# ARMENIA.

## INNOVATIVE AND INSTITUTIONAL DEVELOPMENTS

"INNOVATIVE AND INSTITUTIONAL RESEARCHES" SEL

ATOM MARGARYAN
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Issue N3, 2018

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**"Armenia: innovative and institutional developments" is an electronic periodical wich aims to analyseand briefly represent the overall view and trends of mains innovation and institutional developments of Armenia.**

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YEREVAN, 2018

# 1. CYCLICAL FLUCTUATIONS OF GROSS VALUE ADDED OF HIGH-TECH PRODUCTS OF THE REPUBLIC OF ARMENIA

High-tech industry plays an essential role and importance for the whole economy. The high-tech industry is the industry, with the development of which the economy gets a significant increase in revenues, boosting all sectors of the economy, upgrading and boosting modern jobs. Speaking about the Armenian high-tech industry, the following five directions of the processing industry were highlighted:

- Manufacture of chemicals and chemicals;
- Manufacture of pharmaceutical products;
- Manufacture of computers, electronic and optical equipment
- Electrical equipment production
- Manufacture of machinery and equipment, not included in other groupings.

The above-mentioned high-tech manufacturing industries give rise to a whole set of clusters throughout the country, allowing for the most competitive products to be exported. The results created through these areas are used to meet both civilian and military requirements, with a number of tasks to be resolved. The combination of these 5 spheres is a high-tech industry. The chart below shows the weight of each of the added value of the overall technology industry.

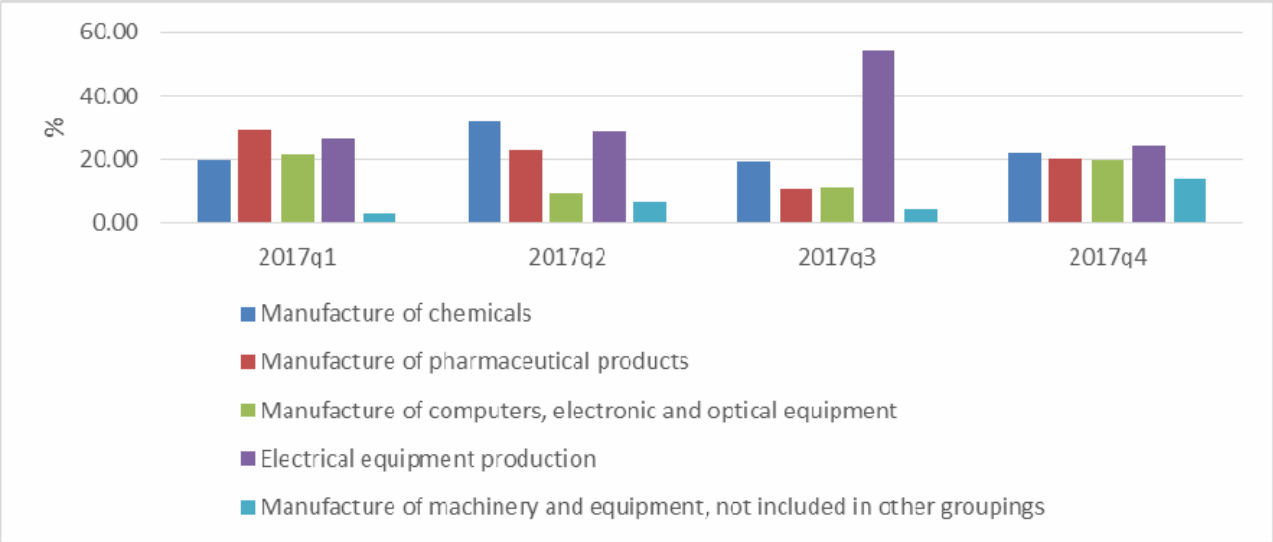


**FIGURE 1.** ***The value added of 5 branches of high technology production in the value added of total high technology production***

Figure 1 shows that a significant share of the value added was the production of electrical equipment in 2017, making about 54.52%. In the fourth quarter of 2017, the share of the production of electrical equipment in value added has dropped, but has not lost its position, occupying the first place with 24.40% [1]. Third place occupies the production of chemicals and chemicals. The latter's share in the second quarter of

2017 was high and equal 32.14%. The lowest level was observed in the third quarter of 2017 - 19.28. In the fourth quarter of 2017, the index slightly increased to 21.84. The third place is occupied by the production of pharmaceutical products, which has the largest share in the first quarter of 2017, about 29.20%, but the share of this sector is declining in the other quarters. In the fourth quarter of 2017 its share was equal to 20.15%. The next position is the production of computers, electronic and optical equipment by 21.41% in the first quarter of 2017, after falling to 19.64% in the fourth quarter of 2017. Finally, the latter occupies the final place in the production of machinery and equipment, not included in other groupings, the largest share of which was observed in the fourth quarter of 2017 - about 13.97%. This index has its lowest weight in the first quarter of 2017, about 3%. The survey showed that there are still many things to do to increase the share of these sectors from the point of view of increasing. Interesting to Understand Formation Continuing the research, let's take a look at the chart below.

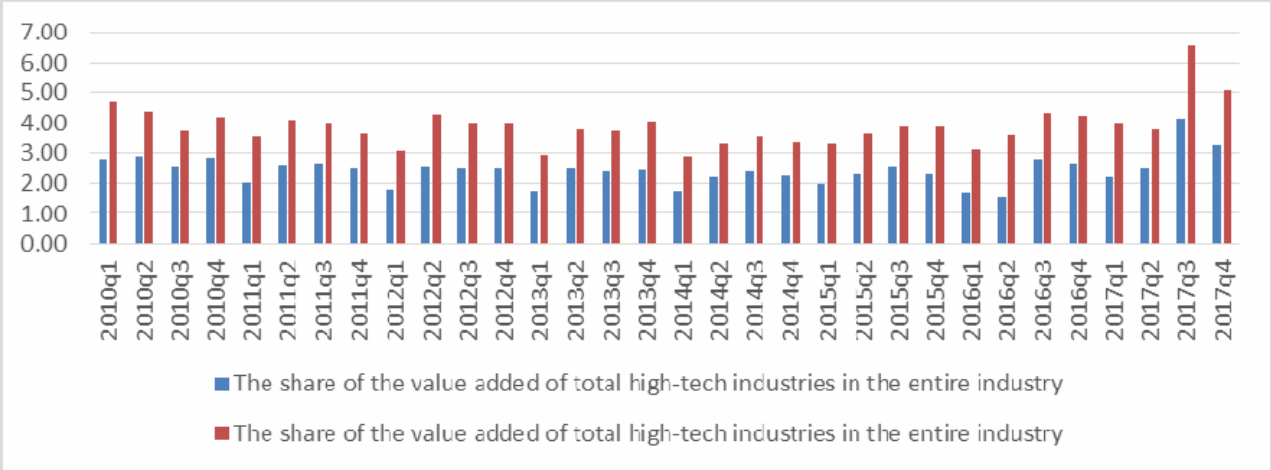


**FIGURE 2.** ***The share of the value added of total high-tech industries in the entire industry and processing industry in the 2010-2017.***

Figure 2 shows the high-tech production share in the value added of the entire industry, which in the fourth quarter of 2017 made up 3.30%, and in the processing industry - 5.11%. Still, the level of development of the innovation economy, which is relevant, in particular, the country, where information technology is the primary source of the economy, is not enough.

Now let's try to study the dynamics of the overall high-tech production with the help of Figure 3 below in 2010-2017.

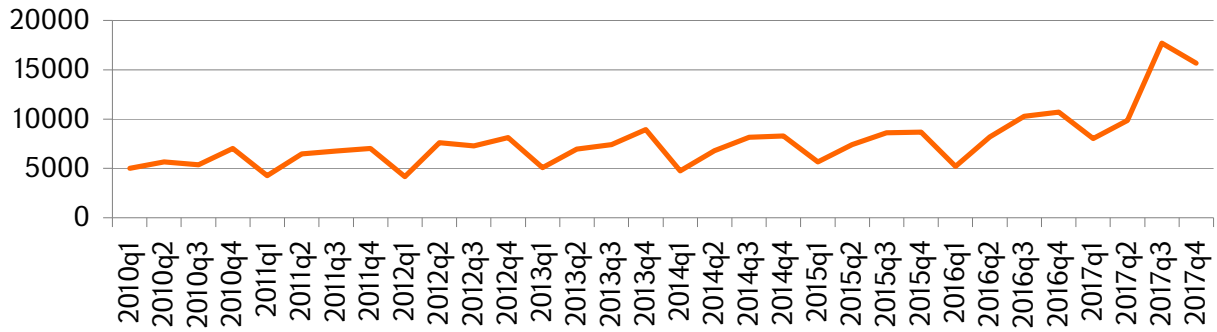


**FIGURE 3.** ***The value added dynamics of the total high-tech production in the 2010-2017.***

It is noteworthy that the quarterly overall high-tech production has had a very volatile nature and seems to have a downward trend since the fourth quarter of 2017 [1]. It is interesting to find out what that trend will look like for future quarters. For this purpose, the utility model [2, p. 447-461] was constructed as follows:

$$IT_t = \alpha_0 + \alpha_1 \cdot IT_{t-1} + \alpha_2 IT_{t-2} + \alpha_3 IT_{t-3} + \varepsilon_t$$

where

$IT_t$ is the total added value of high-tech production in the t-quarter:

$IT_{t-1}, IT_{t-2}$ *and* $IT_{t-3}$ are the total added values of high-tech production in the previous quarters,

$\alpha_0, \alpha_1, \alpha_2, \alpha_3$ are the unknown parameters of model,

$\varepsilon_t$ is the random error of the model in the t-quarter.

Prior to assessing the model, it has been checked out by its in-patient group. As a result, it was found that they are not stationary [3, p. 266-276] and that during the model evaluation, this fact has been taken into account, and the model is evaluated by the least squares method [4, p. 58-63]. Rated model results are sufficient. Determination coefficient is close to 1, Darwin's h-statistics [5] is within the permissible limits, with all coefficients being equal to zero at zero, with separate coefficients significant. Based on the high quality of the estimated econometric model, a prediction has been made that results can be seen in the following charting:

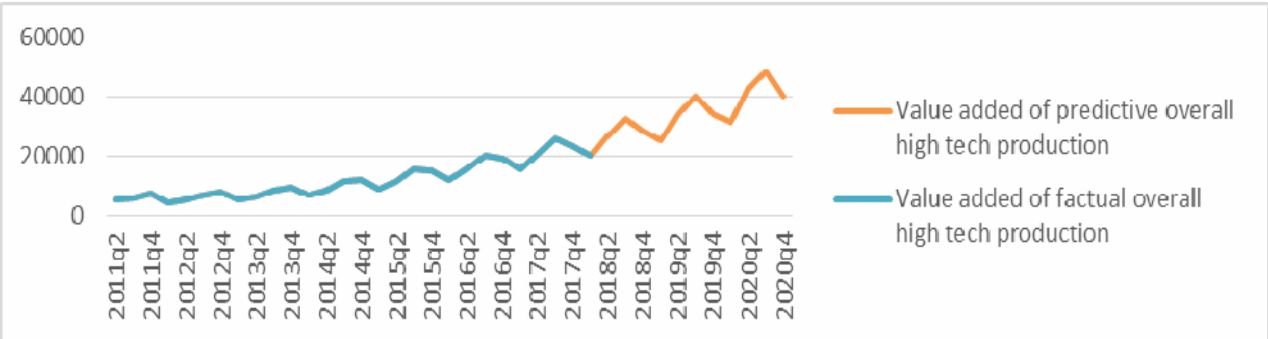


**FIGURE 4.** ***Value added dynamics of factual and predictive overall high tech production in the 2010-2017.***

According to Figure 4, the total added value of high-tech production in the second quarter of 2018 will be 26,906.87 million drams, 32,554.32 million drams in the third quarter of 2018 and 28,624.78 million drams in the fourth quarter of 2018 AMD. Compared to the same quarter of 2017, we come to the conclusion that if the situation remains the same in Armenia and there is no deep shocks, we will have an increase of 30%, 26% and 22%, correspondingly, in corresponding quarters of 2018. It will continue until 2020, and in the fourth quarter of 2020 we will already have an added value of 40, 291, 17 million drams, comparing it with 100.6% in the same quarter of 2017. It is necessary to stress once again that the forecasts are made in the case when significant shocks are not observed in the country until 2020.

Having gained value added by 2020, we will study the cyclical nature of the high-tech industry. For that purpose, look at the chart below, where the actual added value and the potential level or trend of the high-tech industry are included.

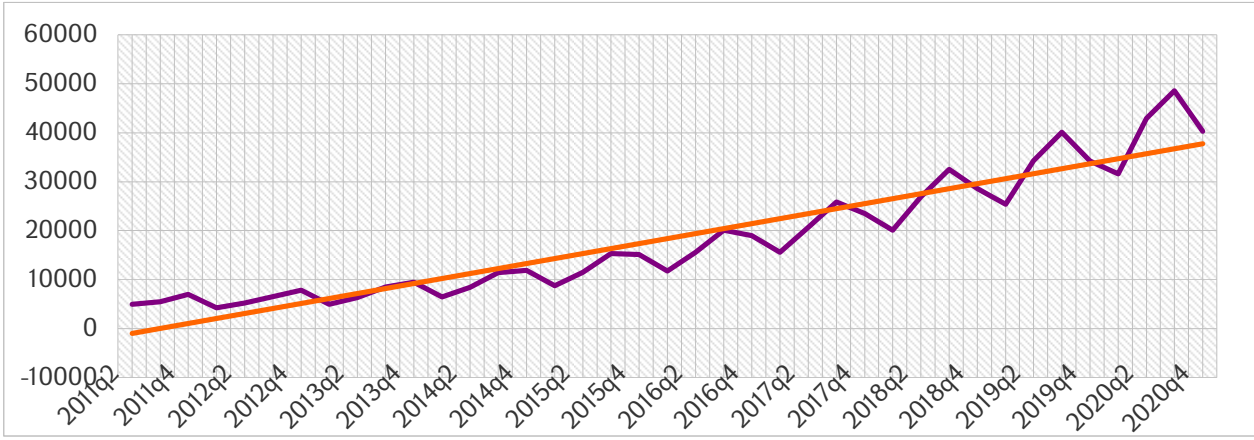


**FIGURE 5.** ***Cycle deviations of the expected total high tech production over the trend aroundin the 2011-2020.***

Figure 5 shows that the total volume of the high-tech industry in 2011-2012 has been above the potential level. Then in 2013-2018 there is a low level of imagery, and from 2018 up to now there is a change of behavior. In particular, after the stagnation of the first quarter of 2018, the upward trend in the third quarter of 2018, the value added to the peak in the third quarter of 2018, and shortly afterwards the recession phase begins again, which lasts for two quarters or six months. The latter ends with a stagnation in the first quarter of 2019, followed by the same process after a short stagnation when again in the first quarter of 2020, the stagnation will be observed, but in this case it will not be like the first quarter of 2019 and the recovery phase will start quickly, which will reach its peak in the third quarter of 2020. It can be concluded that the duration of the cycle is one year and three months (2018 - the first quarter (stagnation) until the first quarter of 2019 (the first quarter of 2019). The same duration is observed from the first quarter of 2019 until the first quarter of 2020.

