is equal to 41.8. This index shows the inner conditions for the growth of GII and Armenia has 39.7 score in 2017. This result is higher of the results of 2016, however it is lower than in 2015. On the other hand IOI

explains afterwards of the innovation transformation. The letter one keeps its important position, as it states about the level of effectiveness of the innovation policy of the country. At first glance, the dynamic of IOI for Armenia can be seen in the figure 3 below.



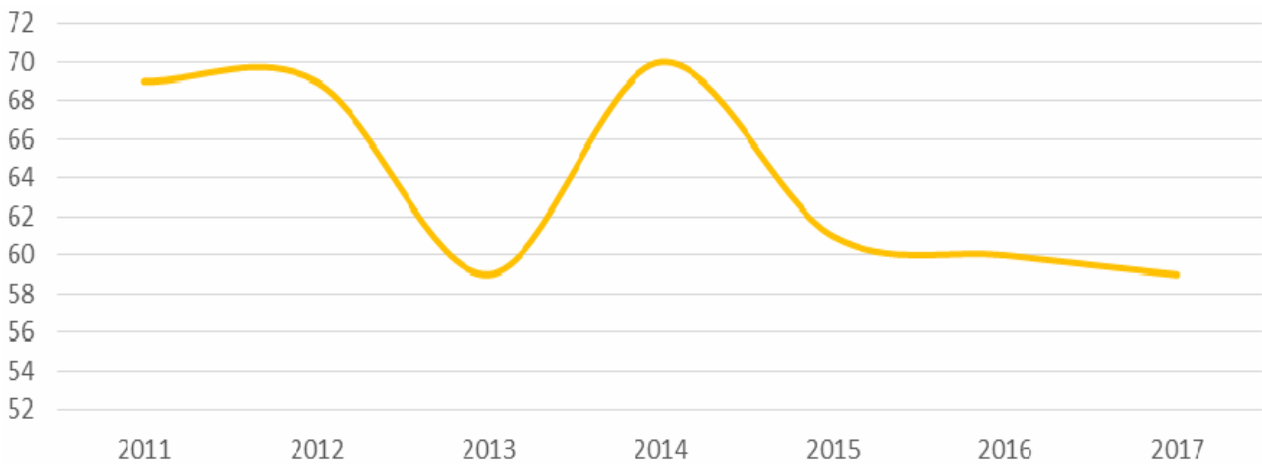
**FIGURE 3. Development of the IOI for the period of 2011-2017**

We notice that the policy towards innovation growth of economy does not satisfy, as the IOI has the tendency of declining. For instance, in 2013 IOI was around 34.8 that is not so good if we take into account the fact that this is the

maximum level of IOI in the period of years 2011-2017. The IOI has gone down to the value of 31.6 in 2017.

With help of another figure we can fix the position of the Armenia by GII.

<sup>4</sup> Official web page of The global innovation index // electronic resource - <https://www.globalinnovationindex.org/content/page/GII-Home>

