Systemic effects of international educational and scientific links. Proposals for the development of educational and scientific national system in Georgia

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Abstract: The present paper describes the international educational and scientific links of Georgia. These links promote the development of long-term and close relationship between countries. After the collapse of the Soviet system, Georgia became a transition economy country and the country gained the possibility to widen its educational and scientific links. Reforms are carried out in different directions, including the system of science and education. However, scientific study of the current reforms is presented only as separate evaluations, which, from our point of view, is not sufficient for achieving long-term effective results. By presenting educational and scientific links in the paper jointly, we have developed a model, which shows possible systemic synergistic effects of these links. Such systemic approach is directly connected to the innovative development of the country.

Keywords: education; science; eastern partnership; Erasmus+; Horizon 2020; national science foundation; knowledge triangle; global competitiveness; innovative development; system.


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1 Introduction

Georgia is involved in the process of European integration in the framework of Eastern Partnership. The eastern partnership (EaP) is a joint policy initiative launched at the Prague Summit in May 2009. It aims to deepen and strengthen relations between the European Union and its six Eastern neighbours: Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine. The Eastern Partnership represents the Eastern dimension of the European neighbourhood policy (ENP). Eastern neighbours also participate in the initiatives open to all neighbouring countries (Erasmus+, TAIEX, SIGMA and the Neighbourhood Investment Facility), and in cross-border cooperation programmes.

In 2014–2020, the European neighbourhood instrument (ENI) is the key EU financial instrument for cooperation with the Eastern Partnership countries. It replaces the European neighbourhood and partnership instrument (ENPI) of 2007–2013. Other funding sources are the thematic programmes, focused on human rights and civil society. The EU assistance to Georgia takes mainly the form of country Action Programmes funded every year under the ENI. Georgia benefits also from regional and multi-country Action Programmes funded under the ENI. In 2014–2017, ENI bilateral assistance to Georgia may range between a minimum of €335 million and a maximum of €410 million.

The partnership program is carried out in four basic directions. As noted in the main partnership documents, working group 4 has the potential to support and facilitate the other three working groups, because, as the people to people working group, it can stimulate interaction and communication between civil society within the EaP countries, and between the EaP countries and the rest of Europe.

A lot of the abovementioned documents are devoted to the activities which should be implemented in the field of science and education. In particular, it is noted that the following issues are particularly important for proper development of education:

- need of tools for continuous educations and for grown up people; informal education and long life learning
- stimulating distance learning
- need to facilitate access to information in regions for the young people to study abroad
- more internship opportunities for the EaP countries in the EU countries
• school exchange programmes (students, pupils and teachers)
• involvement of CSOs in the EU educational programmes.

It is considered that for stimulating research, the following measures are needed:
• to develop joint research
• to conduct research in the humanitarian field
• to establish an institutionalised network of researchers from EU and EaP countries and database of studies and researches with free access.

It should be noted that these recommendations are based on the aims and tasks developed by the European Commission in 2009 and represent EU education strategy until 2020.

Georgia is actively collaborating with Europe for the implementation of the requirements of the EU Association Agreement and Neighbourhood Policy. The country is participating in almost all the educational and scientific programs and tries to support development of long term partnerships.

2 Methodology

For the preparation of the present paper we reviewed the literature regarding international education and science programmes, systems, innovations and competitiveness. Data, reports and surveys were analysed in detail in order to create a clear picture of the research topics. One of the main method used is the comparison method, both in time (literature review on participation of Georgia in international educational programmes for the last ten years) and in space (relations with other countries). To test these hypotheses we use the case study as an analytical tool, as well as synthesis, analogy, correlation and systemic approach.

We studied the ongoing reforms in scientific and educational sector of Georgia and international educational and scientific links of the country based on the programs, such as Erasmus +, former Tempus, Erasmus, Tasis and other programs. Georgia has been actively involved in the above programs for the last two decades and multilateral international links have been developed.

International scientific links are mainly coordinated by Shota Rustaveli National Science Foundation. We have studied the directions of the international activities of the Foundation. Educational and scientific system of Georgia in 2008–2015 is evaluated based on the World Economic Forum’s global competitiveness reports. The conducted analysis showed that international links might be discussed as a single system. As a conclusion, we have presented mutually beneficial system of international educational and scientific relations for both parties – donors and beneficiaries.

3 Literature review

“The fundamental role of education is to provide for the development of individuals so that they may realise their full potential in today’s society, and that, consequently, education institutions at all levels have a very broad range of functions and
responsibilities. However, the specific function of education as the basis of the knowledge triangle needs to be further developed” (2009/C 302/03).

“Public policies which encourage partnership between professional institutions, research universities, business and high-tech centres can anchor education in the knowledge triangle, improve the continuum between basic and applied research, and transfer knowledge to the market more effectively” COM (2011, 567 final, p.7).