## 2. THE CONTROL OF CORRUPTION INDEX AND GDP PER CAPITA IN THE MEMBER COUNTRIES OF EEU

For a sustainable development of any country's economy, a perfect job of the corresponding institutions is required. The way to reach the latter is complicated, but not impossible. In addition, each country has the appropriate level of development of its institutions and should take full account of the current situation and opportunities to take concrete steps to increase the effectiveness of institutes' work. There are countries where the normal functioning of institutions is hindered by centuries-old traditions in which the struggle may require a long period of time for institutional changes. From this perspective, it is important to fight against corruption.

Corruption itself has the potential to disseminate and infect many areas and to reach their zero level of effectiveness. In a number of countries, there is even no idea how to live without corruption. However, as demonstrated by the progress of a number of European and American countries without corruption, it is possible to ensure the economic growth of the country, and a healthy atmosphere in the society aimed at prosperity of its own country. Unfortunately, post-Soviet countries are not covered by corruption risks. Corruption has penetrated many areas into their work ineffective, and the development has led to stagnation.

Corruption is an old phenomenon that has just started from the earliest times and continues its traditions today. This phenomenon is characteristic of both developed and emerging countries and third-world countries. It is enough to remember, for example, the recycling crisis in the Italian city of Naples[1], which started in 2007 and lasts until now. The entire system of garbage disposal was established by the scheme of corruption in the mafia hands which caused a great protest among the public as the city was buried in garbage. This is just one example when a whole sphere loses its effectiveness, causing many problems in different layers of society. Here the role of the state is important, which should be able to fight against this evil directly or indirectly, but in most cases the state becomes an active participant in corruption schemes.

After the collapse of the Soviet Union, when the republics were weakly economically or politically, the state institutions were in a state of pillaging, and suddenly the groups began to root out corruption schemes, especially in different state agencies. Under these conditions, the system began to work inefficiently resulting in numerous shocks in almost all countries. In this context, the assessment of international institutions is of great interest to the achievements in the fight against corruption. These issues are in the limelight of the non-state Transparency International[2], which lists the types of corruption perceptions in different countries.

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[1] https://en.wikipedia.org/wiki/Naples_waste_management_issue

[2] https://www.transparency.org/

For the member states of the Eurasian Economic Union, the issue has been viewed from a different perspective, in particular, the issue of fighting corruption has been touched upon. For each of the member states of the Eurasian Union, the above mentioned index was considered[3]. The first is to study the dynamics of the fight against corruption in Armenia, which is illustrated below.

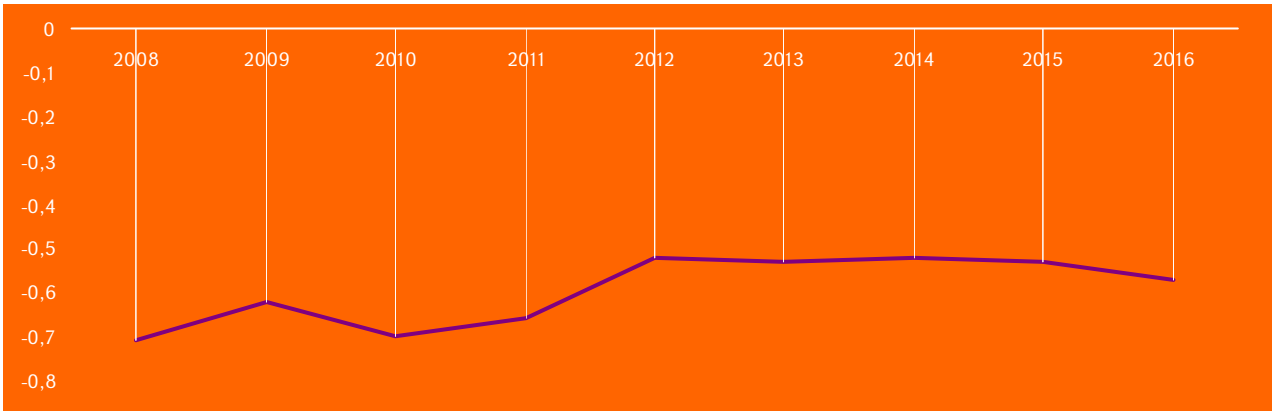



FIGURE 1. ***The dynamics of the fight against corruption in the Republic of Armenia for 2008-2016.***

This index is in the range of [-2; and 5.2 thousand 5] in the vicinity than the actual rate closer to -2; and 5 so the fight is considered weak and ineffective, and Vice versa. According to statistics, the index was below zero in the period under review and fluctuate in the [-0.52,-0.71] corridor. The index reached its maximum value in 2012 -0.52, and at least in 2008 -0.71 in Armenia. Since this year, there has been an increase in the index, and the decline is not deep. Probably the financial and economic crisis, the consequences, on the basis of an attempt was made to improve the situation also in this part, because corruption risks of further deepening can lead to more complex consequences. In 2016, the index was equal to -0.57 Armenia.

Let's describe the situation in Belarus below the graph 2:

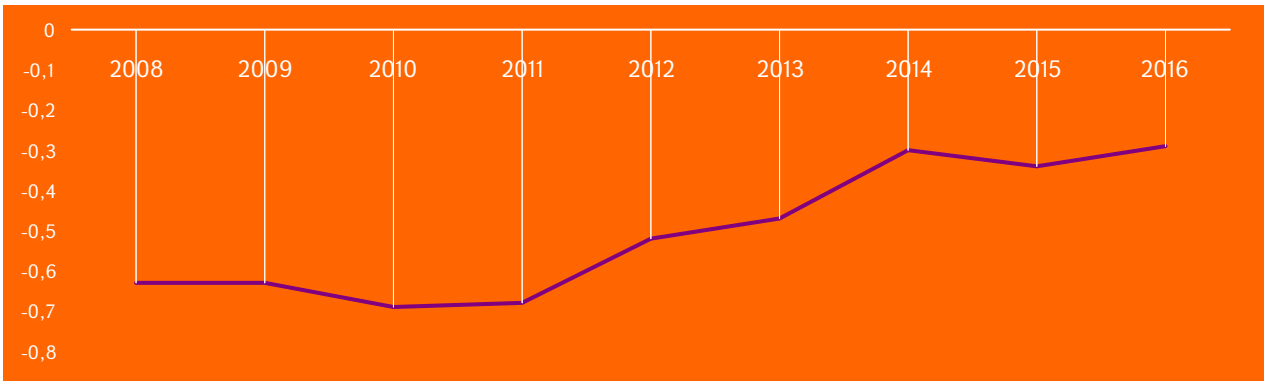



FIGURE 2. ***The dynamics of the fight against corruption in Belarus for 2008-2016***

[3] https://www.theglobaleconomy.com/rankings/wb_ corruption/

As you can see the graph 2 in Belarus much forward went in this rudeness 2010 minimum level -0.69, reaching in 2016-at -0.29 level. Has the fight against corruption become more effective in Belarus over the years of the system policy? Another country-the Russian Federation, where the fight against corruption, the dynamics is as follows: As you can see the graph 2 in Belarus much forward went in this rudeness 2010 minimum level -0.69, reaching in 2016-at -0.29 level. Has the fight against corruption become more effective in Belarus over the years of the system policy? Another country-the Russian Federation, where the fight against corruption, the dynamics is as follows:

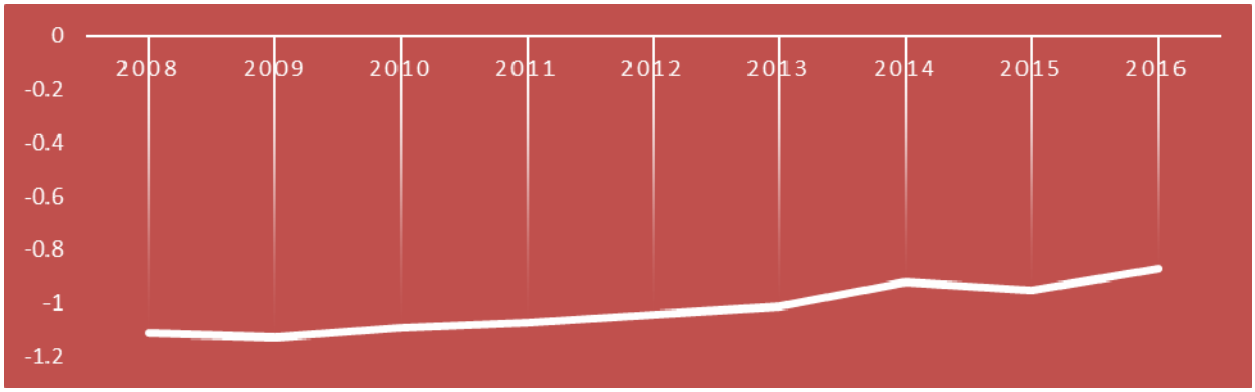



FIGURE 3. ***The dynamics of the fight against corruption in Russia for 2008-2016***

The situation in RUSSIA is difficult. Of course, the fight against corruption has become effective over the years, but MTV is still at a low level. In 2016 we recorded these increased maximum value of 0.87 for Armenia. The minimum level was observed in 2009, immediately during the crisis, fixing -1.13 indicator. This situation is also due to corruption in the system of existing schemes of complexity, which were formed during these years. Russia as an obese power faces the biggest challenges, which complicate things. In recent years, illegal sanctions not only will not contribute to the fight against corruption, increase efficiency, but also will enable other schemes to circumvent illegal sanctions.

Another schedule concerns the Eurasian Union, the founder of someone from the States of Kazakhstan and Armenia.

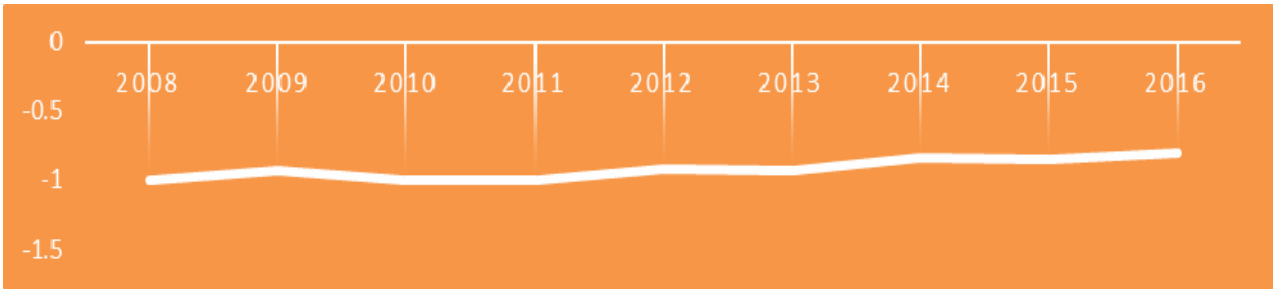



FIGURE 4. ***The dynamics of the fight against corruption in Russia for 2008-2016***

Schedule 4 it becomes clear that in Kazakhstan the fight against corruption is the most effective was than in the Russian Federation, but compared to Armenia and Belarus indicators with Kazakhstan, the indicator is at a low level. In particular, in 2016 the anti-corruption index registered a value of -0.8, which, compared to 2010 -1, the index increased by only 0.2 points. In Kazakhstan, the index is very slowly changing.

And finally, to confirm the Kyrgyz indicator below drinks:

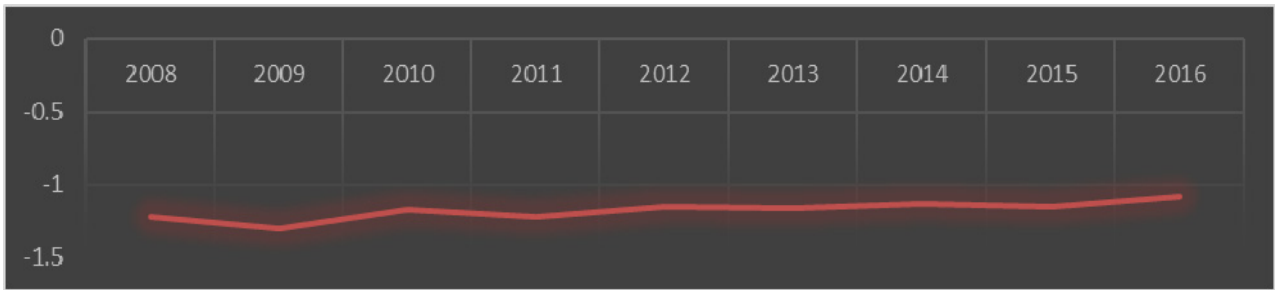
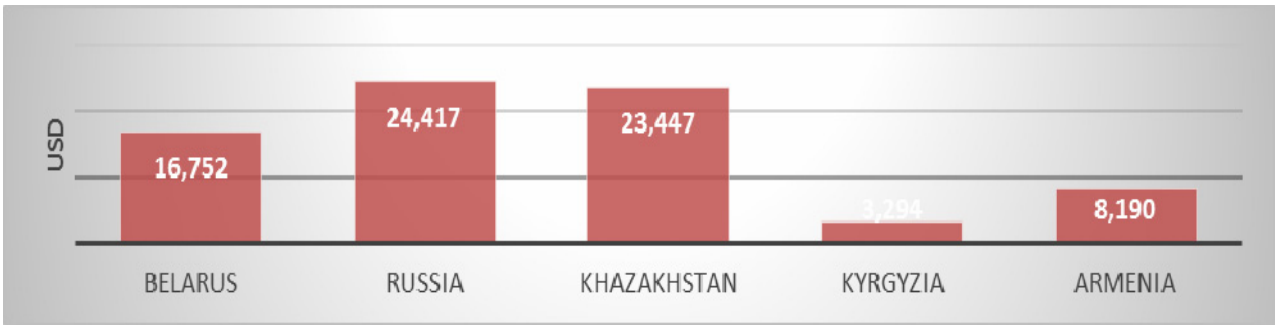



FIGURE 5. ***The dynamics of the fight against corruption in Kyrgyz Republic for 2008-2016***

The Middle Asian state is the worst. The fight against corruption is the most effective. In 2016 it was recorded -1.08 but this index is the highest. The lowest level was observed in 2009 when the country faced the financial and economic crisis. In 2009 the index was close to 1.31. This country should do a lot of work to correct the situation as it directly hits the country's economy. To understand how much the anti-corruption index affects GDP per capita[4], per capita Gross Domestic Product in the Member States of the Eurasian Union in 2016.