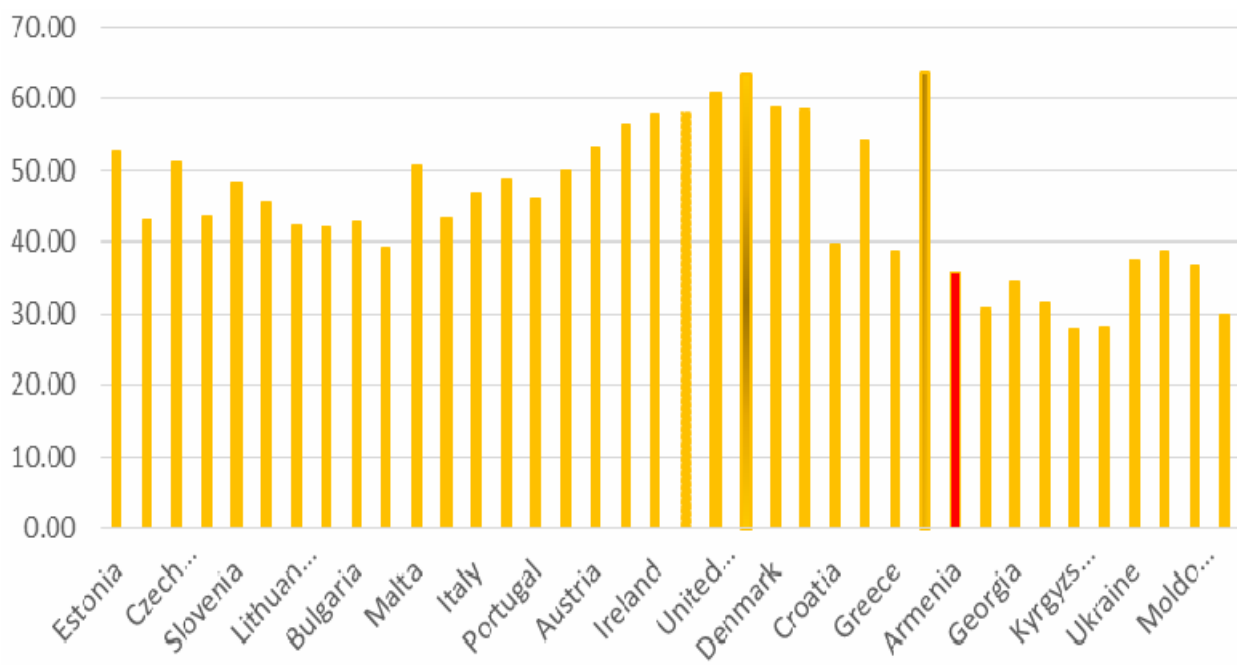


**FIGURE 4. Development of the Rank of Armenia by GII for the period of 2011-2017<sup>5</sup>**

Figure 4 shows that the rank of Armenia by GII has all chances of declining. It is very positive that Armenia moves straight to the club of countries with high level of GII, but with low steps. In 2015 Armenia is in the 61st position by GII among 202 nations. The highest rank of GII was equal to about 70.0 in 2014, but in 2017

Armenia takes only the position 59, which is equal to the lowest result in 2013.

Doing detailed representation of the GII for Armenia, now we can compare Armenian results with other member states of featured three areas. There are 38 countries in the three areas including Armenia.



**FIGURE 5. Countries in EU, CIS and EEU by the GII in 2017**

<sup>5</sup> Official web page of The global innovation index // electronic resource - <https://www.globalinnovationindex.org/content/page/GII-Home>

The figure 5 indicates that the absolute leaders are the countries of EU, like Sweden and Netherlands with the results of accordingly 63.80 and 63.40. In the CIS the top rank has Russia (38.80). Finally in the EEU the first position belongs to Russia with the results of 38.80, second position holds Armenia (35.70) and the third place is for Kazakhstan (31.50). The lowest level of GII in EU has Greece with the result of 38.80. GII for Greece is higher than the Armenian result only by 3 points, although Armenia keeps second position in EEU. The new members of the European Union such as Estonia (52.81), Latvia (45.51) and Lithuania (42.26) show good results. In the South Caucasus Armenia keeps its leadership position by GII, which gives some hope that Armenian economy can turn to the innovative path of development and in the future the GII will rise to the level of Baltic countries.

Now let's turn our attention towards another important issue like the speed of the moving to the leader by GII. The wish of

the countries to have high level results by GII is generally explained by the motivation to put countries to the innovative path of development. The letter will help to solve variety social problems inside the society. Issues with the speed of declining the differences between the countries by GII are being studied by means of the concept of convergence. There are different types of convergence such as  $\sigma$ ,  $\beta$  and group or cluster convergence. All these concepts have the same aim, it is to find out the speed of changes between the top and lowest level of the technological development of the countries. The main differences between convergence indicators are that they are calculated in the different ways.

The estimation of the convergence indicators needs some preparations that should be done. First of all we need to evaluate GII indicators for both beginning (2011) and ending (2017) periods for all 38 countries. This process can be seen in the following table below.

**TABLE 1. Starting and ending values of GII by the countries**

Group	N	Country	start of period-2011	end of period-2017
EEU	1	Armenia	33.00	35.70
	2	Kyrgyzstan	29.79	28.00
	3	Belarus	32.90	30.00
	4	Russian Federation	35.85	38.80
	5	Kazakhstan	30.32	31.50
EU	1	Estonia	49.18	52.81
	2	Hungary	48.12	43.00
	3	Czech Republic	47.30	51.32
	4	Cyprus	46.45	43.51
	5	Slovenia	45.07	48.49
	6	Latvia	39.80	45.51



	7	Lithuania	38.49	42.26
	8	Poland	38.02	42.00
	9	Bulgaria	38.42	42.80
	10	Romania	36.83	39.20
	11	Malta	56.10	50.60
	12	Slovak Republic	39.05	43.40
	13	Italy	40.69	47.00
	14	Spain	43.81	48.80
	15	Portugal	42.40	46.10
	16	Belgium	49.05	49.90
	17	Austria	50.75	53.10
	18	Luxembourg	52.65	56.40
	19	Ireland	54.10	58.10
	20	Germany	54.89	58.40
	21	United Kingdom	55.96	60.90
	22	Netherlands	56.31	63.40
	23	Denmark	56.96	58.70
	24	Finland	57.50	58.50
	25	Croatia	37.98	39.80
	26	France	49.25	54.20
	27	Greece	34.18	38.80
	28	Sweden	62.10	63.80
CIS	1	Armenia	33.00	35.70
	2	Azerbaijan	29.17	30.60
	3	Georgia	31.87	34.40
	4	Kazakhstan	30.32	31.50
	5	Kyrgyzstan	29.79	28.00
	6	Tajikistan	24.50	28.20
	7	Ukraine	35.01	37.60
	8	Russian Federation	35.85	38.80
	9	Moldova, Rep.	38.66	36.80
	10	Belarus	32.90	30.00

From the comparison of the beginning and ending periods of GII of the member states in table 1 we get to know that there are 3 main groups of countries: High, middle and low level of speed of declining the gap between the leaders and followers by the GII. This kind of comparison lets us to analyze how effective are the measures

being taken by the governments to improve GII index of the country through period of 2011-2017. The afterwards is that the lowest level of speed in EEU belongs to Kazakhstan, in EU it belongs to Hungary and Cyprus. With the help of determination of  $\sigma$  convergence for each region we can give an answer to the second question of

this paper: what is the speed of declining the technological gap in terms of declining the differences by the GII among state members of the mentioned three areas for

the period of 2011-2017.  $\sigma$ - convergence shows the growth rate of the variance coefficient. The results of the calculations are represented in the table below.