Besides the documents of the European Commission (COM, 2014, 2010, 2007), our analysis is based on the reports of appropriate organisations (The World Economic Forum, Erasmus+ National Office Georgia, documents of the Ministry of Science and Education of Georgia and the National Statistics Office of Georgia, etc.) and the works by well-known scientists.

It is widely recognised that science and education has a significant impact on economic growth and development. This is argued by a number of researchers, in particular: Friedman (1955); Akerlof and Kranton (2002), Chapman and Greenway (2006), Stromquist (2002), Barro (1991), Englebrecht (2003), Lang (1994), Ryan (2001), Kruger, and Lindahj (2001) and others. It should be noted that the education policy developed and exercised by countries have different implications in developed and developing countries. This is noted by Gunderson and Dreopoulos (2010) and Patrinos and Psacharopoulos (2010).

“Attracting the best students, academics and researchers from outside the EU and developing new forms of cross-border cooperation are key drivers of quality. They can also be important sources of income for institutions” COM (2011, 567 final, p.6). Bettinger (2011) and Chapman (2006) have interesting opinions on this issue.

It is notable that most of the international scientific and educational links are based on the universities, as second academic revolution (Etzkowitz, 2001) defined a new mission of universities: “together with the two traditional missions of instruction and research, a third one: the transformation of scientific knowledge into enterprise competences, therefore, giving birth to the entrepreneurial university” (Martini and Rossi, 2010). Education, science and business are presented jointly in this new mission (Cowan, 2006). However, effective management of research at universities is outlined.

“Compared to North America, the average university in Europe generates far fewer inventions and patents. This is largely due to a less systematic and professional management of knowledge and intellectual property by European universities” COM (2007, p.7). Currently, macro, meso and micro levels are identified and considered in a systemic way in order to improve effectiveness of such management (Tejada-Gomez, 2015).

As our paper deals with the systemic effects, in our opinion it is reasonable to discuss benefits of a system, systems thinking and systemic vision. The word ‘system’ derives from the Greek ‘synhistani’ which means ‘to place together’. In its broadest conception, a ‘system’ may be described as a complex of interacting components together with the relationships among them that permit the identification of a boundary-maintaining entity or process (Laszlo and Krippner, 1998). “The claim that a system is more than the sum of its parts is very well known, and indeed was already made by Aristotle, and it encapsulates a very interesting point, namely that a system has certain qualities and properties that we cannot find in the parts by themselves. These qualities come from the organization of the system” (Morin, 2014).

“Many methodologies are derived from the systems thinking world view including interactive planning, soft systems thinking, systems dynamics, and the viable model to
name a few” (Pourdehnad et al., 2011). “The approach of systems thinking is fundamentally different from that of traditional forms of analysis. This means that instead of isolating smaller and smaller parts of the system being studied, systems thinking works by expanding its view to take into account larger and larger numbers of interactions as an issue is being studied” (Aronson, D. 1996).

For the purposes of this paper, we provide a definition based on Russell Ackoff’s suggestion that a system is a set of two or more interrelated elements with the following properties:

1. each element has an effect on the functioning of the whole
2. each element is affected by at least one other element in the system
3. all possible subgroups of elements also have the first two properties (Ackoff, 1981).

So far, the opinions expressed in our work are cited in three papers – Mulej et al. (2012), Zenko et al. (2013a) and Zenko et al., (2013b). Our approaches provided in our paper are approved by those authors.

It is quite difficult and important to identify systemic connections in business and economic activities. In such case, identification of the measures needed for improving the situation becomes easier. In addition, the system is synergistic and is characterised by a number of subsequent positive effects. Synergy is very difficult to be identified in traditional analysis and it delays in time. Besides the above authors, systemic approach is very effectively used in the researches by Dominici and Levanti (2015), Stowell (2015), Nguyen et al. (2015), Banson (2015), Cancer and Mulej (2014).

4 General review of the reforms in educational and scientific fields of Georgia

After the collapse of the soviet system and regaining its independence, Georgia joined the Bologna process in 2005 (Berge Summit) and the country began to carry out corresponding reforms. The reform package included a series of legal regulations (Law of Georgia on Higher Education, adopted in 2004), the establishment of new institutions (National Examination Centre, National Education Accreditation Centre, Centre for Information and Recognition) and various other initiatives.

Education in Georgia is mandatory for all children aged 6–14. The school system is divided into elementary (six years; age level 6–12), basic (three years; age level 12–15), and secondary (three years; age level 15–18), or alternatively vocational studies (two years). Students with a secondary school certificate have access to higher education. Only the students who have passed the Unified National Examinations may enrol in a state – accredited higher education institution, based on the ranking of scores received at the exams.