FIGUIRE 6. ***GDP per capita in the member states of the Eurasian Union in 2016***

As can be seen from the Figure 5, GDP per capita has been recorded in Russia at USD 24,417 per year.

The second place is occupied by Kazakhstan - $ 23,447. The third is Belarus 16,752 dollars. Armenia occupies the fourth place with 8,190 USD. The minimum GDP per capita was set at $ 3,294 in Kyrgyzstan. Using econometric models[5], an attempt has been made to evaluate the anti-corruption

[4] http://www.worldbank.org/

[5] 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. 447-461

index in per capita GDP per member states of the Eurasian Union. Five models were designed, and the period was chosen for 2008-2016. The following appearance model is presented:

$$Y_t^i = \alpha_0 + \alpha_1 \cdot X_{t-k}^i + \alpha_2 \cdot Z_{t-k}^i + \varepsilon_t^i \quad (1),$$

where

$Y_t^i$ — is the GDP per capita of the i-th country in the t-year,

$X_{t-k}^i$ is the i-th country's index of control of corruption in t-k where $k = \overline{0,n}$

$Z_{t-k}^i$ i i are other variables of the i-th country in the t-k year that can be included in the model for purely preserving the model's quality parameters within the permissible limits, where $k = \overline{0,n}$

$\alpha_0, \alpha_1, \alpha_2$ are the unknown parameters of the model,

$\varepsilon_t^i$ is random error of i-th model t-year,

i is the country of the corresponding Eurasian Union. At the same time $i = \overline{1,5}$

t is the year index, which fluctuates between 2008 and 2016.

Before assessing the model, the series was checked out, the ranks that were stationary, and then modeling the model with the least squares method[6]. As a result, the following coefficients have been obtained, as shown in the table below:

**TABLE 1:** ***Results of 1 model assessment***

| *Depended variable' GDP per capita* | *Independent variable: Control of Corruption* | | | *Significance level* |
|---|---|---|---|---|
| *GDP2011* | *coc* | *coc (-1)* | *coc(-2)* | *Prob* |
| **Armenia** | 2469 | - | - | 0.0172 |
| **Belarus** | - | - | 4847 | 0.0153 |
| **Russia** | 1331 | - | - | 0.0411 |
| **Khazakhstan** | - | - | 3370 | 0.0347 |
| **Kyrgyzia** | - | 992 | - | 0.0378 |

Before proceeding to the spreadsheet comment, note that all 5 rated models have been of good quality. The coefficients of the detection range fluctuated between 0.65-0.98. All tests have shown that the models fit the reality. It should be noted that the low data, of course, has created some obstacles for some tests, but at this level, the overall and estimated coefficients in the model were significant.

It is clear from the table 1 that for Armenia, the estimated coefficient against corruption is positive and is equal to 2469. This indicator is interpreted as follows: if the index increases by 1 point, the fight against corruption will be more effective, then per capita incomes will grow by an average of 2469 USD on equal terms. However, it is

[6] V.P. Nosko, Econometrics for beginners, Institute for the Economy in Transition, Moscow, 2000, pp.58-63

noteworthy that 1 point growth is a complex process, and the change in the ranking is very slow. In the case of Belarus, the index in the fight against corruption affects late. Specifically, if the index increases by 1 point in the year, the impact will be felt only in two years, but in equal conditions, the revenue will grow by an average of 4847 USD. In the case of RF, the index affects the current year, but the extent of impact is not as great as in Armenia and Belarus. Particularly, the 1 point increase of the coefficient in other equal conditions will result in an average increase of $ 1,331. In the case of RF, the index affects the current year, but the extent of impact is not as great as in Armenia and Belarus. Particularly, the 1 point increase of the coefficient in other equal conditions will result in an average increase of $ 1,331. In Kazakhstan, the impact is also delayed, in particular, the increase in the fight against corruption in the current year by 1 point, but in poor conditions, can result in a GDP per capita increase of 3370 USD. And the smallest change was observed in Kyrgyzstan. In this country, if one per cent increase in the fight against corruption in the year, then in another equivalent, in a year, the average per capita GDP will rise to $ 992.

The conducted analysis shows that the most serious fight against corruption can affect the per capita income distribution and concrete steps must be taken to ensure that the member states' normal development without corruption risks.

# 3. ABOUT TECHNOLOGICAL CHANGES AND ECONOMIC GROWTH

## *The trend of technological changes in the World*

A study of long-term technological changes shows that developed countries with a relatively well-established institutional environment are noticeably intensified by technology change. At the same time, however, developing countries, like China, have been recording considerable success in technological changes over the last ten years. Moreover, in emerging economies, the long-term trend of these changes has a more dilapidated tendency, which means a progressive rates of change. As for transition countries, it should be noted that since 1992, the tendency of technological change has a stable low level. Figure 1 illustrates this as an indication of the technological changes as the number of inventions patented by residents.

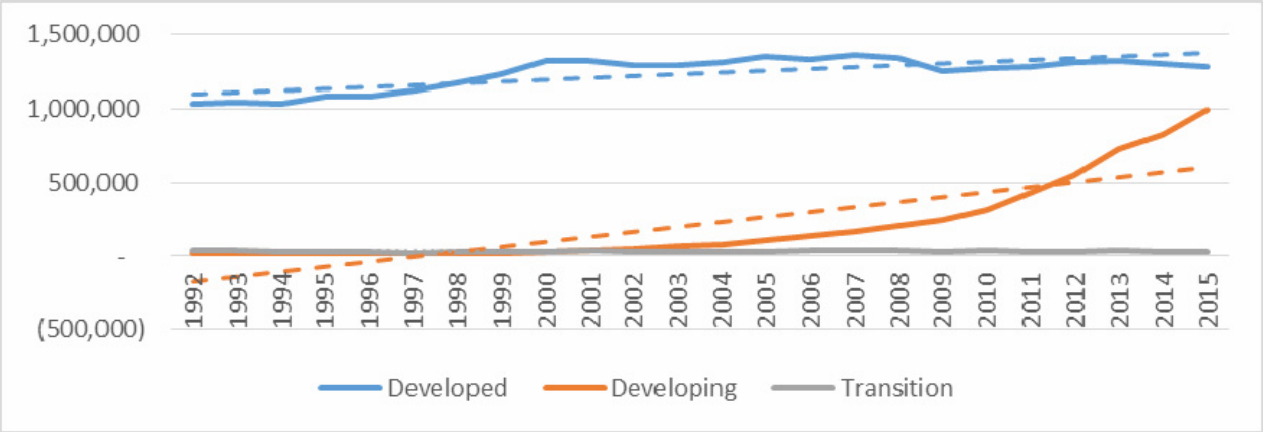



FIGURE 1. ***Residence Patent Growth Rates by Level of Country Development[7].***

As we can see, from 1992 the number of inventions patented by residents has the fastest growth trend in developing countries, in the meantime in developed countries it is gradually decreasing. According to the United Nations standards, Armenia is complementing a series of transitional economies where the number of resident patents per year is 139 in average. It should be noted that developing countries, where the less reliable intellectual property rights in the short term promotes the dissemination of technology, sooner or later try to establish a necessary institutional system to solve that problem, which will reduce the degree of dependence of these countries from inventive ones on the one hand, and as a result of the fight against illicit use of patented inventions, the confidence of the international community towards them will increase, which is a best way for attracting foreign investors on the other hand. The dynamics of the country's patents share by development level is presented in Figure 2.

[7] 116 countries are included in the calculations. The calculations are based on the World Bank's statistical data, see: https://data.worldbank.org/indicator

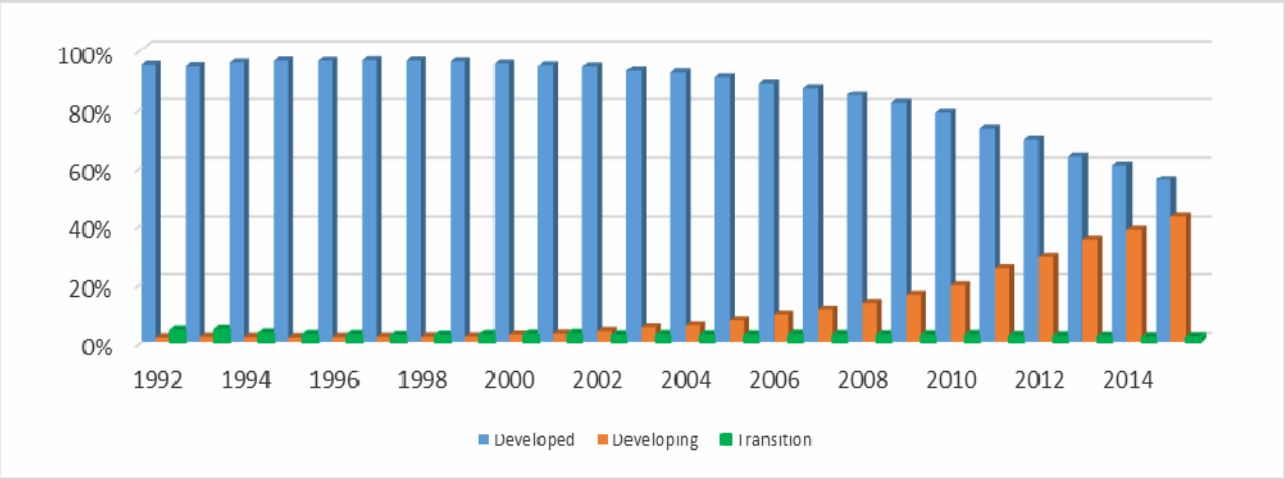



FIGURE 2. ***The changes of patent shares by the countries development level[8].***

From 1992 to 2015 in the developed countries, the share of patented inventions has dropped dramatically from 95% to 55%, and in developing countries, on the contrary, it has increased from 1% to 43%. It should be noted, that among the patents of developing countries China has the largest share. The latter's share of patents in developing countries is about 97% in gross inventories. The share of countries with transitional economies has dropped from 4% to 1% during the study period. Statistics show that after the collapse of the USSR, transition countries intensively lose their scientific potential, which has its share of "guilt" in curbing economic growth. By combining Figures 1 and 2 we can state, that the wave of technological change from developed countries gradually goes to developing countries, in the face of China, which is accompanied by a long-term development of technological change and technology favorable institutional environment. In addition we should note, that although technological change essentially contributes to the spread of technology, we believe it is a necessary but not sufficient condition for the latter. Many institutional theories confirm the thesis that revenue growth contributes to the country's high technological adaptability[9].

## *Economic growth and technological changes.*

It is not secret that technological change and the increase in the level of education of the workforce are closely interconnected. It should be noted that the impact of technological change from the point of view of economic growth may not be unambiguous for all countries. In countries where there are functional institutions (such as availability of student loan programs, real-time education

[8] See the World Bank official website. https://data.worldbank.org/indicator

[9] Nguyen Quoc Viet, Ngyuen Thi Hien, Vu Thi Quy, Vo Ngoc Qui "Institutions matter for technological changes in transition economy: Comparison between Japanese FDI and private enterprises in Vietnam", Faculty of Development Economics, VNU, University of Economics and Business, page 3.

opportunities, etc.), the workforce is more flexible and able to adapt quickly to technological changes and therefore succeeds, and in countries where institutional environment is not well-established, naturally, as a result of the same chain reaction fail. It's no coincidence, that technological changes are often conditioned by the innovative idea that is inherited, which, in turn, is an indicator of labor force. "If there are sufficient conditions for innovative and creative work, then technological advancement is guaranteed"[10].

The above-mentioned opinion is shared by Lucas and Jones. In terms of studying institutional conditions for technological change with the accumulation of intellectual capital, we think it is valuable to classify the capitalist economic system in two major institutional groups as Soskits did: "market-oriented" systems and "centralized market" systems[11]. According to that classification, in countries with a "centralized market" system (such as Germany, Sweden, Japan, etc.), employers are merged into associations and form a system of employees' unified learning and experience sharing, while in countries with "market-oriented" system the relationships between experience exchange and employee qualification training are shaped between individual companies or between the company and its employees (like US, Canada, UK, etc.).

The above-mentioned institutional systems are characterized by their own patterns of technological change. Thus, in countries with a "centralized market" system, as a rule, "sustainable growth" technology dominates, whereas in "free market" institutional systems, "fractious technological changes"[12]. We can state, that modern theories of economics are anchored to the principles of sustainable long-term high-quality growth conditioned by the technological factor. As a rule, such theories are based on the direct impact of the technological factor on economic growth. 2009-2015 Investigations of resident-owned inventions and the average GDP in per capita, indicate, that the quantitative change patterns of a certain type of technology factor are not always accompanied by a change in average GDP in per capita (see table 1).

[10] JOEL MOKYR, Philippe Aghion and Steven N. Durlauf, "Long-Term Economic Growth And The History of Technology", 2005, page 4.
[11] Werle R. "Institutions and Systems: Analysing Technical Innovation Processes From an Institutional Perspective", Innovation Policy and Governance in High – Tech Industries, Germany, 2012, page 31.
[12] See in the same place, p. 32

**TABLE 1.** ***The changes of resident patetns and the GDP in per capita by country development level***[13]

| Year | Indicator | Developed | Growth (%) | Developing | Growth (%) | Transtition | Growth (%) |
|---|---|---|---|---|---|---|---|
| 2009 | Number of Patentes | 1,250,687 | -7% | 246,694 | 17% | 32,502 | -7% |
| | GDP per capita (average) | 39,596 | -11% | 3,379 | -6% | 4,392 | -16% |
| 2010 | Number of Patentes | 1,272,111 | 2% | 313,044 | 27% | 36,047 | 11% |
| | GDP per capita (average) | 40,819 | 3% | 3,924 | 16% | 4,866 | 11% |
| 2011 | Number of Patentes | 1,277,316 | 0% | 436,128 | 39% | 33,268 | -8% |
| | GDP per capita (average) | 44,757 | 10% | 4,331 | 10% | 5,842 | 20% |
| 2012 | Number of Patentes | 1,315,751 | 3% | 556,190 | 28% | 33,784 | 2% |
| | GDP per capita (average) | 43,252 | -3% | 4,554 | 5% | 5,951 | 2% |
| 2013 | Number of Patentes | 1,323,861 | 1% | 728,961 | 31% | 35,861 | 6% |
| | GDP per capita (average) | 44,223 | 2% | 4,633 | 2% | 6,384 | 7% |
| 2014 | Number of Patentes | 1,306,587 | -1% | 825,997 | 13% | 29,933 | -17% |
| | GDP per capita (average) | 44,573 | 1% | 4,632 | 0% | 6,194 | -3% |
| 2015 | Number of Patentes | 1,279,254 | -2% | 994,283 | 20% | 34,253 | 14% |
| | GDP per capita (average) | 39,324 | -12% | 4,252 | -8% | 4,846 | -22% |

[13] There is no information on the number of patents after 2015. The deviations from the predicted pattern are taken into the circle

As we can notice, in 2015, the number of inventions patented by residents in developing countries increased by 20%, while the average GDP in per capita declined by 8% for the same time period. At the same time, in the transition countries in 2011, the number of patented inventions reduced by 8% in 2010, while GDP in per capita increased by 20%. We can also mention, that from 2009 to 2014, the number of patented inventions in Belarus has dropped dramatically (from 1,753 to 652) in the background of the dynamic GDP growth (from 5,176 to $ 8,025), and only in 2015, the proposed change was preserved and simultaneously reduced both the number of patents and GDP per capita amounted to $ 543 and $ 5,740, respectively. The comparison between Russia and Kazakhstan, where GDP per capita is around 10,000, is also remarkable, where GDP per capita is close to 10,000 US dollar (2015), and the number of patents varies considerably: 24,072 and 1,742, respectively)[14]. Please be informed that in 2015/2014, that GDP per capita and patents by residences were reduced by -9.4% and -6.6%, respectively. In 2015/2014, GDP per capita and resident patents in Republic of Armenia were reduced by -9.4% and -6.6%, respectively. A comparative study reveals that:

1. In order the impact of technological change on economic growth to be definite it is necessary to formulate an appropriate institutional environment,
2. The impact of the technological factor on the economic growth should be driven by effective institutions operating in the country.