**TABLE 2.  $\sigma$  convergence in three areas**

Groups	start of period- 2011	end of period- 2017	CHANGE RATE	CHANGE RATE (%)
EEU	0.37	0.36	-0.03	-3%
EU	0.85	0.79	-0.08	-8%
CIS	0.15	0.27	0.78	78%

The table 2 makes it clear, that the gap between the leaders and followers by GII has a vector of increasing in CIS. For instance we declare that GII has deviation around 78% for the period of 2011-2017. On the other hand we see decline of the gap between the leaders and followers in EU, as for the period 2011-2017 the gamma convergence is equal to -8%, and in EEU with -3%.

On the next stage it is analyzed  $\beta$  convergence. In this case we compare

countries inside the three major areas. There are 38 nations in the list and the period is the same. Econometric model will be used to calculate the coefficient of  $\beta$  convergence.

First of all we represent the econometric model<sup>6</sup> which describes the connections between GII at time 2017 and its start period 2011. The model is showed below.

$$GII_{i2017} = \alpha + \beta \cdot GII_{i2011} + \varepsilon_1(1)$$

where

$GII_{i2017}$  – is GII of the country i in 2017 (the end of period),

$GII_{i2011}$  – is GII for country i in 2011 (the start of the period),

$\alpha, \beta$  – are the coefficients of the econometric model,

$\varepsilon_1$  – is the error term of the model for country i.

Model (1) has been estimated with the least squares method<sup>7</sup>. Estimated model has the high level of quality and all the coefficients are significant, accept intercept.

$$\widehat{GII}_{2017} = \underline{2.16} + \underline{1.005} \cdot GII_{2011}, R^2 = 0.92, DW = 1.89 (2)$$

(0.3405) (0.0000)

<sup>6</sup> Magnus Ya.R., Katyshev P.K., Peresetsky A.A., Econometrics, “Delo” Publishing House, M., 2004, art. 67-68.

<sup>7</sup> Econometrics: textbook /ed. I.I. Eliseeva, M., Jurayt, 2014, p. 13-14.

where

$\widetilde{GII}_{2017}$  – is the prediction of the GII for the country I in 2017

After the estimation of the model (1) we can resume that estimated model has high quality, which gives us a chance to find the coefficient of beta convergence. To do this we should write model (2) in the following way.

$$\widetilde{GII}_{2017} = 1.005 \cdot GII_{2011} \quad (4)$$

Then, we can write

$$\widetilde{GII}_{2017} - GII_{2011} = 1.005 \cdot GII_{2011} - GII_{2011} \quad (4)$$

After some calculations will get the following

$\Delta \widetilde{GII}_{2017} = 0.005(5)$ , where  $\Delta \widetilde{GII}_{2017} = \frac{\widetilde{GII}_{2017} - GII_{2011}}{GII_{2011}}$  – is the change of GII index of country i in 2017 compared with basis period of 2011

From the model (5) we can resume that the speed of convergence is equal to 0.4%

## SUMMARY

*The major 3 areas are represented in the research. The first case for such division of the areas is their territorial closeness to Armenia, secondly the tied social – economic relations are existed between the member nations of the three areas and finally the differences those are available in the technological development.*

*The place of Armenia is studied in details in this technological clubs. The results of the research show that in the whole area from EU to CIS it is declared the decline of the speed of the move of the followers to the leaders by the Global Innovation Index in the period of 2011-2017. The reasons for such behavior are variety. Generally we can state that some impact on the situation will have inconsistency of the political and economic structures such as: wars on the three areas, the frozen relations between old partners, the issues of refugees stream from Syria, high level activeness of the terrorist groups and sanctions put from one neighbor on another.*