At the national level, institutional accreditation has been carried out by the National Education Accreditation Centre, resulting in reduction of over 240 private and public universities in Georgia to a total of 60 (2015). Most of these institutions offer three levels of study: a Bachelor’s Program (three to four years); a Master’s Program (two years), and a Doctoral Program (three years). There is also a Certified Specialist’s Program that represents a single-level higher education program.
Currently, there are three types of Higher Education Institutions (HEIs) in Georgia:

1. University – bachelor, master and doctoral programmes (28 universities)
2. Teaching university – bachelor and master programmes (32 universities)
3. College – bachelor and higher professional educational programmes (14 colleges).

Presently all statutorily recognised HEIs have introduced ECTS and Diploma Supplement. The principle of autonomy of the Higher Educational Institution is stipulated in the Law of Georgia on Higher Education as one of the leading principles of the national HE system. The Law on Higher Education provides an entirely new organisational and management structure for higher education institutions and makes public universities more autonomous, more accountable to the public and democratically governed from the inside. Governance and management here are based on the principle of election and the new legislation defines faculty members, students and professors as chief agents in HE.

The state recognises diplomas issued only by authorised HEIs. Authorisation is granted for five years (shifting to the seven year cycle is planned). The accreditation process defines the status of an existing HEI and/or educational programme.

There is no explicit policy to promote mobility of students from or to Georgia, although the number of incoming and outgoing students is steadily increasing. The vast majority of Georgian students study in the USA, Germany and the UK, followed by other EU countries. The majority of incoming students are from Turkey, followed by India, Russia (students from Russia are mostly ethnic Georgians with Russian citizenship), Azerbaijan, Pakistan and Kazakhstan. Table 1 shows the number of students taking part in educational mobility from and to Georgia from public and private HEIs.

Table 1  The number of students going away from and coming to Georgia to study in public and private HEIs

<table>
<thead>
<tr>
<th>Year</th>
<th>Public HEIs</th>
<th>Private HEIs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The number of students sent abroad to study</td>
<td>The number of students arriving from foreign countries</td>
</tr>
<tr>
<td></td>
<td>The number of students sent abroad to study</td>
<td>The number of students arriving from foreign countries</td>
</tr>
<tr>
<td>2009</td>
<td>125</td>
<td>452</td>
</tr>
<tr>
<td>2015</td>
<td>291</td>
<td>2,577</td>
</tr>
</tbody>
</table>

Source: www.geostat.ge

As Table 1 shows the number of students arriving to Georgia to study has increased more than five times both in public and private higher educational institutions. The number of students coming to Georgia to get education significantly exceeds the number of students leaving Georgia for the same purpose, which indicates Georgia’s competitive advantage in education in the region. This is proved by University Ranking by Academic Performance 2014–2015 (URAP) according to which, by academic performance Ivane Javakhishvili Tbilisi State University (TSU) was ranked among the top 1,000 world universities. In addition, TSU holds 175th position in Physical Science Ranking and 387th position in Mathematical Sciences. According to the same data, TSU is included in top 5% of 23,887 universities in the world and in the top 10% among 4,000 European Universities. TSU hold 7th position among post-Soviet universities.

The main obstacle that hinders attraction of international students to Georgia is the language of teaching. Most courses offered by Georgian HEIs are in Georgian. There are
only a few (about ten) Georgian universities which have programmes in other languages (mostly English, German and French). Mobility of Georgian students to study in foreign countries are mainly financed by international programs and organisations [Erasmus+, German Academic Exchange Service – DAAD, British Council, International Research and Exchanges Board (IREB), International Research and Exchanges Board (IREX), Open Society Georgia Foundation (OSGF), United States Agency for International Development (USAID), Open Society Georgia Foundation (OSGF)]. Besides, in 2005 the Development and Reforms Foundation, founded by the President of Georgia, launched grant fellowships for Georgian graduates to take Master study courses abroad. Mobility of academic and administrative staff is also enabled by bilateral agreements between Georgian and foreign universities. Generally, public universities have longer and more intensive international contacts. However, internationalisation is an increasing trend in leading private HEIs as well. Development of joint academic degree programmes is regarded by the HEIs and the state as one of the most effective tools for programme quality enhancement and internationalisation of Georgian higher education.

The integration of education and research has become one of the top priorities in Georgia. Research is clearly stipulated in the mission of universities as one of the main activities, compared to teaching universities, where it is restricted to the obligatory research component of Master programmes. Since Master and Doctoral programmes are implemented in 81% of Georgian HEIs (the rest represented by colleges), research is an integral part of a university life. However, the research component in HEIs is still underdeveloped.

As a result of the reforms implemented by the new government, studying on 23 specialties at higher educational institutions is fully funded by the state. Ministry of Education and Science of Georgia developed ’strategic directions for the development of the system of education and science’ and introduced it to the public. For the implementation of Vocational Educational and Training Development Strategy for 2013–2020, Strategy Implementation Action Plan was designed.