## CONCLUSION

*As a result of the survey, we can come to the following conclusions:*

- *Institutions have a major role in technological change. Developed countries with a relatively well-established institutional environment are noticeably intensified by technological change;*
- *Developing countries with a number of inventions, like China, have made considerable progress. Over the past 20 years, the share of inventions in emerging economies has dynamic growth trend, in contrast to developed countries.*

*There is no clear pattern between the change in the GDP per capita and the number of patented inventions characterizing economic growth..*

[14] The table is compiled on the basis of WB statistical data, and the classification of countries according to the level of development conforms to the UN classification.

***In this section of the "Innovative and Institutional Developments" electronic magazine are described the magistrate students analyzes in thematic areas of the Scientific Laboratory "Innovative and Institutional Research", which were made under the direction of both the Scientific Director of the Laboratory, Ph.D., Associate Professor Atom Margaryan and Laboratory Senior Researcher, Ph.d Harutyun Terzyan and with scientific-methodological support.***

# 1. COMBINATION OF TECHNOLOGICAL AND INSTITUTIONAL CHANGES AS A BASELINE FOR THE ECONOMIC DEVELOPMENT

## *(by the example of blockchain technology)*

**LIANA ISAYAN**

Institutional and technological factors have high impact on moodern economic discussions and researches. There is a great deal of literature on this subject, and it is interesting to see what is the image of theabove mentioned factors, their impact on economic growth, and the co-ordination of institutional-technological factors (the latter will be considered by blocchey technology) in Armenia.

Among the many factors influencing economic growth, institutions have an important role, for example Achemoglu, Robinson and Johnson talk about this in their well-known work: "Institutions as a fundamental cause of long-term economic growth"[15]. On the other hand, economists have been actively discussing the economic role of technologies and innovations, especially in recent years, in journals such as "Jurnal of open innovations", "Journal of Innovation Economics & Management", "Economics of Innovation and New Technology".

[15]https://economics.mit.edu/files/4469

Researchers who explore these issues have found a link between technological innovation and national economic prosperity. For example, a study in 120 countries carried by Kristian Kiani during 1980-2006 estimated that each 10 percentage point increase in broadband penetration adds 1.3 percent to a high income country's gross domestic product and 1.21 percent for low to middle-income nations[16].

In addition, Taylor Reynolds analyzed the role of communication infrastructure investment in OECD countries and found that almost all types of technology developments are crucial in their economic stimulus packages. He shows that there is a close link between telecommunication investment and economic growth and especially following recessions. Such investments help countries to create jobs and lay the groundworkfor long-term economic development.

[16]Christine Zhen-Wei Qiang, "Telecommunications and Economic Growth," Washington, D.C.: World Bank, unpublished paper.

And what kind of impacts do these factors have on the economic growth of our country? In order to answer this question we did a regression analysis as explaining variables (x1, x2) taking two of the twelve pillars used in the World Competitiveness Report published by the World Economic Forum since 2007: Institutions and Technology Readiness, and dependent variable (y), economic growth rate.

$$(1)\ GDP_i = \alpha + \beta * Inst_i + \nu * Tech_i + \varepsilon_i,$$

where

GDPi is the i-yearGDP growth rate,
Insti, Techi i-year independent variables,
α, β and ν are unknown parameters,
εi is the i-yearrandom error of the model.

By evaluating the model with the least squares method using R programming language, the following relationships are noticed between variables:

$$(2)\ GDPi = 2{,}9 * Insti - 16{,}9 * Techi + 9.$$

As we can see from Equation 2, there is an obvious direct correlation between the current economic growth rate and the institutional factor (improvement by 1 point will result in an increase of 2.9 percent of the GDP growth rate), and in the case of a technological factor, there is a surprisingly high reverse connection. To understand, the last, not logical connection, let's look at the dynamics of this indicators.

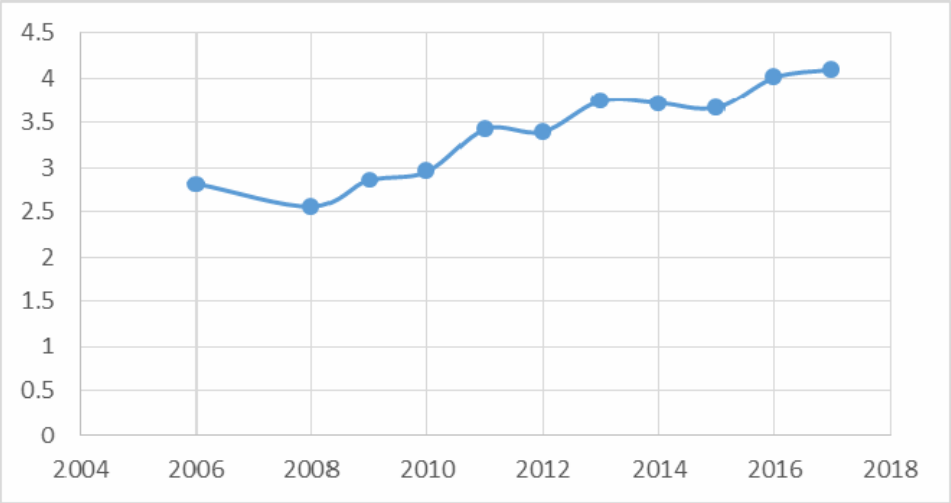



CHART 1. ***The dynamics of technological readiness pillar of the World Competitiveness Index for Armenia.***

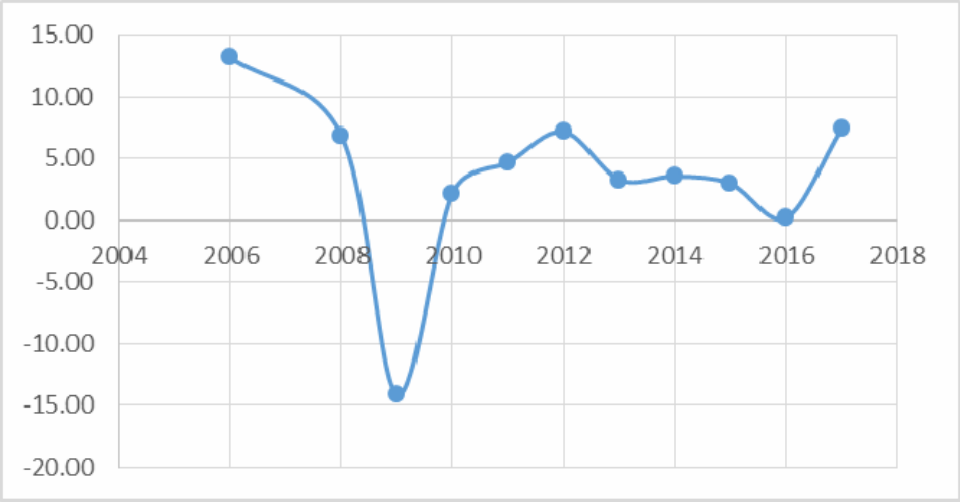



**CHART 2.** ***Dynamics of GDP growth rate of Armenia during 2006-2017***

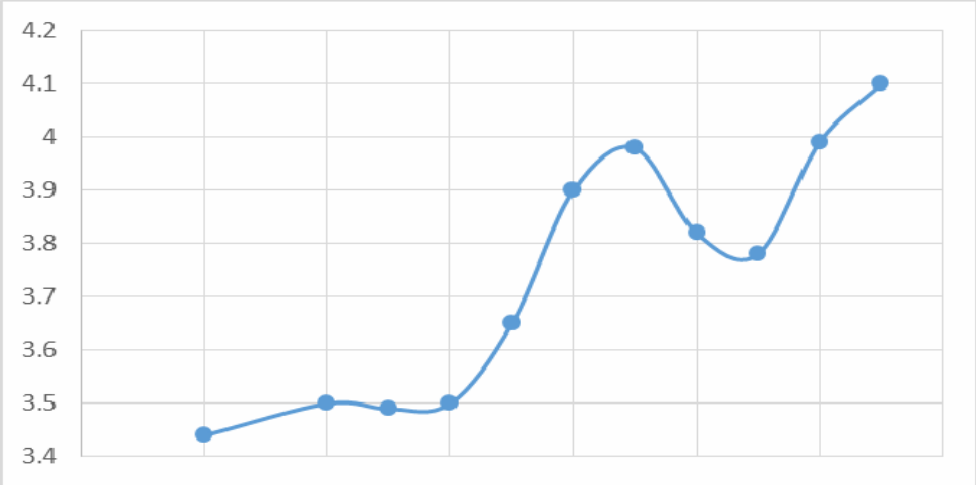



**CHART 3.** ***The dynamics of institutionspillar of the World Competitiveness Index for Armenia.***

As you can see, during 2006-2017, the technology readiness index has grown smoothly, whereas the GDP growth rate has recorded significant shocks and has generally been dropping. At the same time, there is also a shock in the index of institutes, which allows us to claim that progress in the field of technology has been independent of the overall state of the economy and, in turn, did not have a significant impact on economic growth. It is not accidental that over this years, information and communication activity in the formation of our country's GDP amounted to 3.3-3.4%. The key issue is to take steps so that this important field will not be independent from our economy.

As to the model's accuracy, it should be noted that the correlation coefficient R is important in the regression analysis, which indicates the closeness of the connection. To be considered as a "good" analysis in econometrics, it is considered that R should be greater than 0.75, but given that our model is linear, the received figures can be considered useful:

```
> cor(a$GDP,a$Institutions)
[1] 0.126945
> cor(a$GDP,a$Technological.readiness)
[1] 0.06146538
```

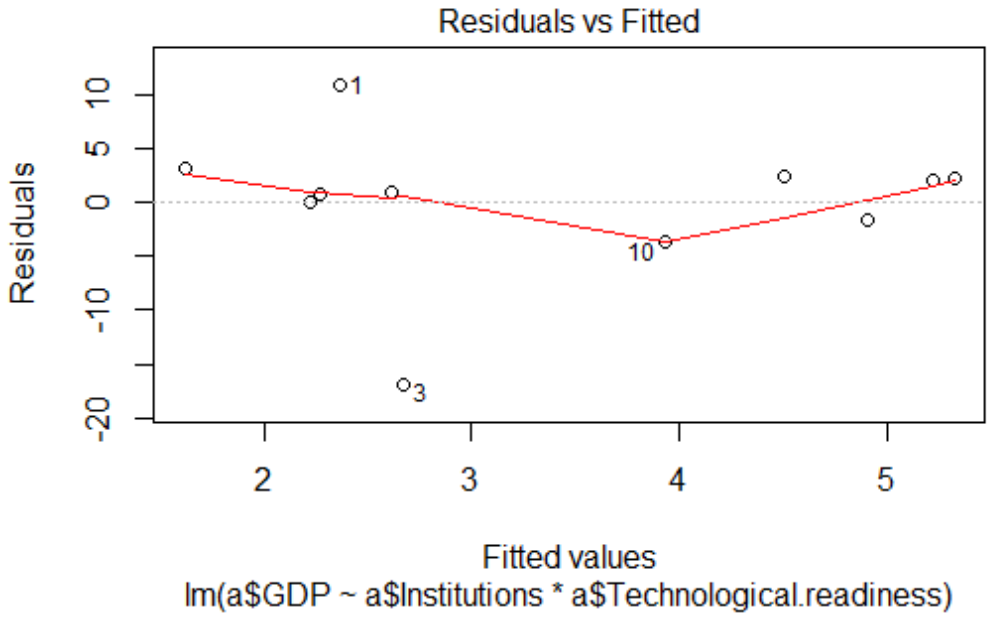
Also an important coefficient is the coefficient of determination ($R^2$), which shows how much the data corresponds to the regression line (trend curve): the closer the coefficient is to 1, the accurate conclusion is. In our case the coefficient of determination is 0.04, which means that only 4% of the values correspond to the equationwhichis not the desired result, and can meanexcessive deviation from the average for some of the data used. For this purpose, we have removed years with the largest and smallest GDP growth rates (the data on the second model are also in the appendices) and in that model we had 0.37 coefficient of determination, but since there were more serious issues of reliability, we will continue the discussion of the first model.

Generally, certain criterias are defined in the literature, which assess the results of the regression model:

- coefficients should have theoretically correct sign and size,
- the angular coefficient should be considerably different from zero,
- the level of the determination coefficient should be high enough,
- model errors should be normal distributed and should not contain defining error, multicollinearity, heteroscedasticity, autocorrelation[17].

We have already talked about the first three points and now let's talk about the other phenomenons separately.

Of course, there are many tests to check for the existence of heteroscedasticity, but we will not deal with them, as it is a common practice to understand that by the distribution of remnants[18].




