

# Georgian Railway Corridor`s Potential Analysis in the Competitive Environment

Dr. Davit Gondauri  
Faculty of Business and Technologies  
Business and Technology University, Tbilisi, Georgia and 0162

Dr. Mamuka Bakhtadze  
Former Prime Minister of Georgia.  
Faculty of Business and Technologies  
Business and Technology University, Tbilisi, Georgia and 0162

Dr. Guram Guramishvili  
Deputy Minister  
Ministry of Economy and Sustainable Development of Georgia  
Tbilisi, Georgia, 0114

Dr. Manana Moistsrapishvili  
Director Railway Transport College  
Tbilisi, Georgia, 0191

Dr. Mikheil Batiashvili  
Chairman of Supervisory board  
Business and Technology University, Tbilisi,  
Georgia and 0162

**Abstract:-** The main purpose of the research is to study the potential of the Georgian Railway Corridor in the competitive environment and to analyze the challenges. In particular, the main objective of the study was to predict the probability of a possible crisis of the railway business using the Altman Z-model as a result of reduced cargo shipments. The object of research is the chosen Georgian Railway Transit Corridor, namely it was important to study the impact of recent changes in freight traffic on the rail transport business on the rail transport business. The paper presents the results of an empirical analysis that based on the reduced number of the cargo transported between the years 2013-2019, using the Altman Z-model, the probability of possible bankruptcy of the Georgian railway business was determined. Based on regression analysis, SLOPE is calculated as the change in cargo turnover and average income. Cargo is transported from Asia to Europe using the Georgian Railway Corridor and vice versa in 15 countries. The findings of the study show the increase in the number of cargo transit from the presented countries is shown in the direction of 7 countries (Turkey, Turkmenistan, Lithuania, Moldova, Russia, Uzbekistan, Kyrgyzstan), the transit traffic decreased in the direction of the other 8 countries. The results of the study can be useful as it provides important recommendations.

**Keywords:-** Altman Z-scores, Transport Corridor, CAGR, New Silk Road, Georgian Railway.

## I. INTRODUCTION

Located between the crossroads of Europe and Central Asia, Georgia is the transit country that connects several regions of economic importance with a total population of 800 million. These include the population of European Union (507 million), the Associate of Independent States (277 million), Turkey (76 million) and the Caucasus region (17 million). The Caucasus Transit Corridor (CTC) is a major transit route between Western Europe and Central Asia for the transportation purposes of oil and gas products, as well as dry cargo. CTC is part of the TRACECA International and Regional Corridor; It is an alternative to the northern corridor leading to the Russian Federation and Belarus in the north and the corridor leading to Turkey and Iran in the south because, Iran cannot receive the cargo sent from Europe and the United States of America. Based on the type of the transport, the transit accounts for about 60 percent of the total weight of cargo handled by the land, 75 percent of Georgian rail transport and almost 80 percent of the volume of cargo handled by Georgian ports (World Bank, 2014).

At the same time, China strongly supports the new Silk Road to be more integrated with the rest of the world (Church, 2018). Even without massive investments as projected by the Trans-Asian Railways and the EATL corridors, Chinese determination to revive the Silk Road trade routes since the launch of the Belt and Road Initiative has promoted China–Europe overland freight trade by railways utilizing existing infrastructure, including some new ones being constructed and put into operation by other countries, and negotiating facilitating institutional arrangements among countries along

the routes. With strong efforts on the Chinese side, the China Europe freight trains have become increasingly a real alternative to maritime transport. For example, the more strategic ones are (1) within Kazakhstan: the Zhezkazgan–Beyneu and Arkalyk–Shubarkol, both opened in late 2014; (2) the Uzen (Kazakhstan)–Bereket–Etrek (Turkmenistan)–Gorgan (Iran) line opened in December 2014; (3) Baku (Azerbaijan)–Tbilisi (Georgia)–Kars (Turkey) Railway Line officially launched in October 2017; and (4) the Marmaray railway linking Istanbul’s European and Asian sides under the Bosphorus Strait opened in October 2013 (Chan, 2018).