Some reforms in scientific and research system were carried out in 2010–2011. Scientific-research institutions (scientific centres) under the status legal entity public law (LEPL) were reorganised and integrated in higher educational institutions as separate structural units. The purpose of these reforms were to promote gradual integration of intellectual potential and material resources of educational and scientific institutions, support increase of effectiveness of educational and scientific research activities. As a result of this reform 12 research institutes were integrated with Ivane Javakhishvili Tbilisi State University; seven – with Ilia State University; 14 – with Agricultural University of Georgia; 12 – with Technical University of Georgia; two – with Tbilisi State Medical University; two – with Batumi Shota Rustaveli State University. Four institutes remained in the system of education and science of Georgia with the status of scientific and research institute. Georgian National Academy of Sciences and Georgian Academy of Agricultural Sciences remain fully autonomous institutions with state funding.

In order to evaluate the reforms carried out in educational and scientific fields of Georgia according to international standards we applied Global Competitiveness Reports of 2008–2009–2014–2015 of the World Economic Forum. Based on these reports we provide indicators, which directly and indirectly demonstrate the situation in educational and scientific fields of Georgia (see Table 2).
Table 2 shows that Global Competitiveness Index of Georgia has improved by 24 points over the last eight years and in 2015–2016 the country took 66th position compared with the 90th position in 2008–2009, while the number of the countries covered by the research increased by 6. However, improvement of the competitiveness in the country did not reflect on the indicators of the quality of higher educational system.

As we can see in the Table 2, over the last eight years the indicator of ‘availability of scientists and engineers’ has worsened the most, by 22 positions and the country took 113th position among 140 countries. The same tendency has been observed regarding the ‘quality of the educational system’ which deteriorated by 18 positions (101st position). The indicator of the ‘quality of math and science education’ also worsened by 22 positions (97th position) and resulted in worsening of the indicator of ‘availability of scientists and engineers’. Georgia had the worst results in ‘university-industry collaboration in R&D’. The indicator worsened by 19 positions (128th position). All this indicate low effectiveness of the activities and policy implemented in the system of higher education and science. For achieving better results, new government of Georgia declared education to be the priority of the state policy.

The main directions in education policy of the new government of Georgia are: intensification of scientific and research functions in higher education institutions; opening of new, modern higher education institutions equipped with high technologies; raising competitiveness of vocational education. Some important measures have already been taken in this direction. In particular, funding of education and science has increased compared with the previous year, funding of National Scientific Foundation of Georgia has increased, new concept for development of higher education has been developed by Georgian scientists working in leading educational and scientific centres of foreign countries and is currently under consideration by the society.

### Table 2  The system of education and science of Georgia in 2008–2015 according to the World Economic Forum reports

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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Number of the countries covered by the research</td>
<td>134</td>
<td>133</td>
<td>139</td>
<td>142</td>
<td>144</td>
<td>148</td>
<td>144</td>
<td>140</td>
</tr>
<tr>
<td>2</td>
<td>Georgia’s position among other countries</td>
<td>90</td>
<td>90</td>
<td>93</td>
<td>88</td>
<td>77</td>
<td>72</td>
<td>69</td>
<td>66</td>
</tr>
<tr>
<td>3</td>
<td>Quality of the educational system</td>
<td>83</td>
<td>97</td>
<td>119</td>
<td>116</td>
<td>114</td>
<td>105</td>
<td>98</td>
<td>101</td>
</tr>
<tr>
<td>4</td>
<td>Tertiary education enrolment rate</td>
<td>55</td>
<td>55</td>
<td>66</td>
<td>82</td>
<td>77</td>
<td>77</td>
<td>84</td>
<td>74</td>
</tr>
<tr>
<td>5</td>
<td>Quality of math and science education</td>
<td>75</td>
<td>84</td>
<td>104</td>
<td>100</td>
<td>101</td>
<td>106</td>
<td>105</td>
<td>97</td>
</tr>
<tr>
<td>6</td>
<td>Availability of research and training services</td>
<td>117</td>
<td>96</td>
<td>125</td>
<td>115</td>
<td>119</td>
<td>130</td>
<td>116</td>
<td>116</td>
</tr>
</tbody>
</table>

Table 2  The system of education and science of Georgia in 2008–2015 according to the World Economic Forum reports (continued)

<table>
<thead>
<tr>
<th>#</th>
<th>Indicators</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Quality of scientific research institutions</td>
<td>113</td>
</tr>
<tr>
<td>8</td>
<td>University-industry collaboration in R&amp;D</td>
<td>109</td>
</tr>
<tr>
<td>9</td>
<td>Availability of scientists and engineers</td>
<td>84</td>
</tr>
<tr>
<td>10</td>
<td>PCT patents, applications/million pop</td>
<td>44</td>
</tr>
</tbody>
</table>


5 Main sources for the international educational and scientific links of Georgia

After the collapse of the Soviet Union, international educational and scientific links of Georgia have been established through implementation of Tempus, Erasmus Mundus, FP7 and other programs. Below, we’ll try to provide a succinct description of the outcomes of Georgia’s participation in the above programs.