## 2. PROBLEMS OF LONG-TERM INFLUENCES OF INNOVATIVE FACTORS OF ECONOMIC GROWTH IN RA

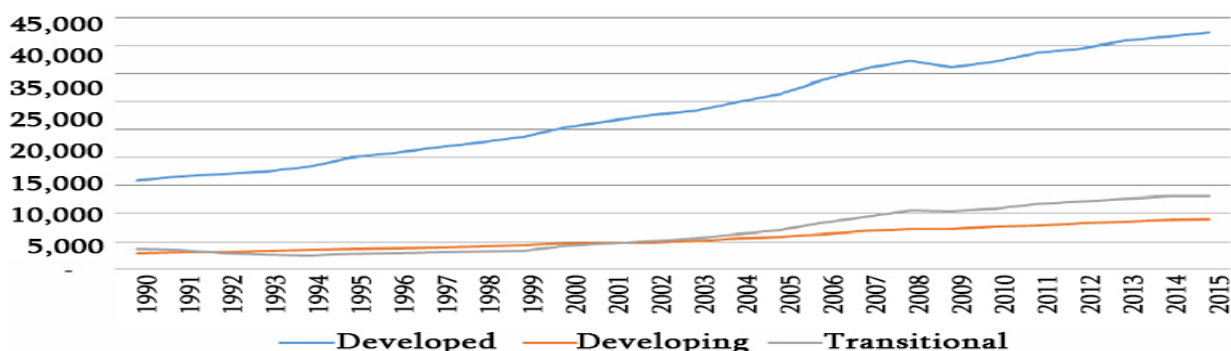
The stable long-term economic growth is the part of economic policy. In recent years high-quality growth has become a subject of discussion, which is important in the context of economic development on the basis of innovation. Within the framework of this analysis examined the features of economic growth of the Republic of Armenia, conventionally classified in phases. Reference is made of the certain issues of necessary institutional changes to ensure the quality of long-term economic growth on the basis of innovation.

Presently, the scientific community enjoys a widespread popularity for the importance of role and significance of scientific engineering, technological and innovative factors of sustainable long-term economic growth. In this content, the problem of equalization of income among the countries is one of the key points. The main problem is, particularly, how these factors contribute to the sustainable long-term economic growth and, as a result, whether they lead to the equalization of income among the countries, or not.

It can be seen from the picture that the income between the countries doesn't have a direction of convergence but differentiation. Years of experience shows that developed countries tend to concentrate the whole scientific potential which is carried not only by doing investments in their own human capital, but also by providing "brains" inflow from countries of low development.

In other words, developed countries collect world creative ideas and use them for developing economic policy from the point of view of long-term growth. Thus they probably turn least developed countries into participants that serve them as a means of gaining benefit.

When discussing the problem of income equalization, the question arises: How should developing countries transfer their own economy to a new, innovative and knowledge-based development path? Of course, as a developing country, the above question also concerns to Armenia. Thus the Armenian economical mind must be focused on solving this issue.



**FIGURE 1. GDP per capita according to the countries' level of development<sup>8</sup>**

<sup>8</sup> According to the level of development, the countries are classified by the methodology of UN and the statistics are taken from World Bank. <https://www.google.ru/>, [www.un.org/en/development/desa/policy/wesp\\_current/wesp\\_country\\_classification.pdf](http://www.un.org/en/development/desa/policy/wesp_current/wesp_country_classification.pdf), <http://data.worldbank.org/indicator>

The responsible of economic policy, as well as many economists, constantly highlights the necessity of knowledge-based economy and national innovation system for providing sustainable long-term growth. However, can RA have a competitive innovation system under the circumstances of constantly straining competition among the world leaders? What kind of structural changes are needed for this and in general, how can innovations effect on sustainable long-term economic growth?

### ***Phase Study of Economic Growth in RA***

It was obvious that in the USSR, Armenia had a leading chemical industry. Armenia became known for its high level of physics and technical education. These are the points for the formation of the national innovation system. People even say that Armenia was a member of the USSR as a Silicon Valley<sup>9</sup>.

Thus it is important to mention that after gaining independence Armenia had favorable launch conditions in the point of view of the provision of resources for forming national innovational system. However after undergoing to "shocking therapy" the statistics was dramatically changed.

Here we divided the period of the economic growth of RA into 3 conditional phases.

#### 1. Post-Soviet (1990–1999)

#### 2. Ensuring stabilization and relative growth (2000–2009)

#### 3. Post-Crisis (starting from 2010)

After gaining independence, the privatization policy passed to the "shock therapy", which led to a high concentration of income, the consequence of which is that the Armenian economy is still not completely released. Macroeconomic indicators characteristic of the first stage, indicate the country's tremor development. To justify this, it is enough to point out the presence of hyperinflation, which, according to the CBA statistics, even reached 67.4% (1993 average)<sup>10</sup>.

Under such circumstances, it would be unnecessary to speak about the technological factor in ensuring sustainable economic growth and the establishment of institutions needed for its establishment. From 2000 we could notice with the relative stabilization of economic growth of the market and this was obvious until the end of the period; under the conditions of the global financial and economic crisis.

The Central Bank of RA managed to stop the inflation and in fact GDP per capita grew from 621 (2000) to 2916 dollars<sup>11</sup> in 2009. Attempts were made to create an innovative system for a competitive economy. Thus in 2002, the Enterprise Incubators Foundation (EIF) was established to promote innovation and to create a beneficial environment for promoting innovational development. So the improvements of technology will support the

<sup>9</sup> Armenia: Diaspora Assisted Growth, EV Consalting, page 3, [http://ev.am/sites/default/files/DIASPORAARMENIA%20CASE\\_Revised-Mar.2010-130312.pdf](http://ev.am/sites/default/files/DIASPORAARMENIA%20CASE_Revised-Mar.2010-130312.pdf)

<sup>10</sup> <https://databank.cba.am/ActivitiesGrid.aspx>

<sup>11</sup> <http://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=AM&view=chart>

growth of information and telecommunication technologies in Armenia<sup>12</sup>.