Improving transport and infrastructure services inside the global value chain is important. Through the Silk Road (Transcaucasian) transit corridor, cargo flows from Central and Southern European countries meet China via the Black Sea, Georgia and Azerbaijan, then the Caspian Sea and Kazakhstan. Georgia has advantages over other Silk Road countries due to the factors such as:

- ✓ Free Trade Agreement with three huge market, which gives Georgia to cooperate with the biggest markets of the continent;
- ✓ Turkish support for the transit highway between Georgia and Azerbaijan;
- ✓ Short-term duration of the export, which is advantageous compared to ocean shipping. If we observe, Chinese exports are growing every day, and is expected to grow even more in the future. It takes 45 days for cargo to arrive in Europe by sea, and 9 days by the Caucasus Corridor.

According to Zheng and Jia (2017), Silk Road countries can be divided into three major segments. The first segment is the core area of Silk Road Economic Belt, which includes five Central Asia countries, including Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan and Turkmenistan. The second segment is the important area of Silk Road Economic Belt, which contains Central Asia, including Russia, Afghanistan, India, Pakistan, Iran, Azerbaijan, Armenia, Georgia, Turkey, Saudi Arabia, Iraq and other regions. The third segment is the expansion area of the Silk Road Economic Belt named Asia - Europe Economic Belt, including Europe and North Africa. Countries such as Germany, France, Britain, Italy, Ukraine and other regions, North Africa, Egypt, Libya, and Algeria are the major players in the above mentioned area. In addition to that, the United States of America, Japan and Australia are selected as representatives of North America, East Asia and Oceania region respectively, based on the criterias such as their comprehensive national strength and geographical location (Zheng and Jia, 2017).

The globalizing ancient Silk Road network is being reinstalled in Eurasia under the Belt and Road Initiative of China and the positive responses of other countries 14 along the routes have strived to revive the branching out network pattern of development characteristics of the ancient Eurasian trade centered on the east–west Silk Road. The Chinese initiative has begun to reap its fruitful outcome at least from

among its Asian neighbors. 4The North–South International Transport Corridor project undertaken by Russia, Iran and India being one, and there is the proposed revival of the ancient “Lapis Lazuli” transit corridor by governments of Afghanistan, Turkmenistan, Azerbaijan, Georgia, and Turkey in November 2017. The trans-regional corridor will encompass mainly railways and highways, which will connect Herat province (Afghanistan) and Turkmenbashi port (Turkmenistan) via Ashgabat. From Turkmenbashi, goods will be able to travel further by ferry to Baku, where they would be placed on train cars and continue westward to Europe across the South Caucasus via the Baku–Tbilisi–Kars railroad. It will be intermodal, although will not stretch the way to China and India (Chan, 2018).

The previous studies have shown that The Georgian Railways opportunities regarding the increase in the volume of transit transportation has been investigated and concluded that the main railway line of the Georgian Railway can carry not less than 30-35 million tons of freight per year in the conditions of the increased demand on the services. The main findings of the research can be considered according to the Average compound annual geometric rate (CAGR) increase in cargo volume in 16-year cycle allows the “Georgian Railway” JSC to add value to the country’s overall GDP by the following model: 3% Increase – the additional value to GDP 0.004%; 4% Increase – the additional value to GDP 0.011%; 5% Increase – the additional value to GDP 0.019%; 6% Increase – the additional value to GDP 0.026%; 7% Increase – the additional value to GDP 0.034%; 8% Increase – the additional value to GDP 0.042%; 9% Increase – the additional value to GDP 0.049%; 10% Increase – the additional value to GDP 0.057%; 11% Increase – the additional value to GDP 0.064%; 12% Increase – the additional value to GDP 0.072%; 13% Increase – the additional value to GDP 0.079%; 14% Increase – the additional value to GDP 0.087%; 15% Increase – the additional value to GDP 0.094%. Rates are a simulation of the regression model which gives the result of the additional economic value (EVA) that creates the railway GDP with the CAGR model of cargo growth. Therefore, the interest rate mentioned in the regressive model is adopted by the following mathematical formula: (Railway PV of EVA) / (PV of FV GDP) (Gondauri and Moistsrapishvili, 2019). The Slope of the Railway and GDP logarithms was calculated and the resulted amount is 47.63%. This means that in order to increase GDP by 1 percent in 2006-2019, it was necessary to increase the value added by the railway up to 47.63%. As for the correlative relation of the railway with the GDP - is 14,555%, and its determination (R<sup>2</sup>) – represents 2,12% (Gondauri and Moistsrapishvili, 2019).