The presence of autotranslation is checked by the famous test of Darbin-Watson, which results can be seen below:

[17] Ղուշչյան Լ., Թերզյան Տ., Դավթյան Լ., «Տարրական էկոնոմետրիկա», Եր., 2002:
[18] The same place: page 256:

```
> dwtest(model)

        Durbin-Watson test

data:  model
DW = 1.8271, p-value = 0.1328
alternative hypothesis: true autocorrelation is greater than 0

>
```

```
> dwtest(model1)

        Durbin-Watson test

data:  model1
DW = 2.6743, p-value = 0.513
alternative hypothesis: true autocorrelation is greater than 0

>
```

This means that 38.2% there is an autocorrelation in the model, that is, the explanatory variables are not significantly related to each other (51% in 2nd model).

The presence of multicollinearity can be denied by the Clayn's significance order, according to which if the coefficient of determination for each indicator separately does not exceed the coefficient of determination for initial regression model, there is no multicollinearity. Thus, the coefficients of supportive regression (regression according to each explanatory variable) for our model are 0.016, 0.004.

Thus, in spite of a number of problems in the model, the rate of economic growth in our country is largely conditioned by these important factors, and therefore they are worthy of serious attention. What can be said about their co-ordination and joint development? Let's look at blockchain technology example.

At present, the topic of the blockchain, which is actively discussed in the field of technology, business and politics, remains incompletely discovered and controversial. It is important to note that blockchain and cryptocurrencies are not the same, as if now thousands of cryptocurrencies have been created using blockchain technology, some of which may even be "useless", the fieldactually is widespread, in favor of which there are many opinions, and criticisms are mostly related to cryptocurrencies.

There is also a point that some of the controversial opinions and the use of such levers, such as recent Moody's analysis of technology and risky assessment, have a special purpose: redistribution by those who are out of the game,by means of which the recent shock in the cypriot market is explained (a sharp drop in February and current market recovery).

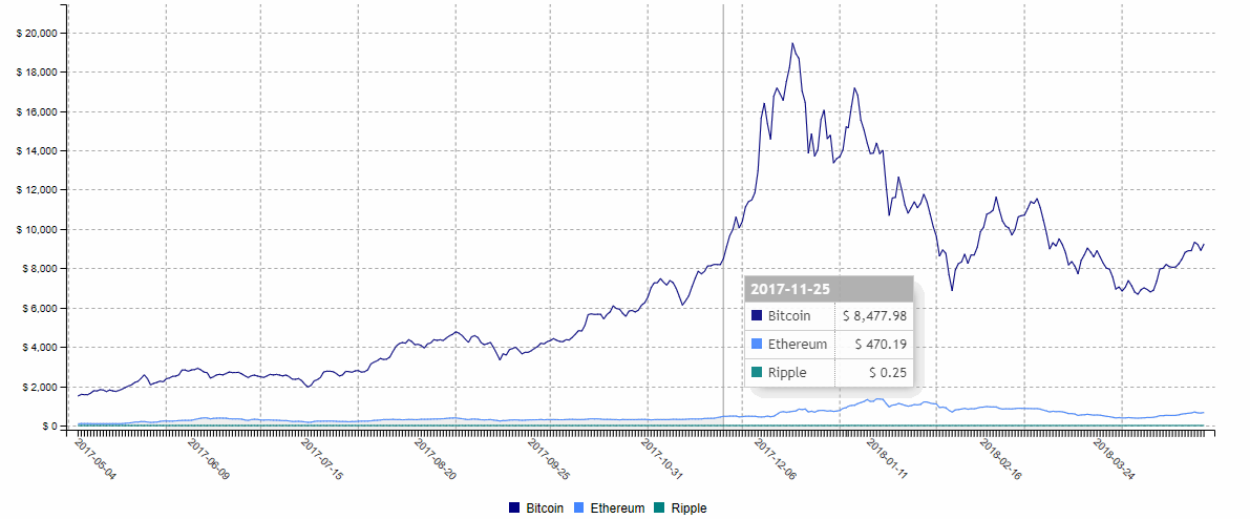
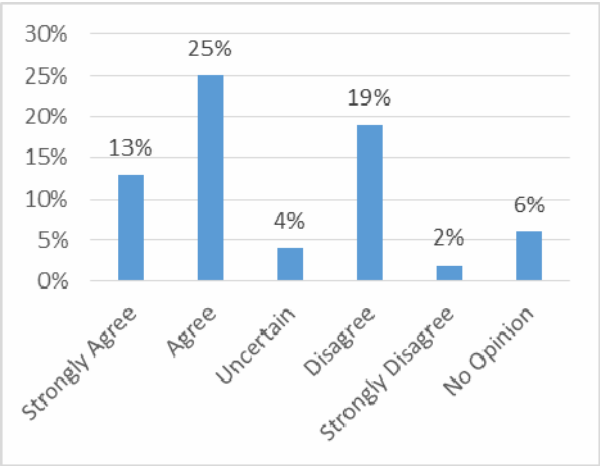



**CHART 4.** ***Dynamics of the values of cryptocurrencies' leading trio (USD)***[19]

But what do economists think about this? The Chicago Booth School runs periodic reviews of the opinion of economists about bitcoin and according to one of this 61 percent of economists believe that the value is derived from the fact that everyone thinks that others will want to use it in trade, so in the future, its purchasing power will fluctuate so much that, in the future, will reduce its usefulness. And, for example, according to a recent study (09.03.18), 25% of experts believe that it is more like gold than currencies.



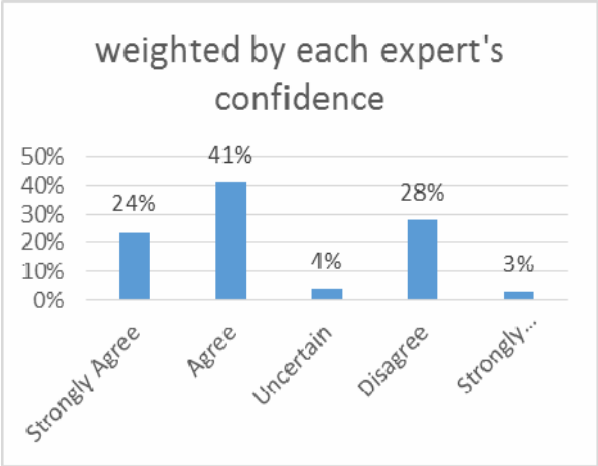




**CHART 5.** ***Economists' response to the question on cypriotcurrencies***

Becausethere are neoclassical economics, institutional and evolutionary economic fields, it is important to make following classification of blockchain typ: public blockchain (eg, bitcoin), permissioned (eg, ripple) and private blockchain (with local, restricted access). If in the case of the latter, blockchainis to reduce the transformation costs and to increase efficiency, such as computers, the Internet, etc. (mostly about thistalk neoclassical economists), for the first case blockchain is considered to be a new institution for

[19]https://www.cryptocurrencychart.com/

economic co-ordination and substitutefor institutions such as firm, market, state, rational contractual relations, about whichtalk Coase, Williamson, Alchian, etc. Unlike the above mentioned elements, blockchain is a decentralized system and does not need a third party for a transaction (such as a notary, real estate registration institution, other intermediaries providing reliability of transactions), thereby reducing transaction costs. Here we will talk about blockchain as institute, about the attitude of the states towards the technology, experiences of different countries in public sector and the legislative regulations.

Now there is no country that has a full legislative framework in this area, and the approaches of the countries differ largely: if some straightly walk towards a full legislative regulation, in some others such activities were prohibited by law because of suspicion of criminal circulation, complexity of supervision and other reasons. This is especially important for crypto-currency, as the most important feature of any monetary unit, as it has long been known in economics, is universal recognition. Consider a few countries.

Japan, for example, is one of the first countries to legalize cypriotcurrencies: from april 2017 cypriotcurrenciescan be used by individuals and organizations as a means of trade. As a result, 63% of the world's bitcoin is now traded in this country, whereas the Financial System Regulatory Body (FSA) months ago talked about the risks of ICO (initial coin offering) and this kinde of funding may even be banned in this country.

Switzerland is also an attractive country for blockchain startups, with independent government-backed organization: The Crypto Valley Association, although there is still no unified regulatory legislation in the European Union, and the European Central Bank has advised banks not to carry out transactions in cryptocurrencies since 2014, until the field has a full legislative regulation.

US has classified the bitcoin as a convertible decentralized virtual currency in 2013. Here bitcoin is taxed as property. Bitcoin is also legal in Mexico since 2017: it is regulated as a virtual currency by FinTech law.

Belarus. here on 28.03.2018 the decree of the President "On Digital Economy" has come into effect, in which the crypto and related activities are considered legitimate[20]. By the decree unprecedented freedom and incentives are given to industry agents, including tax exemptions. Before that, a new accounting standard was adopted in this country, which regulates the recording of cypriotcurrencies.

Below you can see examples of blockchain programs implemented by governments in a number of countries.

[20]http://president.gov.by/ru/official_documents_ru/view/dekret-8-ot-21-dekabrja-2017-g-17716/

**TABLE 1.** ***Projects implemented by governments of different countries using blockchain technology***[21]

| Nation | Project | Status |
|---|---|---|
| Australia | Australian senators launch parliamentary friends of blockchain group. | Announced in August 9, 2017 |
| | The Australian Securities Exchange (ASX) announced that they will use blockchain technology to clear and settle trades by replacing the outdated Clearing House Electronic Subregister System, also known as CHESS. | Announced in December, 2017. The proposed transition is expected to take place in March 2018. |
| China | Social security funds management system | Announced in 2016 |
| | Mortgage valuations on blockchain | Announced in 2016 |
| | Blockchain-based asset custody system (PSBC) | Successfully executed more than 100 real business transactions on the blockchain since the system went live in October 2016 |
| | Blockchain city project (By Wanxiang Group) | The project was announced by Wanxiang Group in 2016 and backed by Chinese government |
| Dubai | Government documents management system to be enacted by 2020 | Ongoing |
| | Global blockchain council (GBC) was established in 2016 with 32 members, including government entities, international companies, leading UAE banks, free zones, and international blockchain technology firms | Ongoing |
| | Digital passport based on blockchain | Announced in June 2017 |
| | Real-time information system about shipments to Dubai | Announced in 2017 |
| Estonia | eID (electronic ID management system) | The government is currently upgrading the existing system with blockchain technology. |
| | E-health (medical information management system) | The government is currently upgrading the existing system with blockchain technology. |
| | e-Residency (a first-of-a-kind a transnational digital identity) | Since 2015, more than 27,000 people from 143 countries have applied and 4272 companies have been established as of December 2017 |
| France | French government has adopted new rules that will enable banks and fintech firms to establish blockchain platforms for unlisted securities trading. | Announced in December, 2017 |
| Ghana | Land title registry project by NGO "Bitland" | Ongoing |
| Georgia | Land title registry project | Ongoing |
| Honduras | Land title registry project | Announced in 2015 and known as failure now |
| Kazakhstan | Announced that they will make the most favorable business climate for cryptocurrency and Financial technology(Fintech) | Announced in July 17, 2017 |

[21]MyungSan Jun, 'Blockchain government - a next form of infrastructure for the twenty-first century', 2018

***Our country's approach.*** The developments in the private sector are quite encouraging, for example, we can talk about organizations such as R & D Hub, YLedger, Hex Division, and so on, about the Yerevan Blockchain Hackathon, about the recently published Multi Group Concern's and the Swedish "Omnia Tech" Company's cooperationto create the world's largest mining company in Armenia and so on. Recently the First Armenian Blockchain Conference havebeen held in Armenia, former Minister of Economic Development and Investmentsalso attended, and which, as we can suppose from main projects: 12 master classes, 15 startup projects presentations, and announcent oabout creating Blokchein Open University[22], is mainly focused on the private sector. And what do we have in the public sector, from the point of view of the legislative regulation?

In February 2018, the "YELQ" faction attempted to adopt a legislative regulation in the National Assembly of Armenia and proposed a draft law of RA "On Digital Technology Development" (*Ղ-253-05.02.2018-ՖԿ-011/0*)[23]. According to the authors, the goal is to create liberal, equitable conditions in the field, to exclude monopolies, to provide tax privileges for industry. However, the project was rejected, primarily by addressing world-wide worries related to money laundering and terrorist activities. The project was also criticized for some omissions (it was noted that even the definition of technology was incorrect in Article 3 of the draft law). And, on 05.04.18, the Central Bank of Armenia sent a two-page note on the "Crypto Currency" to all financial institutions operating in the RA, in which the Monetary Authority warns the financial institutions about high risks of this kind of transactions, possible dangeres and possible violations of legislative requirements and informs that this may result in the application of a measure of responsibility towards a financial organization and / or its employee while implementing following activities: any kind of operation by "cryptoactives" and / or rendering of any services using them, as well as offering financial and banking services to persons carrying out "cryptoactive" operations, advertising this services, etc.

At the end, let's talk about one of the most discussed issues in the field. The Chairman of the Nooor blockchain Armenian Association Vigen Arushanyan has recently posted on his Facebook page[24] an open letter to now already the Prime Minister of Armenai Nikol Pashinyan offering him to hold the upcoming elections with blockchain technology bringing examples of government programs of some countries using blockchain. Active discussions on the topic followed it, a serious sectoral discussion was organized at Hero Hause, the second blockhead hackathon in Armenia was announced: "Blockchain Hackathon. Securing the integrity of elections with oracles ".

In fact, blockchain technology now has multi-industry applications, but there are also few examples of using technology in polling system, some of which we will present below[25].

[22]http://www.mineconomy.am/hy/927
[23]http://www.parliament.am/drafts.php?sel=showdraft&DraftID=47426
[24]https://www.facebook.com/vigen.arushanyan
[25]MyungSan Jun "Blockchain government — a next form of infrastructure for the twenty-first century", Jun Journal of Open Innovation: Technology, Market, and Complexity (2018) 4:7

**TABLE 2.** ***Examples of organizing the selection processby blockchain technology in different countries***

| Nation or Organization | System Name | Base Technology | Application |
|---|---|---|---|
| Abu Dhabi Securities Exchange (Stock Exchange) | – | – | Shareholder voting system |
| Australia Postal Service | – | Digital Assets Holdings | Digital voting of Victoria government |
| Denmark Liberal Alliance | Follow My Vote | Graphene Blockchain Framework | Ballot system for political party |
| Estonia | i-Voting | KSI | National voting system |
| London Stock Exchange(LSE) | – | Hyperledger | Shareholder voting system |
| Moscow government | – | Ethereum | Digital voting of Moscow government |
| Nasdaq | – | – | Shareholder voting system |
| Podemos (Spain) | Agora-Voting | Bitcoin | Ballot system for political party |
| Texas Libertarian Party | VoteWatcher (by Blockchain Technologies Corp) | Florincoin Blockchain | Ballot system for political party |
| Ukraine | E-vox | Ethereum | Voting system for various voting |
| Utah Republican party | Blockchain Apparatus | Smartmatic (private blockchain) | Ballot system for political party |

Thus, as a result of the carried research, it becomes clear that institutes and technologies have a major impact on the economic growth of our country. In particular, according to the results of the regression analysis, institutions are directly proportionate to the economic growth rate, and the technology readiness indicator is independent of the economy. As a result of our research, we can conclude that there are developments in our country regarding the blockchain technology, which is a combination of these factors, which, of course, does not meen we should feel satisfied, and that there is potential for development.