In September 2005, the Government of RA adopted a decision on the development of the innovation system, and already in 2006, "State support of innovative activities" was adopted as an RA law<sup>13</sup>. Despite certain institutional conditions for the creation of an innovative system, it should be noted that no significant results have been achieved.

This proof of it is the 2008-2009 Worldwide economic forums' published Competitiveness Report, according to which Armenia was listed in the 113 place from the perspective on the innovation factor<sup>14</sup>. Let's also note that from 2000 to 2009, export of high tech products wasn't exceeded 6,5 million dollars, and from the point of view of the exported industrial production, its share consisted of the average of 3%<sup>15</sup>.

The third phase is the continuation of the previous one in the sense that: the focus is on the need of creating a competitive economy through innovations and thus nowadays they develop programs and adopt relevant legislative, though there are no significant changes yet. GDP per capita growth in 2010-2015 is average 3% per year, whereas, in the same period, the average inflation fluctuated around 5%. Despite high technology exports in 2015, it

has reached nearly \$ 11 million, but it is obvious that: it has a small share of GDP - 0.1%, so it cannot be locomotive of economic growth. The share of public expenditure on science in the past 6 years has not changed in GDP, almost 0.24%. For comparison, in Belarus it is 0.68%, in Kazakhstan - 0.16% and in Russia - 1.13%<sup>16</sup>.

### ***Innovative factors and Growth of economic quality in RA***

For mitigating the negative balance of the account of payments, the dynamic increase of the state debt and, in general, the external political-economic negative influence we should provide long-term economic stability growth in Armenia. And it is not only a good wish but also an objective requirement.

Of course, in the context of long-term growth, first of all, it is necessary to understand "qualitative growth", which implies not only the quantitative improvement of macroeconomic indicators but also essential changes in the quality of life of the population. The table below presents the comparative analysis<sup>17</sup> of Ginnesian coefficients characterizing the average GDP growth rate per capita, the human

development index<sup>18</sup> developed by the United Nations Development Program and the income consolidation.

<sup>12</sup> <http://www.eif.am/arm/about/>

<sup>13</sup> <http://mineconomy.am/arm/574/gortsaruyt.pastatuxt.html>

<sup>14</sup> "The Global Competitiveness Report 2008-2009", World Economic Forum, page 13, [http://www3.weforum.org/docs/WEF\\_GlobalCompetitivenessReport\\_2008-09.pdf](http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2008-09.pdf)

<sup>15</sup> [www.armstat.am](http://www.armstat.am)

<sup>16</sup> <http://data.worldbank.org/indicator>

<sup>17</sup> <http://data.worldbank.org/indicator/SI.POV.GINI?view=chart>

<sup>18</sup> <http://hdr.undp.org/en/content/human-development-index-hdi>

**TABLE 1. Dynamics of qualitative indicators of economic growth in Armenia in 1990-2016**

<i>Indicator / Year</i>	<i>1990-1999</i>	<i>2000-2009</i>	<i>2010-2016</i>
Average pace of GDP per capita Growth	1%	19%	3%
Changes in Human Development Index	0.24%	1.08%	0.74%
Gini coefficient (average period)	40.32	33.50	30.91

From Table 1, we can notice that the higher rates of economic growth were accompanied by a relatively small change in the human development index. At the same time, the level of income concentration in the country is considerably higher. The aforementioned evidence indicates a lack of economic growth quality. The novelty factor in this regard obtains a key mark which provides greater added value and the opportunity to have a larger share in global income.

As we have already mentioned, some steps have been done from the point of view of the development on the institutional bases in Armenia since the 2000s, and these steps continue until our days. To the question whether Armenia can have a competitive innovation-based economy under sharp competition among the countries, we think it is better to tell that there is no alternative to the country's further quality growth

And what refers to the institutional environment, it is important to realize that initiatives in that direction should continue and first of all, must be actively encouraged by the state. The latter is more or less takes actions in its turn.

However, we believe that both, the formation of the close perfection of the legislative framework and the programs developed by the government cannot be effective even as long as they are not systematized.

They are separate elements of a single chain and they act independently of each other. Therefore, we believe that the relevant state agencies should fulfill the responsibilities of the coordinator properly. Public activity is also of great importance, the coordination of it should be carried out by non-governmental organizations. It is no secret that the formation of an innovative economy has significant risks and its funding is less attractive for business.

That's why venture funds have a great role. The policy pursued by the state is also important, which should be as clear as possible and provide certain privileged conditions for companies that can become locomotives of an innovative economy formation. Thus, there are a number of issues for the formation of an innovative economy in Armenia, but they should be addressed not as an obstacle, but be perceived as new opportunities.

