

## The Current Position of Science Development in the World and in Azerbaijan

Sugra Ingilab Humbatova<sup>1</sup>, Solmaz Aghazaki Abidi<sup>2,\*</sup>

<sup>1</sup> Ph.D. Azerbaijan State University of Economics (UNEC), "Economy and management" department

<sup>2</sup> Senior teacher, Azerbaijan State University of Economics (UNEC), "Foreign languages" department

\*Corresponding Author: abidi.solmaz@mail.ru

Copyright©2020 by authors, all rights reserved. Authors agree that this article remains permanently open access under the terms of the Creative Commons Attribution License 4.0 International License

Article History: Received: 10 November 2020; Revised 12 January 2021; Accepted: 27 January 2021;  
Published online: 5 April 2021

**Abstract** Science, knowledge, scientific output and scientific enterprises are leading resource which possesses decisive significant in the field of general development and especially in economical development. It was founded that the role of number of staff dealing with the research is lower in executed scientific technical works for objective reasons. It is explained as follows: their potential is not fully used; In order to realise their potential the favourable environment, conditions and initial capital are not at the same level. Correlation and regression equation (OLS) structured according to the mathematical economy methods and dependency among variables are determined. Application of obtained and will be obtained scientific achievements, inventions are very weak in strong competition in globalization and international free economic conditions.

**Keywords** Scientific Research Activity, Researches and Developments, Indexes of Scientific Citation

### 1. Introduction

Science, knowledge, scientific output and scientific enterprises are leading resource which possesses decisive significant in the field of general development and especially in economical development.

The world experience shows that scientific and technical progress is essential factor to eliminate social and economical reforms, crisis and stabilize economy. On this point, issue of increase of role of science is particularly agenda to renovate products and increase scientific and technical potential for countries transition market economy.

In fact, in the transition to a market economy, none of the countries in the former Soviet Union were scientific and technical progress, not just at the level of economic development. Changing ownership relationships and directing the financial sector to economic reform has highlighted important challenges such as the development of national science, which provides technological refinement of production and the production of competitive products (Баравва, 2007). The scientific technological factor has almost completely been excluded from the reform list of the economy. The result of such a policy has led to the escalation of the technological crisis, the decline in production, the loss of domestic and foreign markets, and increasing technological dependence on foreign countries.

Of course, it must be taken into account that Azerbaijan, which has embarked on its own path of independent development, has a nation-wide complex of industries, with different levels of development of the industry and scientific-technical fields, as well as other states of the union. All of this, undoubtedly, allows to predetermine the potential of Azerbaijan and prospects for the development of national scientific complexes. The world experience shows that, regardless of the size and the natural environment of each state, the technological innovation and socio-economic progress of each state should develop at a fairly high level. This level is determined by the political and socio-economic aspects of science in general in the economy and the development of society. The level of scientific technical progress should not only be sustainable, but also sustainable. Otherwise, the innovative foundation for socio-economic progress will weaken.

At present, the status of science in the Azerbaijani economy is directed to the tendency in the world system. In developed countries, science is viewed as the key to modern economics: innovations are a source of economic growth, science is a priority over the state's activities and other areas, and the dynamics of scientific costs surpass GDP growth. During transition to economic relations, the scientific and technical potential has not only been focused on, but has been subjected to collapse. As a result, the scientific and technical field in the country has led

to a deep crisis that can also be considered as the following: unit technological space was divided into scientific and technical complexes after USSR collapsed; centralized planned system guidance had never thought of equal-strength and self-supply opportunities of the countries included the alliance; large scientific and research and invention centers were placed in Russia, Belorussia and Ukraine; Scientific-technical complexes for the republics such as Azerbaijan, Georgia, Armenia, Kazakhstan and Uzbekistan were aimed at solving minor problems that were highly specialized; there were not raw materials in countries with raw materials such as Turkmenistan and Tajikistan, the scientific direction was almost completely absent. Thus, the scientific academies of national sciences conduct research only on various subjects of fundamental science.