The early focus has been on infrastructure investments. On the basis of existing railways, China has developed with European and Central Asian cities an ever-intensifying network of scheduled freight trains to carry out and promote long-distance trade along the old Silk Road routes (Chan, 2018).

It should be noted that the most important role in the trade and economic relations between Europe and Asia is played by all the transit routes that provide cargo transportation by rail, sea and mixed form. The European Union is China's the second largest trading partner after the United States of America. As the table below indicates, the railway route accounts for about 1% of total EU-China trade. The Cargo transportation is mainly carried out by the sea route, which exceeds 90% of the total volume of cargo turnover.

conduct in-depth research, quantitative analysis, synthesis, synthesis, Methods of ratio and average values, graphical representation, indexing, comparative analysis and panel data analysis.

The study used European Statistics 2019 data on trade relations between the EU and China, which was carried out by means of transport. The share of imports and exports in total trade turnover between China and the EU in total trade turnover was analyzed.

At the initial stage of the research, competing transit corridors of the Georgian Railway Transport Corridor were analyzed. A modified SWOT analysis of competing transport corridors was conducted.

Transport Route	Import	Export
Sea route	92.600%	96.40%
Air route	2.00%	1.50%
Road transportation	4.40%	1.30%
Railway route	1.00%	0.80%
Total	100.00%	100.00%

Source: prepared by authors, according to data of European Statistics <https://ec.europa.eu/eurostat>

**2.1 Regression analysis methods**

In the process of analysis of the factual materials and the tasks defined under this research, is used systematization of empirical data, the verbal discussion of their results, formal-logical description of the relationship between conclusions and general regularity, methods of statistical research and classification. Together with the Systematic approach, forecasting, statistical data monitoring, comparative analysis, generalization and systematization methods. Data regarding the railway transportation are taken from the Georgian Railway Information Technology Department (2010-2020). We have observed the sensitivity of cargo freight movement in the region. At the same time, we have systematized and compared the different data obtained from railway's information technology department. The regression model analysis Have been selected from the given statistical research methods. We analyzed the classification of cargo shipments in the region according to their categories and countries of destination. In a regression analysis study (including the slope model), It has been identified that when the average revenue of a railway company is increased by an average of 1% per tonne / km (in US dollars), at the same time, cargo through the corridor decreased by an average of a few percent.

If we observe the trend, there is more rail freight flows recorded from east to west than in reverse direction. In 2019, the volume of cargo flows in Eurasia to the west was 56.6% of the total volume (for loaded containers), and to the east - 43.4%. There is an expert prognoses that after 10 years the volume of cargo flows in the west direction will reach up to 57.9%, and in the east direction – up to 42.1%. One of the reasons for this opinion can be the growing export-oriented market of Japan and South Korea.

**2.2 Regression line slope**

To construct the regression model, 2 data have been used - the volume of Georgian railway transport and the average railway revenue per 1 ton / km. The slope of the regression line (b) represents the rate of change in y as x changes. Therefore y depends on x, the slope describes the predictive value of y at the given value of x. Using the conventional intermediate method, which is the one of the most commonly used linear regressions - the slope is calculated as the values of b, x and y:

Given the following factors, the study is aimed to study the potential of the Georgian Railway Corridor in the competitive environment and to analyze of the challenges it may face. In particular, the main objective of the study was to predict the probability of a possible crisis of the railway business using the Altman Z-model as a result of reduced cargo shipments.