## SUMMARY

*Though Armenia has limited resources, we think that it can have a competitive innovation system, and hence it is necessary to choose a narrow target for sector development and to serve as a definite "niche" of the global innovation market. Moreover, in order to diversify the economy, it is necessary to position the country in more than one "niche".*

*We think that our efforts should be directed to the formation of such institutions which will coordinate already existing institutions and will guide these institutions by leading them to the one common goal. Of course, in this context, we should not push the extension of the institutional base into the secondary plan, particularly the field funding institutions and intellectual property of effective enforcement mechanisms.*

*The formation of an innovation economy implies a higher added value, and, hence, to ensure economic progress we should not forget about quality growth. As we know, intellectual property protection institution is one of the peculiarities of the innovation industry, which comprises of a number of risks of monopoly positions from successful businesses. Less successful enterprises that couldn't withstand the internal competition are expelled from the market and can form an unemployed group. The latter cast a shadow on the quality characteristics of the growth. In this regard, it is important to emphasize the formation of mechanisms for the effective allocation of revenue.*



### 3. THE IMPACT OF THE ECONOMIC DIVERSIFICATION LEVEL ON THE HIGH TECHNOLOGY EXPORT OF RA

As demonstrated by the existing moods in the RA, both at the government level<sup>19</sup> and at the regional authorities and ordinary population, our country has chosen the innovation economy as the main path of the development built on the active use of knowledge-based and up-to-date technologies. Therefore, the development of information technologies in the RA economy will keep its place for many years among

other factors in the development of the economy. High-tech exports have a significant impact on the formation of the innovative economy, and its sustained pace is the starting point for the prosperity of this industry. Let's consider the high technology export dynamics in the RA economy in 2011-2016<sup>20</sup>. For that purpose, we will examine the chart below.



**FIGURE 1. Armenia's high-tech export dynamics in 2011-2016**

Figure 1 clearly shows the tendency of growth of high-tech exports in 2011-2016, which also indicates that the government has chosen the innovative way of economic development. However, after the economic crisis of 2008-2009, high technology exports declined by about 6% in 2014 compared to 2013. Here in 2015 we notice a sharp increase, which made about 33%, and by 2016 about 50%. Of course, this is evidenced by the favorable moods that are needed to government and the private sector, both supported through research programs and with new business solutions.

High-tech exports are essentially linked to numerous processes in the Armenian economy: political, social-economic and international developments. We have touched upon the institutional side of those processes. Particularly, the level of diversification of Armenia's economy has been calculated according to three accepted indicators: Ogive, Entropy and Herfindal<sup>21</sup>. It is clear that each of them has shown a certain level of economic diversification. The basis for the calculation of the index is the division of Armenia's economy by spheres of activity.

<sup>19</sup> <http://www.gov.am/files/docs/1322.pdf>

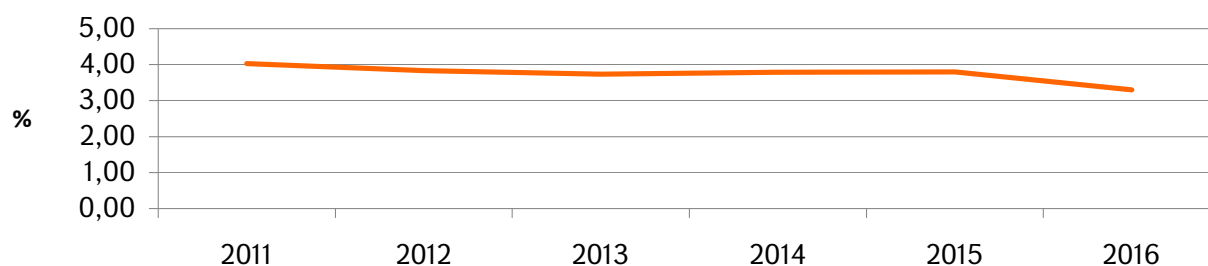
<sup>20</sup> <http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators&preview=on>

<sup>21</sup> Measuring Economic Diversification in Hawaii, Research and Economic Analysis Division

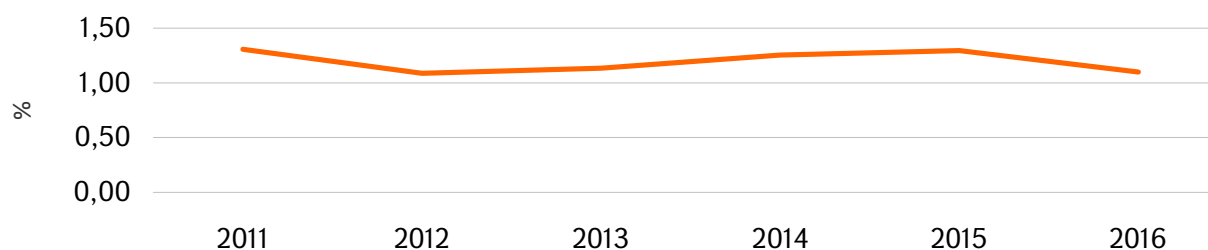
Department of Business, Economic Development and Tourism, State of Hawaii, February 2008.