## **2. Theory and Literature Review**

Actual scientific knowledge is a classical social blessing. It is a base of innovation. In addition, it is an essential component of our economy in applied way.

It should be emphasized that data and information is an essential component in formation of scientific knowledge and its main product. In other words, they are both incoming and outgoing (Arrow, 1962, p. 618). However, complete knowledge is broader, shorter and cumulative (Mayr, 1982, p. 23).

Science and concept of science were come across before Aristotle. In certain periods it appeared in Roman language. Use of this concept in English lasted till 1600 and accepted as synonym of knowledge. Initially, it referred to natural, obvious knowledge in comparison with intuitive knowledge. It was called a natural philosophy in English. The deductive method was preferable.

With the new essence of the "natural philosophy" of science, a new word was demanded for practice and experiment. William Wavell the professor of Cambridge University suggested the term of science in 1834.

We should note that exchange among people is not satisfied only with economic sphere. This, of course, also led to the exchange of knowledge and, in general, a scientific revolution in Europe.

One of the famous economists Romer made several important researches during 1980-1993 years. In his works he based on that the long-term growth was first of all stipulated by the knowledge's accumulation. He applied to the idea of Powell (1886) and considered as "the first necessity of capital".

In the second decade of the XXI century scientific-technical progress is one of the decisive factors in removing the crisis phenomena of the economy in stabilization of socio-economic reforms. Many of the problems now facing humankind can be solved only if we approach science more holistically (Kananaskis Village, Alberta (Canada), 1998).

Developments in science and technology are fundamentally altering the way people live, connect, communicate and transact, with profound effects on economic development. (Lee-Roy Chetty, 2012).

From this point of view, updating of production and enhancing the role of science in scientific and technical potential for the transition to market economy countries increasing problem is particularly acute. In reality during the transformation to a market economy none of the states of former Soviet Union was factor of the economic development. As important issues: the changes of economic reforms ownership and technological update the direction of production in the financial sector and the national development of science for providing production of competitive products were in the second plan. We can say that the scientific-technological factor was removed completely from the list of economic reforms. As a result of such policy it has led to aggravation of the technological crisis, decrease in production loss of domestic and foreign market, dependence on growing technologically from foreign countries.

**Research methods:** theoretical and empiric methods were applied, information was realized, induction and currently methods were treated in this article. All science literature, official documents, the results of activity in this direction is studied. Correlation and regression equation structured according to the mathematical economy methods and dependents among variables are determined..

## **3. The Development of Science in the World**

Scientific and research activity in the world experience is regarded as scientific and technical development indices in the country. Also, the total number of scientific articles published in the scientific journals included in the scientific citation index system, such as Sciences Citation Index (SCI) and Social Sciences Citation Index (SSCI), is calculated. As a source of information it is accepted the US National Science Foundation and Thomson Reuters scientific statistical database of the international scientific organizations. Studies of scientific and research work covers the following areas: Earth Science, Astronomy and Cosmos, Mathematics, Physics, Chemistry, Biology, Medicine, Psychology, Sociology Technics and Technology, Mechanical Engineering, Agricultural Science. Indicators of research activities of the world countries are published in the special report of Science and Engineering Indicators of the US National Science Foundation.

These reports, which have been renewed from time to time, are ranked according to the level of research activity published in the above-mentioned journals. A list of world countries based on the 2011 data was

published in 2014.

The given typology is focused on two groups:

1. Resource indicators of science:
  - a) number of engineers and constructors for per 1000 population;
  - b) SREDW costs for per capita of the country (the USA dollar);
  - c) SREDW costs for per investigator (the USA dollar);
  - d) share of financial deduction of SREDW in GDP of the state (in %)
2. Effect indicators of science:
  - a) number of scientific publication for per 1000 of population;
  - b) number of scientific publication for per 1000 of engineers and scientists;
  - c) number of submitted resident patent application for per 1000 population;
  - d) number of submitted resident patent application for per 1000 of scientists and engineers;
  - e) share of high-tech products in total exports of the country
  - f) number of computers for per 1000 of population

Use of relative indicators enables to compare certain big and small countries and also to classify them according to the types of progress level of science.