5.1 Tempus projects in Georgia

Tempus projects in Georgia have created a solid basis for the successful implementation of the Bologna Principles through supporting curriculum development, introduction of the quality assurance mechanisms and lifelong learning. More than 80% of Tempus projects in Georgia have been implemented in the field of curriculum development and modernisation, covering the subject areas of medicine, biology, law, engineering, agriculture, environmental studies, European studies, economics, veterinary medicine and social work.

In the framework of Tempus, new programmes have been developed for Bachelor, Master and doctoral levels of higher education, using ECTS. Implementation of modern teaching, learning and assessment methods have led to the development of curricula compatible with European standards. Since 1995 ca. 17 Mio Euro has been allocated to Georgia in the framework of Tempus projects. In 1995–2013, in the framework of Tempus I, II, III & IV 77 projects were implemented totally, including Tempus I–II selection round 1996–1999 – five projects; Tempus III (selection round 2000–2006) – 19 projects; Tempus IV (selection rounds 2008–2013) – 38 projects (see Table 3).
<table>
<thead>
<tr>
<th>Project type</th>
<th>Tempus I and II</th>
<th>Tempus III</th>
<th>Tempus IV</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joint projects</td>
<td>5</td>
<td>16</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Compact projects</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Structural and complementary measures (Tempus III)</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Structural measures (Tempus IV)</td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>19</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

|                                                       | 2010 | 2011 | 2012 | 2013 |       |
|                                                      | 4    | 4    | 10   | 14   | 59    |
|                                                      | 0    | 0    | 0    | 0    | 5     |
|                                                      | 0    | 1    | 1    | 2    | 5     |
|                                                      | 2    | 5    | 12   | 19   | 77    |

Five capacity building for higher education (ex-Temps) projects involving Georgian higher educational institutions have been selected in 2015. Supporting and monitoring the implementation and dissemination of results of ongoing projects selected under the Tempus IV programme is one of the main responsibilities of National Erasmus+ Office Georgia. Currently 30 Tempus projects are being implemented in Georgia. Last Temps projects will be over by the end of November 2016. Two Jean Monnet projects have been founded in 2015 with participation of Georgian institutions.

The Tempus projects have formed bases for establishing scientific links with the educational centres of the UK, Germany, France, Italy, Austria, Belgium, Netherlands, Spain, Poland, Portugal, Romania, Bulgaria, Estonia, Scotland, Latvia, Serbia, Armenia, Uzbekistan, Ukraine, Azerbaijan, Tajikistan.

5.2 Erasmus Mundus programmes in Georgia

The Erasmus Mundus action 2 – LOT 6 (previously ECW LOT 5) project is addressed to Armenia, Georgia and Azerbaijan. Georgia has been participating in Erasmus Mundus Programme since 2004. The EU partners are from Greece (ATEI of Thessaloniki), Portugal (Politechnic Institute of Viana do castelo), Italy (Sapienza University of Rome), Belgium (Vrije Universiteit Brussel), Latvia (Rezekne’s Augstskola), UK (Swansea Metropolitan University) and Bulgaria (University of Ruse).

Georgian universities participated in 23 Erasmus Mundus consortia since 2007. Currently 18 projects are running involving 17 Georgian Universities (11 public and 6 private) from different cities. Table 4 presents mobility Statistics from Georgia in Erasmus Mundus – Partnerships in 2007–2013 for all types of participants (Undergraduate, Masters, Doctorate, Post-Doctorate and Faculty) with total number 847.

<table>
<thead>
<tr>
<th>Years</th>
<th>Undergraduate</th>
<th>Masters</th>
<th>Doctorate</th>
<th>Post-doctorate</th>
<th>Faculty</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>16</td>
<td>14</td>
<td>11</td>
<td>5</td>
<td>3</td>
<td>49</td>
</tr>
<tr>
<td>2008</td>
<td>23</td>
<td>14</td>
<td>13</td>
<td>5</td>
<td>3</td>
<td>58</td>
</tr>
<tr>
<td>2009</td>
<td>22</td>
<td>17</td>
<td>12</td>
<td>5</td>
<td>3</td>
<td>59</td>
</tr>
<tr>
<td>2010</td>
<td>18</td>
<td>15</td>
<td>10</td>
<td>3</td>
<td>4</td>
<td>50</td>
</tr>
<tr>
<td>2011</td>
<td>18</td>
<td>12</td>
<td>13</td>
<td>8</td>
<td>9</td>
<td>60</td>
</tr>
<tr>
<td>2012</td>
<td>79</td>
<td>68</td>
<td>72</td>
<td>34</td>
<td>45</td>
<td>298</td>
</tr>
<tr>
<td>2013* (planned)</td>
<td>92</td>
<td>65</td>
<td>51</td>
<td>22</td>
<td>43</td>
<td>273</td>
</tr>
<tr>
<td>Total</td>
<td>268</td>
<td>205</td>
<td>182</td>
<td>82</td>
<td>110</td>
<td>847</td>
</tr>
</tbody>
</table>


As Table 4 shows, total number of participants in Erasmus Mundus Programmes in Georgia increased nearly 17.3 times in the period of 2007–2013. The largest increase (36.6 times) was observed in faculty participants, increase in other types of participants was more or less equal – nearly 17 times. These facts prove that participation in Erasmus Mundus programme is a good possibility for widening international educational and scientific relations and for achieving high standards in many various directions of.
scientific research and higher education. Six Georgian students got scholarships for Erasmus Mundus Master Courses in 2015.