One of the major recommendations is to use the potential of technology factor to achive a positive dynamics in GDP growth rate. This can be done, for example, by regulating theblockchain technology field, with private sector support and innovations like this in public sector.

We also recommend to pay considerable attention to the institutional factor since the recorded direct correlation indicates that the achievements we have here will be reflected in the GDP growth rate, in which we have had a problem for years.

[26]MyungSan Jun, 'Blockchain government - a next form of infrastructure for the twenty-first century', 2018

# 2. GLOBAL VALUE ADDED CHAIN AND ADDED VALUE OF RA

DIANA MATEVOSYAN

Value added is the value added at the product development, recycling and market promotion phase. The added value is the difference between the cost of the product (market price) and costs for its creation (spent raw materials). The value chain describes all the processes that firms and employees do to make the product look more purposeful. These processes are as follows:

- design (design, design),
- production,
- marketing,
- distribution:
- submission (delivery) of the offer to the final consumer.

These processes can include one firm or a division between different firms. Chain processes can produce goods or services in one geographical area or work in several regions to make the final product look. Global value chains are the value chains that are split between many firms and include a large geographical region. Global value chain-GVC's idea is focused on how different tasks and processes are placed on the value chain between the distributed regions.

GVC main streams flows are:

- I2P (importing to produce) - include the results of all imported intermediate releases: raw materials, services,
- I2E (importing to export) - include intermediate foreign goods used to produce goods and services that will be subsequently exported.

According to these flows, two main indicators of GVC's participation in the country are calculated:

1) $\frac{I2P}{export}$

2) $\frac{intermediate\ issue\ of\ the\ given\ country}{export}$

As far as these two indicators are high, so much of the country's participation in global value chains is high.

GVC-length-length chain length according to industrial branches

The GVC-distance to final demand-index measures how many phases / countries the country has to produce before the product or service reaches the end-user.

The country's competitive position in the GVC system is measured in three stages:

1) the volume of GVC accession;
2) Ability to stay part of the GVC,
3) Improving the position within the GVC

The country can not develop in isolation in offering competitive products or services as it can not have competitive advantages in the production of all goods. The country participates in the creation of a global value through its resident companies. The Republic of Armenia had the experience to become a key part of the global value chain, particularly the example of being a part of the USSR, from the design of any product to the final consumer, to the territory of the USSR. This was not as universal as the attempt to participate in a regional value chain that did not lead to the development path because the allocation model was optimal and rational in terms of economics. It was a political (dependent) nature.

### *GVC mechanism*

The GVC system is based on the model of Leontief Intercompact Balance. Below we present it with a conventional copy.

Suppose the global economy is composed of G countries and N branches.

$$AX + Y = X$$

A-gxg dimensional intermediate output matrix

Y-Nx1 size vector of final product of the given country

X-Nx1 size gross product vector of the given country

Returns the vector of global value added coefficients.

$$V = V\_a \times X \wedge (1 - 1)$$

### *RA Value Added*

Value added research will help to make an idea of participation in the global value chains of Armenia.

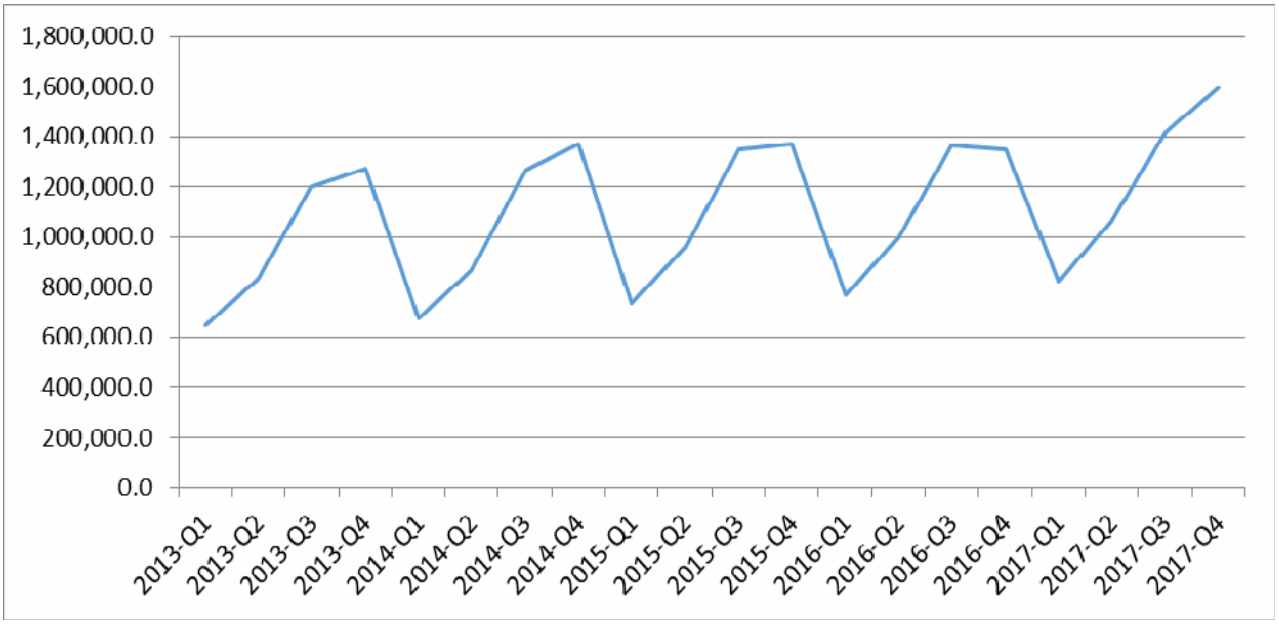



**FIGURE 1.** ***Value added dynamics of RA in 2013-2017 quarterly***

Figure 1 presents the value added dynamics of the RA for 2013-2017 quarterly. The picture shows that the added value of the RA has a strong seasonal effect and a steady increase. Seasonality is explained by the large share of agriculture in added value of Armenia. The agricultural sector is seasonal, so our added value also has a strong effect on seasonality. In average, agriculture provided 1/5 of the added value in 2013-2017. Present the value-added industries in the non-agricultural period during the last 5 years (table. 1).

**TABLE 1.** ***The value-added industries in the non-agricultural period during the last 5 years***

| Period | Sector | Structure, % |
|---|---|---|
| **2013 Q1** | Manufacturing | 15.47 |
| **2014 Q1** | Wholesale and retail trade | 15.08 |
| **2015 Q1** | Wholesale and retail trade | 14.52 |
| **2016 Q1** | Real estate activites | 14.24 |
| **2017 Q1** | Real estate activites | 13.57 |
| **2017 Q2** | Wholesale and retail trade | 13.97 |

I will also present the dynamics of the information and communication industry (figue 2).

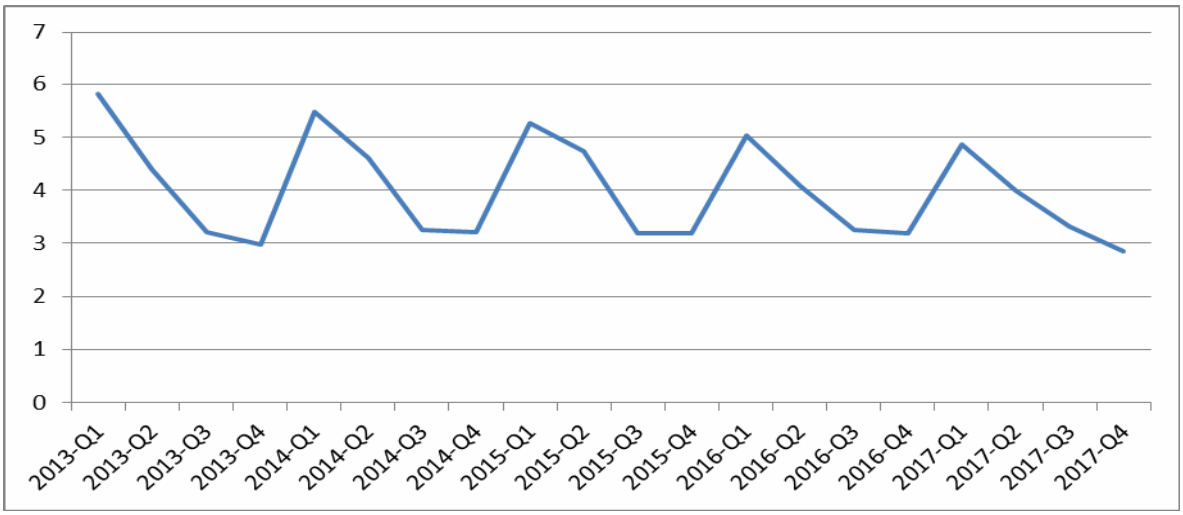



**FIGURE 2.** ***Value added in the sphere of information and communication of RA in 2013-2017 quarterly***

Figure 2 shows that its highest value is recorded in the first quarter of each year. It turns out that there is a potential for value added in the face of information and communication. Keep the FO level at the downturn in the field of information and communication.

Let's summarize the dynamics of the series of the RA NF (sal. 3).

**TABLE 2.** ***Chain dynamics indicators***

| Year | VA | Absolute Growth Rate | Annex Tempo % | Growth rate % | 1% absolute content | Growth pace % |
|---|---|---|---|---|---|---|
| **2013** | 3715256 | - | - | 100 | - | 0 |
| **2014** | 3957638.1 | 242382.1 | 6.52 | 106.52 | 37152.56 | 6.52 |
| **2015** | 4182333.4 | 224695.3 | 5.68 | 105.68 | 39576.381 | 6.05 |
| **2016** | 4418670.5 | 236337.1 | 5.65 | 105.65 | 41823.334 | 6.36 |
| **2017** | 4479057.6 | 60387.1 | 1.37 | 101.37 | 44186.705 | 1.63 |
| ***Total*** | ***20752955.6*** | | | | | |

In 2017, compared to 2016, the FH increased by 60,387.1 million. in AMD or 1.4%. The highest growth was in 2014 - 24,2382.1 million. The minimum increase will be in 2017. The pace of growth shows an upward trend, which indicates the acceleration of FH production.

TABLE 3. ***Dynamics of basic indicators***

| *Year* | *VA* | *Absolute Growth Rate* | *Annex Tempo, %* | *Growth rate, %* |
|---|---|---|---|---|
| **2013** | 3715256 | - | - | 100 |
| **2014** | 3957638.1 | 242382.1 | 6.52 | 106.52 |
| **2015** | 4182333.4 | 467077.4 | 12.57 | 112.57 |
| **2016** | 4418670.5 | 703414.5 | 18.93 | 118.93 |
| **2017** | 4479057.6 | 763801.6 | 20.56 | 120.56 |
| **Total** | 20752955.6 | | | |

In 2017, compared to 2013, the FH has grown to $ 763,801.6 million. in AMD or 20.6%. In 2013-2017 the average wage was 4150591.12 million drams. Every year, the average per capita has grown by 4.8%. To analyze the value-added dynamics of the RA (from the structural perspective of the series) and to build a TSE model for predicting.

$$WO = T + S + E$$

The choice of the model depends on the time series structure. This model assumes that the time series can be summarized as the sum of seasonal, seasonal and random components.

**Step 1:** Make the leveling of the baseline series smooth by the slider method. The received series will not have seasonality.

**Step 2:** Use the seasonal component to estimate the seasonal component. As a result of the calculation, the seasonal adjusting coefficient of the series is K = -8429.222. We got S_i.

**Step 3:** Exclude the seasonality effect by removing the appropriate S_i from each level of the series. It turns out.

$$(2)\ T + E = Y\text{-}S$$

Y-series level

That is, the currently viewed time consists of a trend and an accidental component.

**Step 4:** The following is the trend equation:

$$(3)\ T = 951882.3 + 1382.04 \times t$$

**Step 5:** Consider the time series corresponding to the Adaptive Model: T + S (Table 5).

**TABLE 4.** ***Time series corresponding to the Adaptive Model: T + S***

| Period | T+S |
|---|---|
| 2013-Q1 | 621198.737 |
| 2013-Q2 | 834888.186 |
| 2013-Q3 | 1223045.632 |
| 2013-Q4 | 1266607.27 |
| 2014-Q1 | 676482.914 |
| 2014-Q2 | 890172.363 |
| 2014-Q3 | 1278329.809 |
| 2014-Q4 | 1321891.447 |
| 2015-Q1 | 731767.091 |
| 2015-Q2 | 945456.54 |
| 2015-Q3 | 1333613.986 |
| 2015-Q4 | 1377175.623 |
| 2016-Q1 | 787051.268 |
| 2016-Q2 | 1000740.717 |
| 2016-Q3 | 1388898.162 |
| 2016-Q4 | 1432459.8 |
| 2017-Q1 | 842335.445 |
| 2017-Q2 | 1056024.894 |
| 2017-Q3 | 1444182.339 |
| 2017-Q4 | 1487743.977 |

Check the quality of the model.

Calculate the average percentage error.

(5) MPE = -0.0795%

It does not exceed 5%, so the model is better than this criterion. Calculate the average absolute percentage error.

(6) MAPE = 1.9656%

It does not exceed 10%, so the model is better than this criterion.

Current mistake.

(7) ME = (- 1.6298E-9) / 20-0

Let's consider the coefficient of determinism of the built-in adaptive model.

(8) R & lt; 2 & gt; = 0.98%

It turns out that the built-in adapter model explains 98% of the total variation of the FPW time series.

Fisher criterion.

(9) F_stat = 1131.52

(10) F_criteria = 4.41

11) F_stat> F_crit

Therefore, the equation is statistically significant.

It turns out that the adaptive model of the built-in time series effectively describes the process - the dynamics of the RA NF. We can make predictions for this model of the National Academy of Sciences.

F_ (2018-Q1) = 897619.621 million drams

F_ (2018-Q2) = 111130,071 million drams

F_ (2018-Q3) = 1499466.516 million drams

F_ (2018-Q4) = 154,3028,154 million drams

## Armenia's participation in the GVC

To assess Armenia's participation in GVC, consider the following indicators:

- Net export / GDP
- Trade Turnover / GDP
- RA added value/World added value

For the period under review (2013-2017), Armenia's trade turnover / GDP had an average of 54.5%.

External trade relations are slightly less than half of GDP.