20 countries include in group of countries with high-progressive science (I group). Among them the USA, Japan, Germany, Great Britain and France are giant countries in this field.

They have high absolute and relative costs (80% of global spending) for SREDW, a large number of employees, a high level of private participation in financing and research, a low share of government, scientific and technological achievements and a stable leadership in discoveries. Although those countries belong to the same groups and possess almost same relative indicators, they can be divided into 3 subgroups:

- a) this group includes countries with high resource costs and high scientific rationality: Sweden, Switzerland, Japan, the USA.
- b) this group includes countries with high resource costs, rather low scientific rationality, where costs exceed income: Germany, France, Israel.
- c) this group includes countries with high scientific rationality and not much resource indicators: European countries (Netherlands, Denmark, Finland, Belgium, Ireland, Norway), also the Great Britain, Canada, Australia, New Zealand, Korea, Singapore.

Countries with medium level science progress are entered in II group. It includes Western European countries (Italy, Spain, Portugal, Greece), Eastern European countries, CIS countries, some countries of Southern, Southeast and Eastern Asia, Southern and Central America. Most of them are in the stage of establishment of new national scientific schools in science and research area. Financial difficulty in these countries confined scientific research opportunities and scientific progress in SREDW stage. Financing is realized thankful to the state exceeding private sectors. This group can also be divided into 3 subgroups for indicators of medium progress of science:

- a) It includes countries with the same costs and scientific rationality indicators. There include countries: In countries such as Czech, Spain, Slovenia, SAR, Romania, Bulgaria, Mexico, Argentina, Chili, Turkey classic science (nature-oriented research that does not require large amount of financial resource) covers structure of SREDW.
- b) This group embraces countries with medium costs indicators and rather low scientific rationality. The list includes Poland, Croatian and Ukraine. Nowadays countries come across with low financing, reduction of scientific and technical potential and “brain flow” in the direction of scientific progress.
- c) This group includes countries with medium and low costs and high scientific rationality. There are 4 countries in this group: Hungary, Slovenia, Thailand and Philippine. Its assessment particularity is due to low resource supplement for science to scientific research possessing descriptive character. This kind of researches does not require much costs, however rationality can be high thankful to publications. Therefore, in the comparison between “costs”/ “product” these countries tend to “product”, consequently it affects their place in the world of science in the world.

III group. Countries with low scientific progress. There are 12 countries in this group: India, China, Tajikistan, Uzbekistan, Vietnam, Uruguay, Ecuador, Egypt, Bolivia, Nigeria, Sri-Lanka, Ben cover 2 subgroups.

a) This group include countries engaged with highly financed scientific product but with rather low indicators. China and India are in this group.

b) Other group of countries with very low financing and lack of scientific and technical personnel, undeveloped scientific infrastructure. Scientific researches in this type of countries are done via support of state budget or foreign sponsors and this finance is mainly spent on agricultural areas and mining work.

#### 4. The Development of Science in Azerbaijan

International experiences show that territorial size, regardless of the natural conditions of each state, its economic and social progress in the source of technological innovation and assimilated technology needs enough high level development. This level of science in the economy and the development of society, political and socio-economic directions are determined.