By examining the methodology of the division of the economy into the sphere of activity it becomes clear that for the 2000-2010 the economy has had 16 branches, and since 2011 - 20 branches<sup>22</sup>. In these branches, the total value added is distributed unevenly. Therefore, there is a problem of diversification as per the total

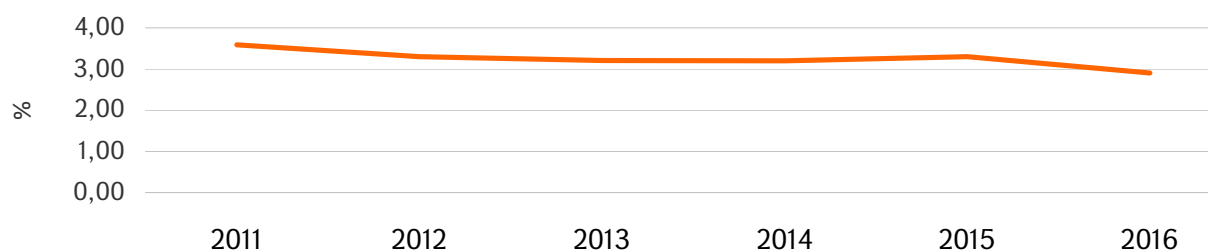
value added. From the point of view of our research, the share of "Information & Communications", "Professional, Scientific and Technical Activities" and "Education" branches is of particular importance. The latter's dynamics over the past five years is as follows:



**FIGURE 2.** *Share of "Information and communication" branch in RA value added in 2011-2016*



**FIGURE 3.** *Share of "Professional, Scientific and Technical Activities" in RA Value Added Tax 2011-2016*

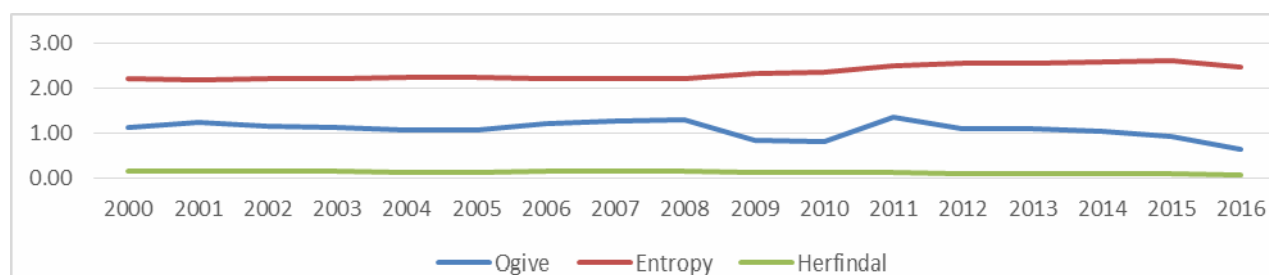


**FIGURE 4.** *Share of "Education" branch in RA value added in 2011-2016*

<sup>22</sup> <https://www.cba.am/am/SitePages/statrealsector.aspx>

By examining the charts 2-4 above, we come to the conclusion that, in general, these three spheres, where the processes occurring directly and / or indirectly contribute to the economic development of the economy, still retain a very small value in the value added of the RA weight with the result they created. Particularly, in 2016, the value added in the "Information and Communication", "Professional, Scientific and Technical Activities" and "Education" branches in Armenia added 3.30%, 1.10% and 2.90%, respectively. Of course, these figures can be compared to different countries around the world and say that

their data is approximated above, but our problem is not just to compare and say that it is impossible to change the situation in any way, but should understand the government's targeted economy development vector, which, as it has been said, is the formation of innovation economy. In pursuit of what we have in terms of the diversification of Armenia's economy, we have been evaluating the dynamics of Armenia's demarcation levels by the added value of the branches, as a result of which the following picture was obtained:



**FIGURE 5. Describing the degree of diversification of the Armenian economy in 2000-2016<sup>23</sup>**

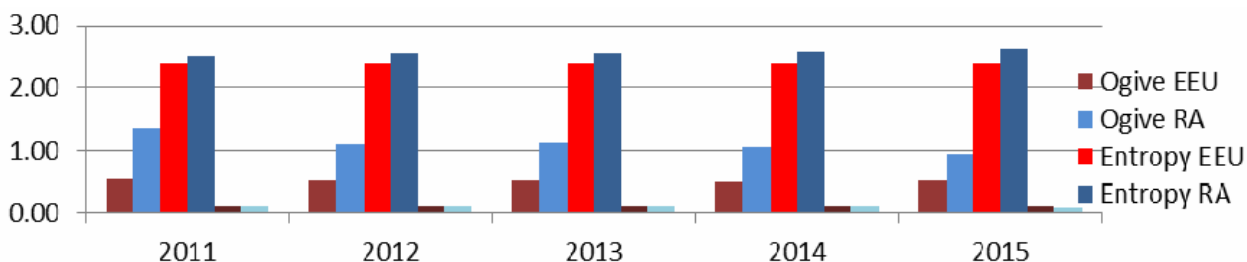
The three indexes given in Figure 5 answer the same question. How diversified is the economy of Armenia, but the latter are interpreted differently. In particular, how much the Ogive index is close to zero, the economy is so diversified. This implies that the value added is distributed according to the branches equally. In the case of Entropy, the latter assumes the greatest possible value for greater diversification. In the case of Herfindal index, it is assumed that the index is close to zero, so the economy is

diversified. In 2016, the Ogive, Entropy and Herfindal indexes declared the following values respectively: 0.66, 2.49 and 0.07. EEU<sup>24</sup> membership is a new challenge for Armenia's economy. For this reason, it is important to compare the dynamics of the Armenian economy diversification indexes with the dynamics of the whole union's economy diversification indexes in 2011-2015. Following the calculation<sup>25</sup> of the above-mentioned committees for the Eurasian Economic Union, the following results were obtained.