Armenia's net export / GDP ratio was at an average of -21.56%. The Negative Sign by Global Value Added Chain means that the outside world is the 21.56% GDP contribution to our added value. These aggregated indicators show that Armenia does not participate in global value chains, if it looks at 404 commodities, in particular, that Armenia has its share in intermediate production at least with a small fraction (0.04% in trade turnover). I would like to recommend 2 items.

- Wheat - import: 64206.81, export - 315856.91
- Flour grain - import: 120.92, export - 424.68.

Finally, RA added value/World added value is 0.002%.

Thus, it turns out that Armenia, as an open economy, has a share in the global value chains, but with very small share, and mainly in the form of agricultural products (intermediate production).

# 3. THE EFFECT OF TRANSACTION COST ON THE ECONOMIC SYSTEM: IN EXAMPLE OF TAX SYSTEM RA

KAREN SAROYAN

## *The effect of transaction costs on the activity of firm and its role in determining the rational size of the firm*

Transaction costs are the constituent part of the total costs of a firm. As it is said, there is not unified definition of transaction costs so we cannot accurately separate it from other elements of total costs. To solve this problem we divide the total costs of firm into two main partsthat'sare transformation and transaction costs. Based on this context we say that the cost is transformative if it is directly related to production and suppling of goods and services so eventually it is the costs of needed resources for the production of goods and services. On the other hand transaction costs are costs between economic entities for organizing cooperation which aren't directly related to production process, but they also effect on firms activity.

Nevertheless, the experience shows that this classification isn't unequivocal and in some cases transformation costs can be converted to transaction costs. For example, let's consider a one contractual model called "take or pay" widely used in sale of natural gas. The essence of this model is that a customer either has to obtain an adequate volume of gas or pay no to obtaining it since a supplier wants to receive guarantees for its investment, which is expressed in contract with additional condition. For customer it is potential transaction cost while from the point of view of the supplier it will be regarded as a transformational cost. The case is more illustrative when the supplier is an outsourcing organization, which provides additional employees to its customers. When the customer pays an appropriate amount of money for hiring employees he doesn't know clearly whether this hired workers well be used completely or some of them will be idle. Hence it will be right to assume that the supplier or the seller want to gets some guarantees in converting transformation costs to transaction cost, while the buyer or the customer wants to get rid of those transaction costs and to include it in production or transformation costs.

All this taking into account now we will pay attention on our next problem observing a new kind of element which predetermines the optimal sizeof firm and is known as "the center of transaction costs". From institutional economics we know that for the first time there were proposed definitely well-grounded approaches about firms and their borders by R. Couse and O. Williamson. According to Couse firms emerge as a response of increasing market coordination and as a result of existence of transaction costs and they will be tended to expend as long as the costs associated with another additional transaction will not be equal to the same transaction costs incurred

in another firm. In this sense it is more simpler and acceptable the standpoint of O. Williamson.

According to Williamson firms provide more reliable protection of specific assets against extortion and let their owners rapidly adapt to unpredictable events but all this is obtained at the cost of losing incentives. So he concludes that the limits (borders) of the firms go beyond where the benefits of rapidly adapting to new conditions and more reliable protection of specific assets equals to the costs of losing incentives. Fig. 1 illustrates its graphic representation, where.

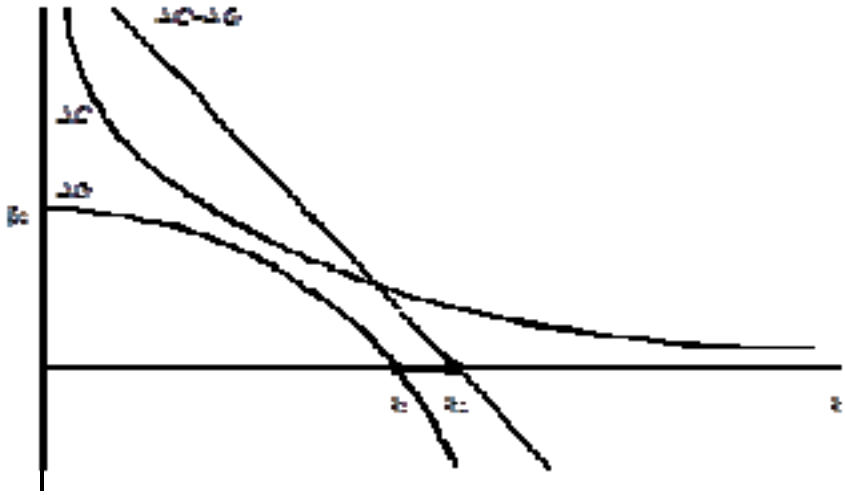


**FIGURE 1.** ***Vertical integration model***

ΔC-the difference of cost between firms own production and buying needed component in the market. This difference is related to the specificity of the resources,

ΔG-the difference of administrative costs between firm and market mechanism,

ΔC+ΔG- the sum of difference of production and administrative costs between firms and market mechanism

k- the degree of resource specificity

β(k)- the administrative costs inside the firm

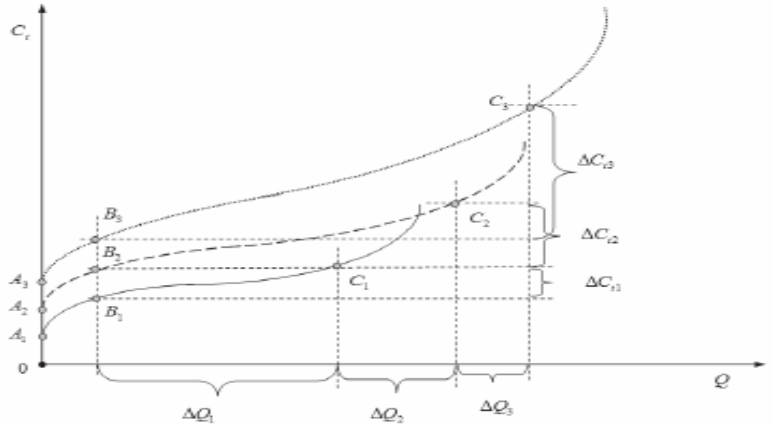
M(k)- market transaction costs

$$\Delta G = \beta(k) - M(k)$$

The question we are interested in is whether it possible to make changes in the structure of firms that will affect especially on the value of ΔG thereby letting expend the boundaries (limits) of the firm. Of course, it is and here is where the idea of "the center of transaction costs" comes to help us. To understand this idea correctly we need to consider it together with two processes directly related to each other:

- the formation of a new element (department) in the firms structure such as the formation of accounting, marketing, juridical departments within the firm,
- the increase in the level of production.

What happens in the total costs of the firm when a new element such as marketing or accounting department is added to itsstructure. As we had admitted that only directly production-related costs were considered as transformation costs, hence the emergence of a new, non-productive element within the firm leads to the increase in total costs thanks to transaction costs. Therefore, in the most general form this connection can be presented in the following graphic form;




$Q$ – level of production
$C_t$ – transaction costs
the transaction costs of the firm consisted of 1 element
the transaction costs of the firm consisted of 2 elements
the transaction costs of the firm consisted of 3 elements

**FIGURE 2.** ***Tthe transaction costs of the firm consisted of several elements***

The part of the curve reflecting the change in the value of transaction costs according to the changes in the level of production from An to Bn shows the proportional increase of transactional costs associated with low adaptability, integration processes in small levels of production. In addition, the enlarged increase of transaction costsin case of small levels of production confirms two known facts;

- low effectiveness (small effect of scale) from per transaction,
- high costs associated with integration within the firm.

The next part of the curve (Bn; Cn)[27] represents the change of transaction costs in the "normal" segment of the volume of levels of production without their sharp increase which is associated with the increase of integration of the transaction processes related to the standardization of these processes and, as a consequence, lack of additional adaptation requirements for the firm. The part of the curve located to the right at Cn, shows the consumption of firms advantages at a given level of transaction processes as well as the qualitative and quantitative enhancement requirements oflabour forcecapable of providing a large-scale and diversity of transaction processes.

The likelihood of the transaction processes of organizational units in the structure of the firm during adding

[27]«Журнал институциональных исследований» Том 7, номер 4, стр. 112-128

additional elements is expressed in a comparable increase of the transaction costs associated with the increase of new elements.This fact is reflected in the equation; |0; A1| = |A1; A2| = |A2; A3|, as well as in identification of the initial growth of transaction costs;(A1; B1) ≡ (A2; B2) ≡ (A3; B3). The most important fact shown in fig. 2 is the fact of low productivity (return) by the addition of a new element in the firm's institutional structure. This is expressed in the reduction of “normal segment” of the changes of transaction costs (related to level of production); ΔQ2 > ΔQ3 and in increase of its variable part enhancement; ΔCi1<ΔCi2<ΔCi3. The explanation of this phenomenon is that the addition of new, additional elements in the structure of the firm, in the current transaction mechanism, leads to the expansion of the co-ordination costs within the firm. Consequently, the larger the number of elements inside the firm, the faster is the consumption of the "normal" integration, the adaptive resource between the elements within the firm.

In order to provide a more figurative representation of the low productivity (return) of the unification of additional resources in the structure of the firm we recommend to exclude the ineffective segments of the level of production(An; Bn) and (Cn; ∞)ʹ related to the apparent absence of firms incentives to maintain the appropriate level of production. Now Let's try to link the points of effective sector Bnand Cn in a straight line to find out the general characteristics of the transaction costs dynamics during adding additional elements in the structure of firm such as shown in fig. 3.

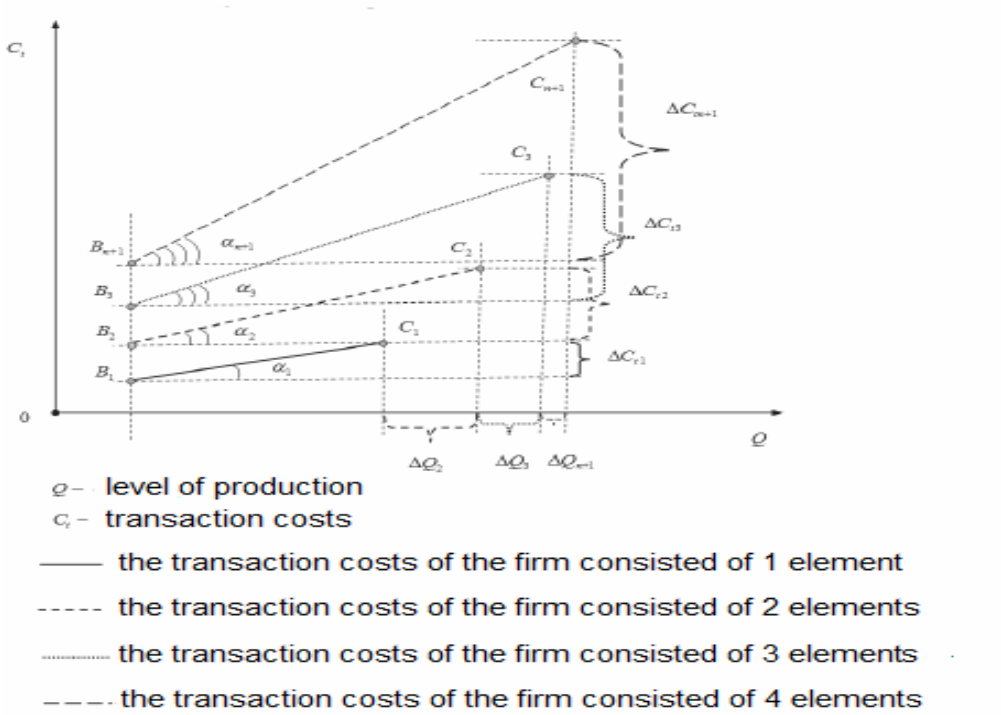



FIGURE 3. ***Tthe transaction costs of the firm consisted of several elements***

As can be found in fig. 3 the inclines ofthe α1, α2, α3, αn + 1 angles as well as the lines connection in a simplified form describe the changing characteristic of firms transaction costs according to level of production.The increase in the inclination of the corners clearly demonstrates the low productivity(return) from the combination of elements during the absence of institutional changes.In addition, it becomes apparent that when the αn + 1> 45° condition is reached, a negative result is generated by a constant, large, intensified growth of the transaction costs that ultimately leads to the absorption of transactional benefits from the combination of these elements. And this moment (the absorption of transaction benefits) is the moment when an extra new transaction is more profitable in the market or in another firm than within the firm.

Consequently, either the firm reacheson potential maximal boundaries of its natural sizes or has to take actions to change its environment and / or technology, although short-term implementation of technological change is extremely difficult, and the impact on the internal institutional environment is improbable. We are inclined to believe that at this time, if not decisive but essential role is playing the introduction of a new component in the firms structure which aims not to create transaction benefits, but to change the internal institutional environment of the firm by creating a center of transaction costs. This type of component should concentrate on significantly larger groups oftransaction costs, which will be reduced due to the scale effect, staff specialization and the flexibility ofinternal structure. The effect of creating a center of transaction costs in the structure of a firm is presented in fig. 4.

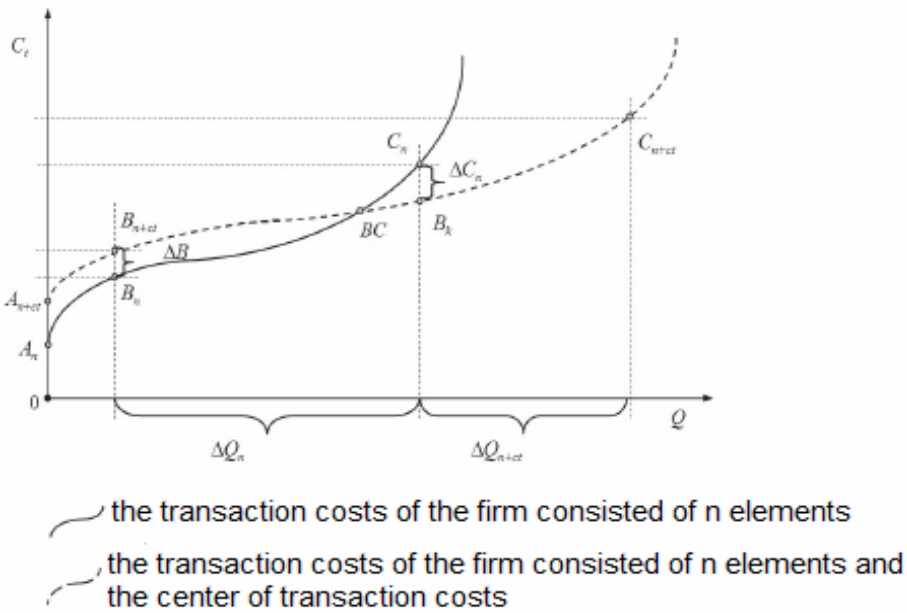



FIGURE 4. ***The effect of the center of transaction costs on a firm***

In fig. 4 the length of the |An; An+ct| ≈ |0; An| segment represents the need of substantial initial costs for creating a center of transaction costs.The ΔB gap of the changing transaction costs describes the negative impact of institutional change inside the firm on small levels of production, and the ΔC gap already reflects the fact ofexisting return in the case of maximumlevels of production creating the center of transaction costs besides the addition of nadditional elements within the firm.