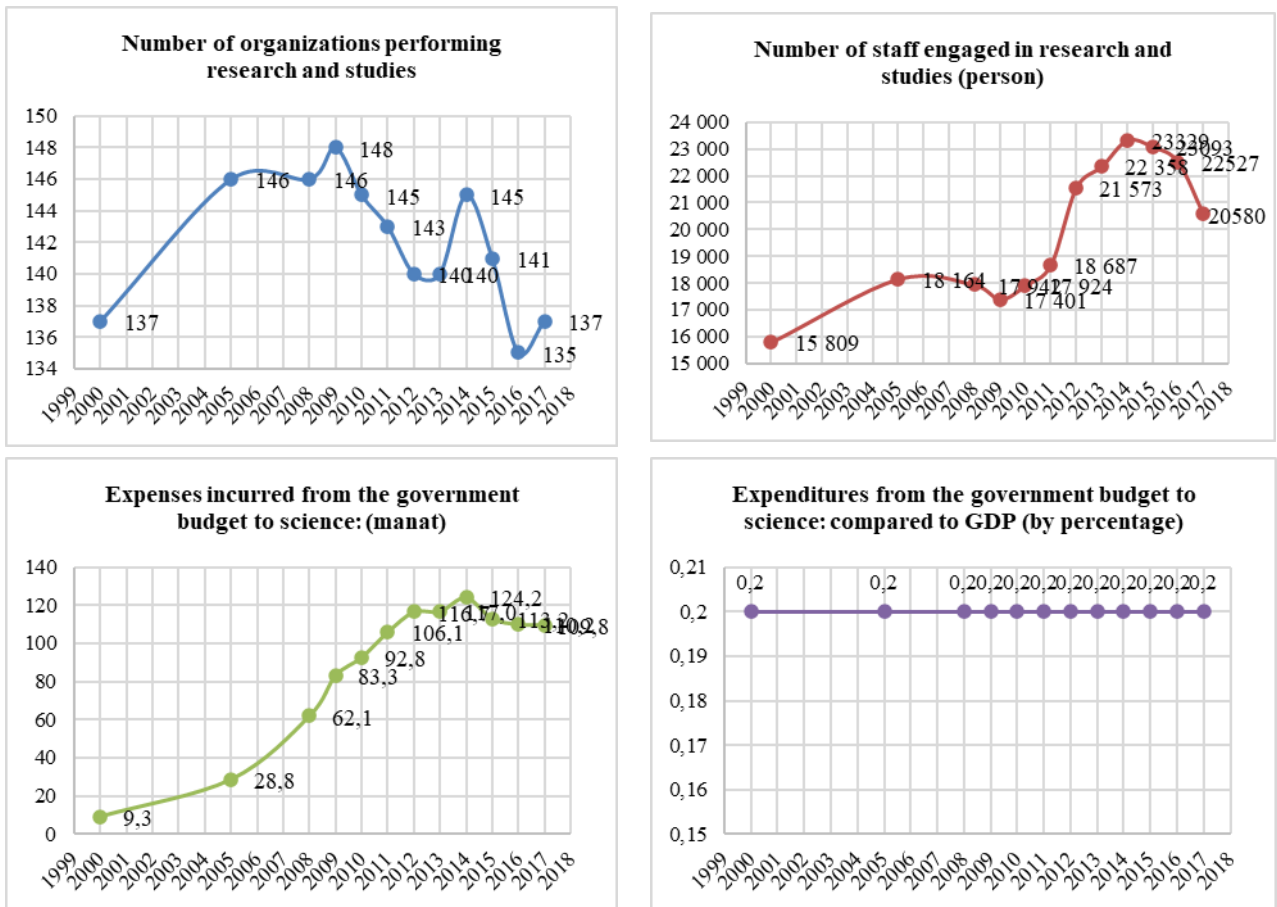
For every nation to get developed, the application of both science and technology has to go hand in hand (Samiksha S. 2015). The level of obtained scientific technical progress is not only sustainable including constantly must be developed. Otherwise the innovation foundation of socio-economic progress will be weakened.