Altman Z-score has been a well-accepted model of predicting survivals and failures of manufactures since 1968. However, short of an underpinning theory causes a wide gap between asking and responding sides, which still has no effective solution. This research proposes a rough set approach to inducing granular evidence and solving evidential coefficients of financial ratios for the distressed companies (Ko *et al.*, 2017).

**II. RESEARCH METHODOLOGY**

During the research the Empirical and theoretical research methods have been used in the work. Such as Georgian or foreign publications, scientific and applied works and related statistical materials, research results of individual governmental and non-governmental organizations in order to

$$\frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^n (x_i - \bar{x})^2} \tag{1}$$

Covariance divided by the sum of squares of value x. The slope should be calculated using linear regression to y-intersection, as the intersection is calculated using the slope. The slope of the regression line is used to statistically test the

value of the linear relationship between  $x$  and  $y$  (Bewick *at. al.* 2003, 454).

### 2.3 Altman model

Altman's research paper on turn-discriminatory analysis, published in 1968, has been repeatedly used on the example of various companies. For example, the Altman model was constructed using this method for selective 66 companies – from which the 33 companies successful and 33 companies bankrupt. The first version of the model contained 22 estimated significant ratios derived from the financial statements. The coefficient with the minimum statistical value was dropped, after which the model construction and the analysis of the statistical values of the coefficients were repeated. When the number of coefficients was reduced from 5 to 4, then the statistical reliability of the model was drastically reduced, leading Altman to conclude that a 5-factor variant is preferable. The model makes an accurate forecast in 95% of the given cases.

Z-Model (Altman Z-Score) – This is a financial model that allows you to predict the probability of a company going bankrupt. This formula is based on a combination of financial ratios, which are the basic financial data regarding the company's operations. Altman developed a four-factor formula for non-profit organizations, namely:

$$\text{Z-score} = 6.56T1 + 3.26T2 + 6.72T3 + 1.05T4 \quad (2)$$

Where, T1 = working capital / assets T2 = retained earnings / assets T3 = EBIT / assets T4 = equity / liabilities.

The results of the calculation according to this formula are summarized as follows: 1. If the indicator is 1.1 and less then - "red zone" there is a probability of the company going bankrupt; 2. If the indicator is from 1.1 to 2.6 - "gray" zone, border condition, the risk of bankruptcy is not high, but it is not excluded. 3. If the indicator is 2.6 and more "green" zone, the probability of bankruptcy is low.

While, Altman's 5-factor Z model is used in manufacturing facilities. Its formula looks like following:

$$\text{Z-score} = 0.717T1 + 0.847T2 + 3.107T3 + 0.42T4 + 0.998T5 \quad (3)$$

Where, T1 = working capital / assets T2 = retained earnings / assets T3 = EBIT / assets T4 = equity / liabilities. T5 = Return / asset calculation according to this formula

The results are summarized as follows: 1. If the indicator is 1.23 - and less "red zone" there is a probability of bankruptcy of the company; 2. If the value is from 1.23 to 2.9 - "gray" zone, border condition, the risk of bankruptcy is not high, but not excluded 3. If the value is 2.9 and more "green" zone, low probability of bankruptcy.

The criteria presented above in the Altman formula of the study are based from the data of the balance sheet and profit and loss statements of the Georgian Railway for 2013-2019. The probability of a possible crisis in the railway business under the Altman model was first used and analyzed in our study.

### 2.4 Average Annual Geometric Growth Model (CAGR)

CAGR<sup>1</sup> is one of the most accurate means of calculating return on investment, which is increased and valued during the investment period. CAGR allows investors to compare investments over different periods of time. CAGR makes it possible to compare the return on a particular investment with risk-free instruments. It also allows us to assess how high the risk premium is.