## *The quantitative assessment of transaction costs in the relation of firm-tax system*

If an entrepreneur has to comply with numerous bureaucratic procedures to register as a taxpayer, as well as declare and pay the various taxes established in the tax regulations, those circumstances may entail redundancies, delays and additional costs, and trigger unnecessarily high transaction costs.

Many factors affect the degree to which taxpayers comply with their tax obligations. In general terms they can be grouped into economic and non-economic factors.

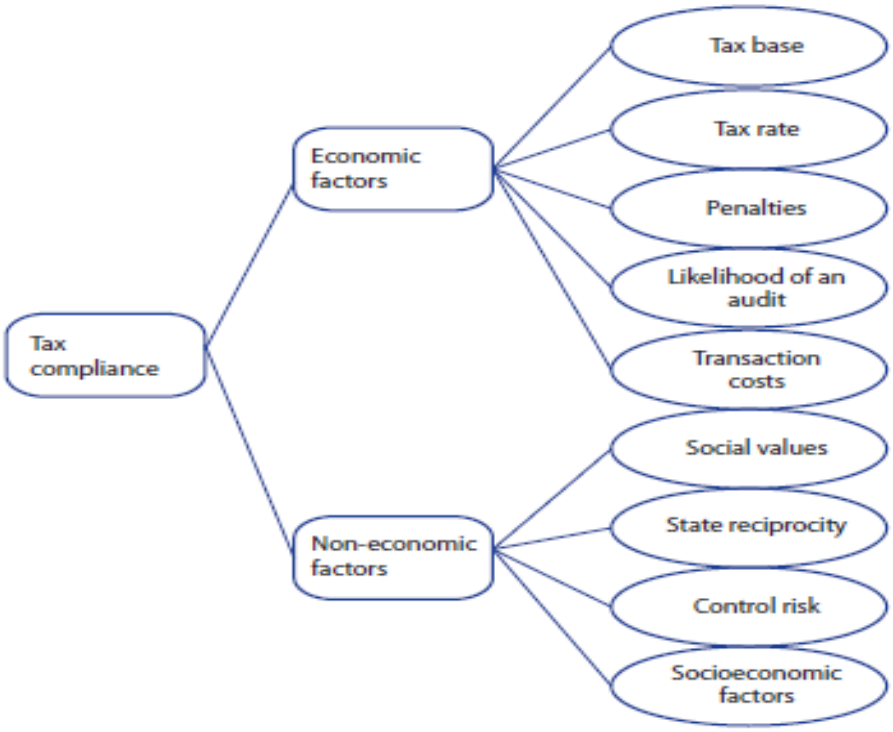



FIGURE 5. ***Factors affecting tax compliance***[28]

[28]Measuring tax transaction costs in small and medium enterprises, p. 4

From fig. 5 it becomes clear that a high-impact economic factor is the tax transaction cost. Tax transaction costs are defined as the sum of the costs to administer the system, or administrative costs, and the costs of having to comply with the system, or tax compliance costs. Administrative costs are those that must be incurred by the tax system's administrator in order to discharge its functions and duties, including: registering taxpayers, carrying out control or auditing programmes, guidance and assistance services, and so on. The costs most commonly considered are the human resources required; the acquisition of furniture, facilities and computer equipment; and the costs incurred in devising means of helping taxpayers to manage their tax obligations.

Tax compliance costs are those that taxpayers must meet in order to comply with the tax legislation in force. They include not only the acquisition or hiring of the human resources, material and information technology needed to comply with such legislation, but also the cost of the time spent in obtaining the information, assistance and guidance needed for tax compliance.

In practice, this two types of costs presented above are very difficult to distinguish, so when talking about tax transaction costs of a firm, we will admit that these costs arise in tax relations between firm and tax system. Therefore, we will apply this approach to theoretically assess the value of the transaction costs according to their particular types.As we know, the theory offers different types of transaction costs that are ultimately classified and grouped in the following types: 1.Search and information costs, 2. bargaining costs, 3. Measurement costs, 4. Property rights protection costs, 5. Costs of opportunistic behavior.

**1.** The costs of searching and obtaining information are considered to be the costs of the firm that are related to the presentation of all necessary documents to tax organ. These expenses are calculated by the following formula:

$$COI = D + P + C + T,$$

where

COI- is the costs of obtaining information,
D- the costs of obtaining all necessary documents,
P- the costs of delivering announcement and electronic applications envisaged by tax legislation,
C- consulting costs,
T- staff training costs.

Transaction costs are calculated on the basis of the documents, which include cash registers, cash books, settlement records, invoices, and other documents required for the financial reports. These costs also include the cost of consulting, as well as staff training.

[29]«Формирование и оценка трансакционных издержек налогового администрирования»_, А. Д. А.

**2.** Bargaining costs include the financial resources and time needed for establishing good relationships with tax authority. Here we can also add additional payments to accountants or other professionals who are required to establish "good relationships" with tax authority. Bargaining costs are calculated by the following formula:

$$NCS = SM * 12,$$

where

NCS- bargaining costs,
SM- additional monthly fees with basic size, 12-months.

It should be taken into consideration that time factor plays a major role in assessing bargaining costs. The factor of time implies the overall duration of the time needed to establish good relationships with tax authority. Sometimes these bribes are included. By the way, the factor of time needed to establish good relationships with tax authority may be measured in the following way.

$$T = Ct * n,$$

where

C- is the total duration of time,
Ct- is the time duration needed to establish contact with the tax authority,
n- the total number of contacts needed to achieve the expected positive result.

In this casebargaining costs are calculated by the following formula:

$$NCR = CC * F,$$

where

NCR- is the cost of establishing good relationships,
CC- costs of contacts,
F- the frequency of contacts per year.

**3.** Measurement costs include the time required to submit the required documents to the tax authority and other costs incurred, such as the additional payments of accountants and other professionals, as well as expenses incurred for submitting other necessary documents to the tax authority. In most cases, the cost of measurement may also include the time of acquiring the accounting software, and the cost of submitting the financial statements to the tax authority. The measurement costs are calculated by the following formula.

$$COM = \Sigma\, n\, I\, Ai * Tp1 + S + E,$$

where

COM- measurement costs,
Ai- annual supplementary fees of accountants or other professionals,
Tp- the ratio of time spent by economic entitles,
S- the costs of acquiring of necessary accounting software,
E- other costs.

**4.** Property rights protection costs include all costs associated with the feesof lawyers, accountants and other professionals who are hired to protect firms property rights in judical, tax, administrative and other processes. These costs also include the costs of that processes. The costs of property right protection can be calculated by the following formula:

$$COPPRL = ((\Sigma\ nLi1) * T / 365)) + E,$$

where

COPPRL- judicial and other costs for protecting the property rights,
Li- the annual fee of lawyers and other professionals,
n- the quantity of lawyers and other proffesionals,
T- the duration of judicial and other processes by days,
365- the number of days in per year,
E- other costs.

**5.** Costs related to the opportunistic behavior are caused by asymmetric information between firm and tax authority when the tax authority pursues its own interests. Costs related to the opportunistic behavior are calculated by the following formula:

$$OPCA = A * (P * T/365),$$

where

OPCA- is the cost of opportunistic behavior associated with the entry of funds into the budget,
A- The amount of money entries into budget,
R-the annual interest rate ofa bank deposit,
T- the number of days,
365- the number of days in per year.

The tax authority seeks to collect as many tax revenues as possible from the economic entities, and consequently, the transaction costs for the firm arise as a result of the opportunistic behavior of the tax authority. However, it should be taken into account that the costs related to opportunistic behavior are considered to be one of the key elements of tax administration since they point to the vulnerabilities of the relations between the tax authority and the taxpayer (firm).

This was the assessment of the several types of transaction costs that arise in the relations between firm and the tax authority and they have a great impact on the effectiveness on the present and future activities of the firm.

## *The assessment of hidden transaction costs in the tax system of Republic of Armenia as an important precondition for assessment of tax administration*

When we speak about transaction costs emerging in a tax system, it is necessary to take into account the fact, that this costs emerge as a result of tax relations between tax authority and business environment, so here we need to clarify the concept of tax relations and what we understand under tax relations.

According to the tax code of Republic of Armenia (Article 1- part 3) tax relation are relations of taxpayers registration, providing of services, determination, calculation and payment of tax and fees and accounting of tax liabilities, but in the cases defined by Code it includes any other relations. So according to its basic legal definition we conclude that the tax system actually acts as a big transaction sector, the goal of which is to ensure the financial interests and stability of the state. However, we all know from practice thatit doesn'talways go as planned so that tax system fully reaches it goals In terms of collecting state budget revenues and this is reflected in the occurrence of tax gap between potential and actual volumes of collected tax entries. Hence, here we will try to estimate the size of that gap and thus to find the hidden transaction costs in the tax field and use this indicator to estimate the tax administration (tax effort).

The analysis of tax gap allows tax-policy makers and stakeholderstoaccurately assess the loose of tax revenues which are related to tax discipline, tax avoidance and to choosing a not optimal tax-policy. There are mathematical ("Top-to-bottom" and "Down-to-Bottom" approaches[30]) and econometric (Stochastic boundary model[31]) models for calculating the tax gap. Here we will use an econometric model.

First of all the assessment of tax gap implies an estimation of potential tax revenues which is carried out by an ADL econometric model. In this work, the ADL model was used to estimate the long-term impact of the explanatory variable on the response variable as a percentage dependence and to calculate the expected value by using that dependence. Since the tax revenues are primarily derived from the GDP and the import hence in this model we consider the dependence of the tax revenues from the GDP, the lags of GDP, the import, the lags of import and from the lags of tax revenues. With significant variables the final model has the following form;

$$Tax = \beta_0 + \beta_1 IMP + \beta_2 GDP_{-1} + \beta_3 GDP_{-4} + \beta_4 ar(2) + \beta_5 ar(3) + \beta_6 ar(4) + \beta_7 ma(1)$$

Ar(2), ar(3) and ar(4) are the 2nd, 3rd and 4th lags of the stationary series of tax revenues, and ma (1) is a shock of the previous period. To assess the model we have taken time series up to the fourth

quarter of the 2016 as we want to estimate the collected tax revenues in 2017 which should actually be collected and compared with actual tax revenues.

Based on the obtained results we can calculate the long-term effect on explanatory variables on the response variable which is carried out by the following way.

$$E(Tax) = \beta_0 + \beta_1 E(IMP) + \beta_2 E(GDP) + \beta_3 E(GDP) + \beta_4 E(Tax) + \beta_5 E(Tax) + \beta_6 E(Tax) \quad (1)$$

$$E(Tax)(1 - \beta_4 - \beta_5 - \beta_6) = \beta_0 + \beta_1 E(IMP) + E(GDP)(\beta_2 + \beta_3) \quad (2)$$

$$\frac{\partial E(Tax)}{\partial E(GDP)} - \frac{(\beta_2 + \beta_3)}{(1 - \beta_4 - \beta_5 - \beta_6)} \quad (3)$$

$$\frac{\partial E(Tax)}{\partial E(IMP)} = \frac{\beta_1}{(1 - \beta_4 - \beta_5 - \beta_6)} \quad (4)$$

(3) and (4) are the assessments of the long-term impact. By placing the corresponding coefficients in (3) and (4), we will get 0.70 and 0.35 respectively, which means if GDP increases by 1% tax revenues will increase by 0.70% and if the amount of imports increases by 1% tax revenues will increase by 0.35%. ma(1) is a shock of the previous periodwhich is calculated by the following formula:

$$\widetilde{Tax_t} - 0.68 * \varepsilon_{t-1},$$

This means that if it is a shock example of 1 standard deviationat t moment, tax revenues will increase by 0.68% at the moment of t + 1, but this shock will be extinguished at t + 2.

For the evaluation, let's consider the changes in GDP and imports for 2016 and 2017 and respectively the change in their tax revenues:

***The GDP, import volumes,tax revenues and their respective growths in 2016 and in 2017***

| *Variables* | *2016թ.* | *2017թ.* | *Nominal growth* | *Real growth* |
|---|---|---|---|---|
| ***GDP*** | **5,067,293.5** | **5,568,901.5** | **9.9%** | **7.5%** |
| ***Import*** | **2,167,275.1** | **2,806,699.2** | **29.5%** | **26.8%** |
| ***Tax revenues*** | **1,079,689.10** | **1,204,053.14** | | |

According to the results, if the nominal GDP grew by 9.9%, tax revenues should grow by 9.9 * 0.70 = 6.93%. Similarly, in the case ofthe nominal growth in the volumes of import tax revenues will grow by 29.5 * 0.35 = 10.33%. If we multiple this growths by the value of tax revenues in 2016 and then summarize that indicators, we will get a result which can be conditionally called as “potential tax revenue”.

In 2016, tax revenues amounted to 1,079,689.10 million drams. Therefore,

according to the effects of GDP and import presented above in 2017 tax revenues should be respectively 1,154,503.49 and 1,191,180.59 million drams, while in 2017 it was actually collected only 1,204,053.14 million drams (including VAT returns). As a result, the difference has been 1,141,630.94 million drams, whichcan be conditionally called as "tax gap" or "tax loophole". However, the result should be clarified taking into account two circumstances. First of all, during the import it is generated a type of tax called VAT (value of additional tax) which a firm can credit. If the firm imports goods into Armenia he must pay a value of additional tax added to the initial value of that good and if this goods are sold inside the country the tax only generated by this part and the firm can credit from it the initial VAT paying during the import. Therefore, to avoid from double-counting the amount of tax (which is actually ***239,284.90***) paid on a border during the import should be deducted from the value of tax revenue generated by GDP. The next circumstance is that besides actually collected taxes there is also tax exemptions or tax privileges which can be collected in other equal conditions and this estimated tax privileges amounted to AMD **356,753** million drams.

As a result, it is assumed that the potential tax revenues which must be collected in 2017 amounted to **1,141,630.94** million drams so the tax gap for 2017 amounted to ***545,593.04*** million drams, which is 10% of GDP. Based on the obtained result we can also estimate the tax administration (tax effort) in 2017 which will allow us to understand that how close we are to the potential tax revenues. So, by making the ratio of actual tax revenues / potential tax revenues, we get that in 2017 the tax administration has made ***68.82%***. This result means that the existing shadow which the tax authority has failed to comply is **31.18**%.