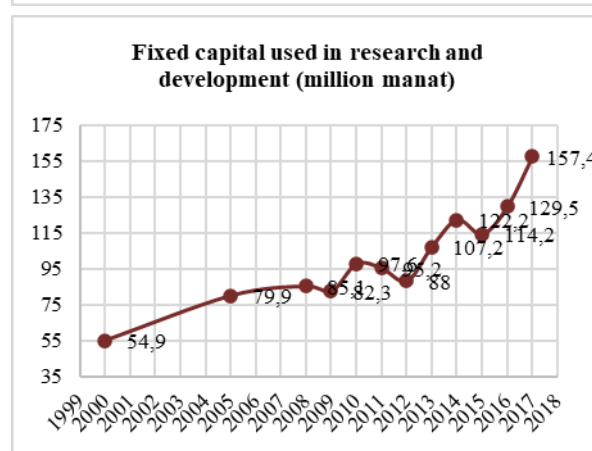
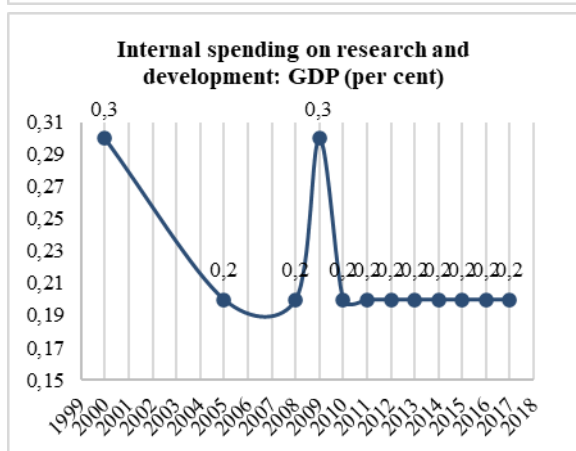
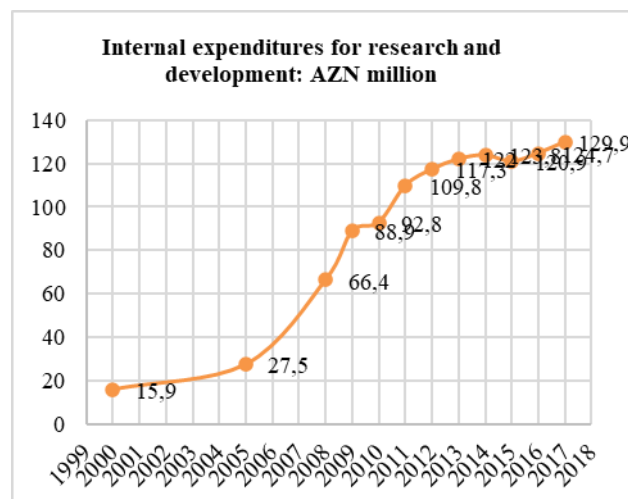
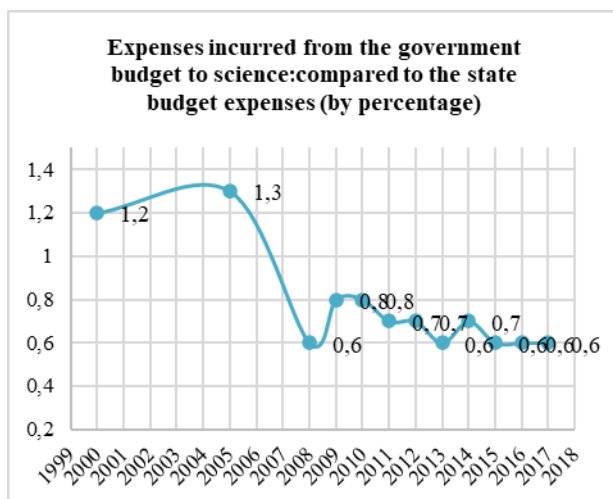
Embarked on the path of independent development Azerbaijan, as the other states of the former Soviet Union had complex national economy developed different levels in the field of industry and scientific-technical areas. Of course all this allow to determine potential of Azerbaijan and prospects of development in the national research facilities in advance.