For the period from 2014 to 2020, Erasmus+ replaces seven programmes bringing together: The Lifelong Learning Programme (Erasmus, Leonardo da Vinci, Comenius, Grundtvig and Jean Monnet); The Youth in Action programme; Five international cooperation programmes (Erasmus Mundus, Tempus, Alfa, Edulink, the programme for cooperation with industrialised countries); The new sport action.

The Erasmus+ programme aims to boost skills and employability, as well as modernising Education, Training, and Youth work. The seven year programme will have a budget of €14.7 billion; a 40% increase compared to current spending levels, reflecting the EU’s commitment to investing in these areas. Erasmus+ will provide opportunities for over 4 million Europeans to study, train, gain work experience and volunteer abroad. Erasmus+ will support transnational partnerships among Education, Training, and Youth institutions. We hope that international educational links of Georgia will further widen and deepen in the frames of the Erasmus+ programme.

5.3 International scientific links of the Shota Rustaveli National Science Foundation

Establishing a National Science Foundation in 2005 was one of the most important decisions among the measures taken for reforming the system of science and education in Georgia. It was founded by the decree #653 of the President of Georgia on July 17, 2005 aiming to provide state funding for scientific development.

Rustaveli National Science Foundation (SRNSF) was established by the order of the Minister of Education and Science of Georgia, June 28, 2010. Rustaveli National Science Foundation is the successor of Georgian National Science Foundation and Foundation for Georgian Studies, Humanities and Social Sciences (Rustaveli Foundation).

SRNSF allocates funds for the projects in the following 10 directions: Georgian Studies; Humanitarian, Economic and Social Sciences; Engineering, high-technology materials; Information Technologies, telecommunication; Mathematical Sciences; Physical and Chemical Sciences; Life Studies Science; Medical Sciences; Earth Studies Science and Environment and Agrarian Sciences. Apart from the above-mentioned directions, the Rustaveli Foundation also finances ‘Leonardo da Vinci’, a competition for young inventors who study at school, as well as international Olympiads, competitions for developing electronic dictionaries, etc.

In 2014 the budget of Shota Rustaveli National Science Foundation amounted to 22 543 898 GEL (about ten million euros); 95.10% of the budget was spent on grants and programs.

SRNSF promotes implementation of fundamental, applied and innovative research in a competitive environment, development of the knowledge-based society, reinforcing links between science and education, integration of Georgia into international research area and popularisation of science. In cooperation with scientific community, state and private entities Shota Rustaveli National Science Foundation performs its activities transparently and impartially.

In order to fully develop scientific potential of Georgia, it is essential to activate cooperation with the academic fields of leading countries, share their experience, increase involvement in joint research, etc. To conduct activities in this direction the Fund is actively cooperating with international scientific foundations and programs, namely:
Support of International Cooperation: NATO State Stipends. Georgia National Science Foundation has triggered additional measures to encourage participation of Georgian researchers in NATO ‘science for peace and security’ (SPS) Programme.

In 2012, CRDF Global – GRDF scientific grant program was launched. The US Civil Research and Development Foundation (CRDF Global) and Research and Development Foundation of Georgia (GRDF) announced the grant competition in the frames of the project ‘peer review and sustainable science for Georgia’. The program is financed by the Defence Threat Reduction Agency (DTRA), USA and it aims at supporting high quality, innovative biological research in the fields interesting for DTRA which are also important for Georgia’s scientific society.

CRDF–GNSF Young Scientists Support Program. Facilitate early career development of talented young Georgian scholars through funding one year duration research projects (including two to three months lab visits to a US host scientific centres) and strengthen US – Georgia collaborations.

CNRS-GNSF joint programme. The GNSF and the French Centre National de la Recherche Scientifique (CNRS) launch a call for Proposals for Collaborative Bilateral Research Projects. Projects are selected on the basis of their quality and novelty, the perspective they offer for developing the CNRS-GNSF collaboration, young researcher’s recruitment potential, and the perspective for the future joint application to the EU Framework Programme.