<sup>23</sup> The calculations were made by the authors

<sup>24</sup> <http://www.eaeunion.org/#about-countries>

<sup>25</sup> Own calculations



**FIGURE 6. Dynamics of diversification indexes in RA and EEU other countries in 2011-2015**

Figure 6 shows that Armenia is in the lead position by the Ogive index. The economy of Armenia can be considered as more diversified than the economy of the whole economy, and the Herfindal index imbalance is almost unchanged. Before examining the connections on high-tech export volumes and above-calculated diversification indexes using the

econometric model<sup>26</sup>, a correlation analysis<sup>27</sup> of the relationships between these indicators was conducted. There was a significant relations between the high tech export volumes and the Herfindal index. Consequently, the econometric model was written on the basis of these strong variables.

The following econometric model was observed:

$$HTE_t = \beta_0 \cdot e^{\beta_1 t} \cdot HI_t^{\beta_2} \cdot \varepsilon_t \quad (1)$$

where

$HTE_t$  – is the the volume of high-tech export in year  $t$ ,

$HI_t$  – is the level of Herfindal Index in year  $t$ ,

$\beta_0, \beta_1, \beta_2$  – are nonestimated parametres of model,

$\varepsilon_t$  – is the random error of the model in the year  $t$ ,

$t$  – is the index of year: At the same time, the period 2000-2016 was observed.

The model by the specification (1) cannot be estimated because there is strong correlation<sup>28</sup> between independent variables. That's why an attempt has been made to divide model (1) into two models as follows:

$$HI_t = \alpha_0 \cdot e^{\alpha_1 t} \cdot \gamma_t \quad (2)$$

where

$\alpha_0, \alpha_1$  – are model parametres,

$\gamma_t$  – is the model random error in year  $t$ :

$$HTE_t = \beta_0 \cdot HI_t^{\beta_1} \cdot \varepsilon_t \quad (3)$$

where

$\beta_0, \beta_1$  – are model parameters,,

$\varepsilon_t$  – is the model random error in year  $t$ :

<sup>26</sup> Kremer N. Sh., Putko B. A., Econometrics, Unity, M., 2003, p. 17.

<sup>27</sup> Econometrics: Textbook. Assistant / Gladilin A. V., Gerasimov A. N., Gromov E. I., M., Knorus, 2006, p. 71.

<sup>28</sup> Econometrics: textbook / ed. II Eliseeva, M., Prospect, 2009, pp. 48-51.

Model (2) has been linearized, and then estimated by OLS<sup>29</sup>. The results of the estimation can be seen below.

$$\widehat{\ln HI}_t = \frac{-1.88}{(0.0000)} - \frac{0.002}{(0.0000)} \cdot t, R^2 = 0.84 \quad (4)$$

where

$\widehat{\ln HI}_t$  – is predicted value of the HI in logarithms in year  $t$  from estimation of model<sup>30</sup> (2).

Estimated (4) model is of high quality. The  $R^2$  is close to one, the estimated coefficients are significant<sup>31</sup>, and the other statistical criteria<sup>32</sup> are in the norm. From model (4) the predicted values of the  $\widehat{\ln HI}_t$  were calculated and the latter was used to estimate the model (3). The model (3) is linearized and then estimated by the least squares method, as a result of which we will have the following estimated model:

$$\widehat{\ln HTE}_t = \frac{11.41}{(0.0000)} - \frac{2}{(0.0004)} \cdot \widehat{\ln HI}_t, R^2 = 0.61 \quad (5)$$

where

$\widehat{\ln HTE}_t$  is predicted value of the HI in logarithms in year  $t$ .

After getting the estimated model (5), we can clearly state how the degree of diversification of the economy affects the volumes of technological export. Thus, the 1% increase in the Herfindahl index (deterioration of the economy diversification or deepening of concentration), in other equal conditions, can result in a high-tech export volume, an average of 2% reduction.

The result is once again confirmed by the hypothesis that the high-tech export

volumes are truly dependent on the degree of institutional factor, the degree of diversification of the economy. It is necessary to understand that only the problem of diversification has been considered by us, but the high-tech export volumes also depend on other quantitative and qualitative factors, in which a modern innovation economy is needed to have a competent and targeted policy.

<sup>29</sup> Nosko V. P., *Econometrics for beginners*, Institute for the Economy in Transition, M., 2000, pp.58-63.

<sup>30</sup> Verbic Marno, *Guide to modern econometrics*. Trans. with English. V. A. Bannikova. Scientific. Ed. and pre. S.A. Ayvazyan, M., *The scientific book*, 2008, 616 p. "The Library of Solev." pp. 30-34.

<sup>31</sup> Magnus Ya. R., Katyshev P. K., Peresetsky A. A., *Econometrics*, Delo Publishing House, M., 2004, pp. 108-124.

<sup>32</sup> *Econometrics: textbook* / ed. II Eliseeva, M., Prospect, 2009, pp. 91-105.