During the research, we collected the data regarding the exports, imports and transit of cargo transported in the Georgian railway corridor in 2011-2020 according to 15 countries. Sensitivity of cargo transported by countries was calculated using the average geometric (CAGR%) increase / decrease model.

$$CAGR = \left( \frac{V_{final}}{V_{begin}} \right)^{1/n} - 1, \quad (4)$$

Where, CAGR is the average annual geometric growth, V (begin) is the initial value, V (final) is the final value, n is the number of years.

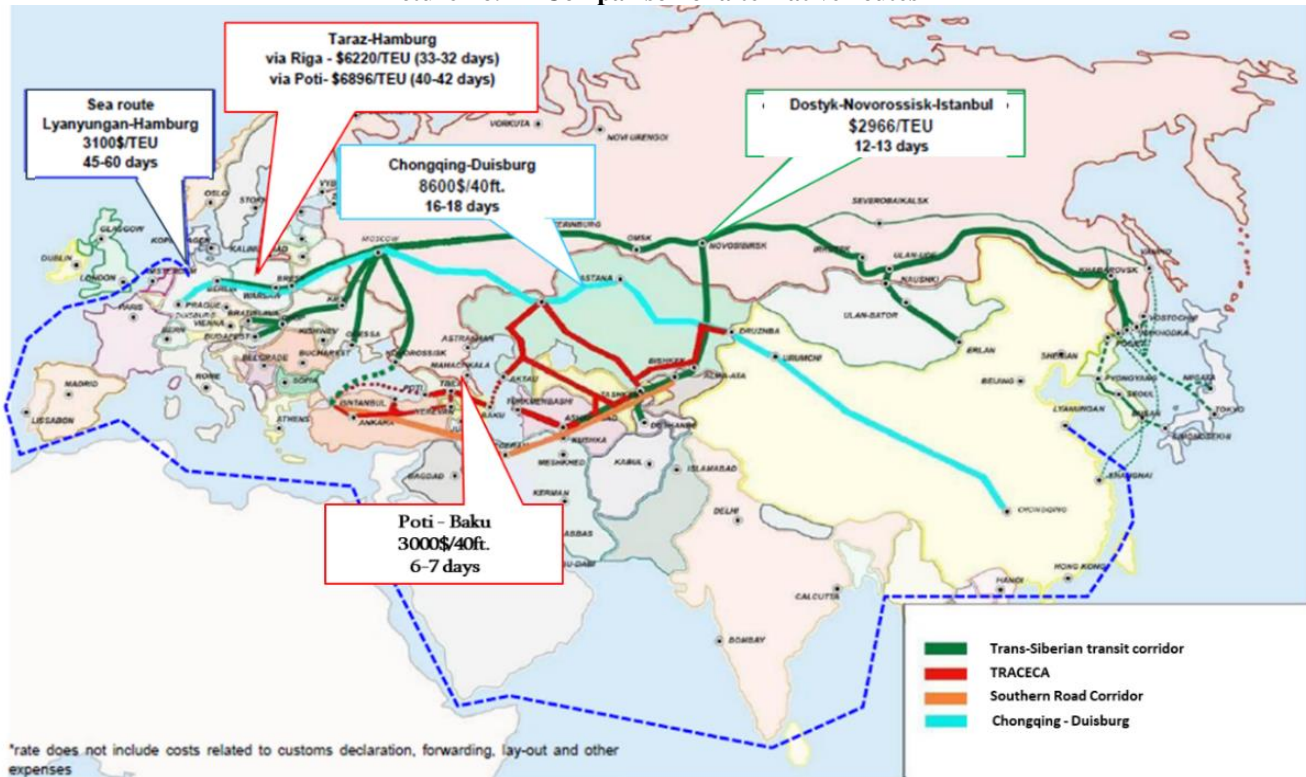
## III. RESEARCH RESULTS AND ANALYSIS

### 3.1 Georgian Railway Corridor in a competitive environment

The countries located on the Asia Pacific coast analyzed as a result of qualitative / empirical research are connected to the developed countries of the Western Atlantic Ocean by five existing international routes, one of which passes through the territory of Georgia. These international transit corridors are:

- North Sea Corridor;
- South Sea Corridor;
- Trans-Siberian transit corridor;
- Southern Road Corridor;
- New Silk Road or Transcaucasian transit corridor.