Through joint efforts of the Ministry of Foreign Affairs of Japan, the Japan International Cooperation Agency (JICA), the Ministry of Education, Culture, Sports, Science and Technology in Japan (MEXT) and the Japan Science and Technology Agency (JST) a unique program ‘Science and Technology Cooperation on Global Issues’ has been implemented since 2008. The program aims at supporting scientific and technological cooperation with developing countries. It consists of two components: 1. Science and Technology Research Partnership for Sustainable Development (SATREPS); 2. business trips of Japanese scientists involved in Science and Technology Research. SATREPS is implemented in the frames of JICA technical cooperation and aims to widen opportunities for scientists and research institutes and universities of developing countries (including Georgia) which cooperate with Japan in technical issues through implementation of joint research.

The Memorandum on Scientific Cooperation between the Shota Rustaveli National Science Foundation and Jülich Research Centre GmbH (FZJ, Federal Republic of Germany) was signed. The aim of the Memorandum is to develop and strengthen cooperation between universities, research institutions and researchers of both countries.

Science and Technology Centre in Ukraine (STCU)-GNSF. Targeted Research and Development Initiatives Program. It supports advanced research in Georgia’s priority research domains (Life science and biotechnology; Information and communication technologies; Energy efficiency) and development of state-of-the-art technology in partnership with foreign collaborators.

In 2009 the Rustaveli Foundation signed a Memorandum of Understanding with Romualdo Del Bianco Foundation, Florence, Italy. The memorandum envisages implementation of joint, international research, and academic exchange programs between Georgia and Italy. In 2011 the Shota Rustaveli National Science Foundation and the National Research Council of Italy (CNR) announced a joint Research Grant Competition aiming to deepen relations between Georgian and Italian scientists and
scientific centres, to encourage mobility of researchers from the two countries, to provide financial support to joint scientific research projects, etc.

The Academic Swiss Caucasus Net (ASCN) is a five-year programme aiming at promoting social sciences and humanities in the South Caucasus. It is funded by GEBERT RÜF STIFTUNG, a Switzerland-based private foundation aiming at supporting science. The ASCN Management, hosted at the University of Fribourg, Switzerland, launches call for proposals open to researchers from and resident in Georgia.

Shota Rustaveli National Science Foundation announces a call for ‘joint research activities with foreign scientists originated from Georgia’. The aim of the call is to intensify the process of involvement of successful Georgian scientists working abroad into joint activities in order to improve standards of research in Georgia. Close cooperation with successful Georgian scientists working abroad will give an opportunity to local researchers to raise their awareness on state of art in developed countries and to adopt modern research methods.

Horizon 2020 is the biggest EU Research and Innovation programme ever with nearly €80 billion of funding available over seven years (2014 to 2020) – in addition to the private investment that this money will attract. It promises more breakthroughs, discoveries and world-firsts by taking great ideas from the lab to the market. Georgia-European Union Association Agreement and the decision of the Ministry of Education and Science to become an associate member of H2020 in order to ensure direct participation of Georgian Scientists in European research and grant sets new tasks for the National Science Foundation. For this purpose, Shota Rustaveli National Science Foundation adopted a new charter in 2015 and its main goal is to develop an effective science funding and management system.

Thus, we may conclude that the Shota Rustaveli Science Foundation plays one of the most important roles in formation of international scientific links in Georgia. It continuously contributes to widening and deepening of international scientific relations. Future development of science in Georgia greatly depends on effective functioning of the Foundation.

6 Bilaterally profitable system for the donors and the beneficiaries

Based on the paper, it could be said that Georgia has close educational and scientific links with the European Union and other leading countries. By presenting educational and scientific links in the paper jointly, we aimed to answer the following questions derived from the objective of the paper:

1 While determining the education and science policy, which key directions, can be identified along with the traditional approach, in order to achieve more effectiveness?

2 How systemic synergistic effect can be achieved?

In order to achieve the above mentioned goals, we think it is necessary:

- To unite the current reforms in the country under one, long-term innovative policy, which will be developed based on knowledge triangle (education, science, business).
To develop a multilevel education policy on the basis of existing international educational and scientific links. Namely, a) education for education (working on improving the training and retraining system for teachers in secondary schools, higher education and vocational institutions and improvement of curriculums); b) education for involving Georgian scientists in International research systems (development and implementation of different activities for promoting Georgian scientists’ participation in joint scientific and scholarship programs); c) education as a business (statistical data prove that the number of students coming to Georgia to get education exceeds the number of students going abroad from Georgia with the same purpose. This points to the competitive advantage of Georgia in this field, therefore development of this field should be supported); d) education for creating a knowledge triangle in priority fields of the country (special attention should be paid to carrying out various activities for making science and education to meet international standards in the fields where Georgia has competitive advantage). This will ensure introduction of leading standards in the country (Gagnidze, 2011; Gagnidze and Maisuradze, 2012). We would like to present our concluding ideas on the Figure 1.