Currently the science status of Azerbaijan economy is directed towards the world system tendency. In developed countries science is regarded as the key of modern economy: innovations are considered as the source of economy growth, the activity of the government and is the priority over the areas, dynamics of scientific spendings follows the GDP growth rate exceed. It was not paid much attention to the scientific technical potential in transition period of economic relations, even it was destructed. As a consequence of it, it has led to deep crisis situation in the scientifically technical sphere in the country.

Let's take a look at the dynamics and proportion of other indicators of funds allocated from the state budget for scientific research in our country during the year.

**Table 2.** Dynamics of main indicators of scientific and research issues





Science system of the world is very dynamic in terms of time and space. Gradually, progress and degradation of states in the field of science leads to change of their scientific status in the world community. This situation can be seen in the case of Azerbaijan. While studying the key indicators of science in the country in 2005-2015, it was determined that the number of research and development organizations increased from 136 to 141 during 2000-2015. During that period the number of personnel engaged with research and development increased by 1,52 times compared to 2000, 1,37 times compared to 2005, almost remained stable 1,38 times compared to 2010, also number of Doctors of Science in 2015 increased by 2,35 times compared to 2000, 2,29 times compared to 2005, 1,85 times compared to 2010, number of Doctors of Philosophy increased by 1,95 times compared to 2000, 1,96 times compared to 2005, 1,83 times compared to 2010. In addition, the number of scientific and pedagogical workers working in higher education enterprises, who are not enrolled into personnel but engaged with research and development, has decreased. The decrease in 2015 was 0,06 % compared to 2000, 0,15 % compared to 2005, 0,05 % compared to 2010, also the number of Doctors of Science among them during that period in 2015 decreased by 1,15 times compared to 2000, remained unchangeable compared to 2005, 0,09% compared to 2010, the number of Doctors of Science increased by 1,06 times compared to 2000, 1,01 times compared to 2005, 1,10 times compared to 2010. State budget allocated to science in 2015 increased by 12,11 times compared to 2000, 3,93 times compared to 2005, 1,21 times compared to 2010, net weight of GDP remained stable 0,2 percent, net weight of costs of state budget slightly decreased, domestic costs allocated to research and development in 2015 increased by 7,62 times compared to 2000, 4,39 times compared to 2005, 1,31 times compared to 2010, net weight of GDP remained stable 0,2 percent, main funds used in research and development in 2015 increased by 2,08 times compared to 2000, 1,42 times compared to 2005, 1,17 times compared to 2010 (26).

## 5. Result of Research

Lets look through the mutual relations among science indicators:

$$Y_{YYETi} = 15,9138 - 0,00106453 X_{TIMHS} + 1,14657X_{DBEÇX}$$

(0,5013)    (-0,5285)                      (9,0010)\*\*\*

$$R^2 = 0,988294; DW = 1,774998 \quad (1)$$

$$Y_{YYETi} = 34,9187 - 0,00178049X_{TIMHS} - 0,19723X_{Tiiöv} + 1,24058X_{TişÜX}$$

(1,2313)                      (1,2313)    (-0,8860)    (-0,8341)                      (10,0103)\*\*\*

$$R^2 = 0,993607; DW = 2,120417 \quad (2)$$

As the statistic significance is little in basic facilities used in research and works is removed and a new equation is obtained.

$$Y_{YYETi} = 34,3379 - 0,00247932X_{TIMHS} + 1,19742X_{TişÜX}$$

(1,2601)                      (-1,4120)                      (11,0622)\*\*\*

$$R^2 = 0,992125; DW = 1,875425 \quad (3)$$

Note: \*  $p \leq 0,1$ ; \*\*  $p \leq 0,05$ ; \*\*\*  $p \leq 0,01$

- YYETİ — Carried out the volume of scientific technical research
- TİMHS — The number of staff dealing with the research and works
- DBEÇX — Expenses spent for science from state budget
- TİŞÜX — Total expenses for research and works
- TİİÖV — Basic facilities used for research and works

It is clear from obtained equation, all structured three economic mathematical dependence R2 is selected correctly. But all three economic mathematical dependence the statistical significance number of the staff dealing with research and dependence is low ( $p \leq 0,1$ ;  $p \leq 0,05$ ;  $p \leq 0,01$  is not paid) and negative sign.

It shows that the role of number of staff dealing with the research is lower in executed scientific technical works for objective reasons. It is explained as follows: 1. Their potential is not fully used; 2. In order to realise their potential the favourable environment, conditions and initial capital are not at the same level; 3. Application of obtained and will be obtained scientific achievements, inventions are very weak in strong competition in globalization and international free economic conditions.

At the same time although in equation (2) the volume of basic facilities are many but as a result of not using fully the statistic significance of this factor is low and negative sign. For this reason it was removed from next equation.

So, for any successful economy, particularly in today's quest for knowledge-based economies, science, technology and engineering are the basic requisites (Samiksha S. 2015).

In broad terms, there are two possible goals for engaging the policy process and two primary strategies for achieving those goals. The goals are either to improve policies that affect science (policy for science) or to improve policies that can benefit from scientific understanding (science for policy) (*American Meteorological Society. 2006*).

Finally, I hope the decree Strategy Road Map which was signed by president of Azerbaijan Republic in December, 06, 2016 covered the 11 sectors of economy will direct to increase the indicators of our research too.

**REFERENCES**

- [1] American Meteorological Society. 2006. The Role of Science in Society. <https://www.ametsoc.org/ams/index.cfm/policy/learn-the-ropes/science-and-society/the-role-of-science-in-society/>.
- [2] Angela Merkel, The Role of Science in Sustainable Development. Science 17 Jul 1998: Vol. 281, Issue 5375, pp. 336-337 <http://science.sciencemag.org/content/281/5375/336>
- [3] Arrow, K. 1962. "Economic Welfare and the Allocation of Resources for Invention. Princeton, 609-626, Princeton University Press.
- [4] Lee-Roy Chetty. 2012. The Role of Science and Technology in the Developing World in XXI Oct 3, 2012 Ethical Technology <https://ieet.org/index.php/IEET2/more/chetty20121003>
- [5] Machlup, F. 1984. Knowledge: Its Creation, Distribution, and Economic Significance. vol. II, The Economics of Information and Human Capital. Princeton University Press, Princeton.
- [6] Mayr, E. 1982. The Growth of Biological Thought: Diversity, Evolution, and Inheritance. The Belknap Press of Harvard University Press, Cambridge, MA.
- [7] Romer, P. 1986. "Increasing Returns and Long-Run Growth," Journal of Political Economy 94, 1002-1037.
- [8] Role of Science and Technology in Development of Ghana. <https://www.ghanaweb.com/GhanaHomePage/features/Role-of-Science-and-Technology-in-Development-of-Ghana-254448>
- [9] Sakyi, Kwesi Atta. 2012. Role of Science and Technology in Development of Ghana. <https://www.ghanaweb.com/GhanaHomePage/features/Role-of-Science-and-Technology-in-Development-of-Ghana-254448>
- [10] Samiksha S. 2015. Importance of Science and Technology in National Development – Essay. <http://www.yourarticlelibrary.com/technology/importance-of-science-and-technology-in-national-development-essay/8563>
- [11] Варавва М. Ю. К вопросу о роли науки и научных знаний в теориях новой экономики российских экономистов // Известия ОГАУ. 2007. №16-1. URL: <http://cyberleninka.ru/article/n/k-voprosu-o-rol-i-nauki-i-nauchnyh-znaniy-v-teoriyah-novoy-ekonomiki-ros-siyskih-ekonomistov> (дата обращения: 25.05.2017).
- [12] <http://gtmarket.ru/ratings/scientific-and-technical-activity/info>
- [13] <https://www.nsf.gov/statistics/seind14/>
- [14] [www.stat.gov.az](http://www.stat.gov.az)