As the Figure 1 shows, on the one side there is a list of sources of international projects and programmes, and on the opposite side – the directions of education and science policy. Interconnection of these two sides creates an area where several international projects are united in each direction of the policy. We consider that scientific analysis of this new ‘area’ using the existing links will be an additional source of new opportunities and new ideas. It will give a good basis for new and more beneficial project proposals for international competitions which will develop mutually beneficial effective circular system.

In general, in most cases, participants of all the international projects think of continuing and deepening the project after it has been implemented. Interdisciplinary and/or extended format approach is less likely to be used in such processes. The places we are focusing our attention at might become a meeting place for the parties, which, in fact, work in the same field and have common goals and interests but did not even plan to discuss outcomes of the research in an extended form. They will have opportunity for dialogue and networking.

Using the knowledge gained from implementation the projects for common interests provides an opportunity to obtain synergistic effect. For instance, it is known about 80 endemic medicinal plants (Amirejibi and Benashvili, 2009) grow in Georgia due to its climate conditions (high vertical zonality: from subtropics to permafrost and semi-deserts). These plants are studied in research institutes and the knowledge and information obtained is shared to the audience at higher education institutions. Medicinal plants, as raw materials, are exported to foreign countries. However, in Georgia they are used only in small quantity for producing final products. Cooperation between the representatives of education, science and business sectors and their foreign colleges (which is one of main direction of the system, which will involve Horizon 2020 and projects of Rustaveli Foundation) will create the basis for supporting the development of economic fields in Georgia, in which the country has competitive advantage in the region. Such cooperation will also support development of education for creating a knowledge triangle in the fields that are priority for the country. Other directions have also been identified, which are reflected in the system (the sub-system on the Figure 1).
This is the very systemic approach, which can be used for achieving synergistic effects. Achieving of such effect is possible as Erasmus+ combines seven previous programs.

Why do we think the model of the study is a system?

- each part of the model meets all the above characteristics of the system described by Ackoff (1981)
- for the transition or developing economy or for relatively less developed region within one country, the multi-level policy model of education and science shown in the paper enhances the process in two directions, in particular: the integration process among economies of different countries and economic development within a definite (large) country
- the shortest way to stimulate these processes is to minimise the costs (e.g., elimination of parallelism) and get the maximum effect
- such vision of the policy lays the foundation for long-term integration process among the countries
- non-existence of such vision of policy hampers these processes.

Besides, we believe our paper is interesting for the readers as it is the vision of a representative of the country with transition economy, which may be of interest to:

- policymakers of the country, whose regions are at different levels of development (for example EU) and the equalisation of economic development is the most effective and shortest way
- we think that our views expressed in the paper will be of great interest for the experts working in the countries with transition and developing economy.
7 Conclusions

Georgian, the country of Golden Fleece, has had state organisation since ancient times. The country developed its own alphabet and educational centres, which shows that Georgian people have always striving for education. And nowadays, science and education are still priorities for the government of Georgia.

Some of the measures taken in this direction are as follows: National Qualification Framework has been created, higher education institutions began to use ECTS system that made student exchange and mobility easier, six state universities were joined by 52 scientific and research institutes.

As seen in the analysis, the Shota Rustaveli Science Foundation allocates funds for researchers in ten directions, which are important for involvement of Georgian scientists in international research and introduction of up-to-date technologies. Grant competitions promote famous scientists to carry out fundamental and applied research as well as scientific integration of young researchers, doctoral students and post-doctoral researchers. Such processes are especially important for post-soviet transition economies, as until just two decades ago scientific activities of these countries were not directed to the international research centres based on fair competition.

In the last decades funding of the Shota Rustaveli Science Foundation doubled. The activities of the fund are based on new charter since April 21, 2015. The following activities are planned after reorganisation of the foundation: expanding the network of international experts; development of a new grant management system and a new base; development of united scientific portal of Georgia; supporting scientific, informational and technological infrastructure; reorganisation of competition programs and development of new ones.

Erasmus+ programs stimulate development of international educational and scientific links on each level of higher education in many scientific directions. Participation in this program strengthens and promotes development of education and science in Georgia.

Based on the paper, it could be said that Georgia has close educational and scientific links with the European Union and other leading countries, which should be used for exercising an effective education and science policy.

The new government of Georgia has taken some measures in the fields of science and education. In particular, development strategy for science and education has been developed in cooperation with foreign experts, schoolchildren are provided with textbooks for free, teaching at 23 specialties at higher education institutions is funded by the state, etc. However, results in international assessments have not improved as two years is not enough for achieving medium and long term goals.

The strategy developed by the Ministry of Education and Science of Georgia highlights the need for systemic approach to this field. The document states that “challenges at different levels of education and in science are often inter-conditional and/or characterised by similar defects. As a result, education and science development policy should be based on the common vision of the system”. Consequently, we consider that the multi-level policy of education and science suggested by us and development of a systemic model for its implementation will contribute to increasing the effectiveness of education and science policy and innovative development of economy in Georgia.
References


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