Picture no. 1 - Comparison of alternative routes



Source: authors' analysis

**North Sea Corridor** - At present we can briefly formulate as follows: Asia - Arctic Ocean - Northern Europe (Scandinavian countries).

**Its main advantages:** Short distance; Small transit time; Lack of international overload ports.

**Its main disadvantages:** Seasonality; High level of technical barriers; High cost (high shipping rates); Complexity of operational management procedures.

**Southern Sea Corridor** - As of today, we can summarize as follows: Asia - Mediterranean basin - Northern Europe - Scandinavia - Baltic countries.

**Its main advantages:** Safety of the corridor; Low tariffs; Coverage rates; High level of competition between sea lines; Voyage full year.

**Its main disadvantages:** Distance of the given corridor; Considerably longer transit time; Many international shipping ports.

**Trans-Siberian Transit Corridor** - Includes the railway route that connects Japan, North Korea, Mongolia, China, and Central Asia through Russian territory with the Nordic countries and the Baltic states to the east.

**Currently, the main advantages** of the Trans-Siberian Railway Corridor are: it has no seasonality; One transit country between China and Europe; One custom procedure; Permeable and fixed tariffs.

**Its main disadvantages are:** Long distance; Large transit time (compared to the Transcaucasian corridor); High levels

of corruption and crime; Technical incompatibility at the border. Operational difficulty of reset.

**Southern Ground Corridor**- Includes a route from Europe via Turkey to Iran, Turkmenistan, Uzbekistan and Kazakhstan, which runs to the Pacific coast of China.

**The main advantages** of the Southern Road Corridor are: short distance; Small transit time.

**Its main disadvantages are:** Operational difficulty of shipment; High levels of corruption and crime; Absence of pervasive tariffs; No agreed common customs procedures; Different border procedures in the corridor; Low level of logistics infrastructure.

Thus, the internationally competitive corridors of the Transcaucasian Corridor are the Trans-Siberian Railway and the Southern Land Corridor. Both have the ambition to attract freight flows between the West and the East and to transport their own corridor, although only the Trans-Siberian Railway corridor can do so more or less successfully than the Southern Land Corridor.

*Competition through the pipeline*

The following oil pipelines directly compete with the Georgian Railway in terms of oil and oil products transportation: Caspian Pipeline Consortium (CPC Pipeline), which transports raw oil materials from Kazakhstan, the Tengiz oil field (on the Caspian Sea coast), to Russia, Novorossiysk (on the Black Sea coast);

- Baku-Tbilisi-Ceyhan (BTC pipeline), which transports crude oil from Azerbaijan (Caspian Sea coast) to Turkey (Mediterranean coast);
- Baku-Novorossiysk pipeline, which transports crude oil from Azerbaijan (Caspian Sea coast) to Russia, Novorossiysk (Black Sea coast);
- Baku-Supsa pipeline, which transports crude oil from Azerbaijan (Caspian Sea coast) to Georgia (Black Sea coast);

**Strengths:** Large capacity at low cost - Pipelines often have low transport and operating costs, especially for large oil producers who are also involved in their construction. An oil pipeline is a much more efficient means of transporting large volumes of oil than a railroad.

**Weaknesses:** Oil quality change - Pipelines generally do not carry all quality raw materials as different quality oils are mixed in the pipeline, which in turn affects the quality of the product. Therefore, pipelines are best suited for medium level oil, while for high and low quality raw materials, pipelines are not the best means of transportation.

**Lack of pipelines for oil products** - It should be noted that pipelines compete with the railway only in the transportation of crude oil. As for processed petroleum products, they are not subject to transportation via pipeline.

#### *Competition from road transport*

There is a competition in Georgia in terms of transporting goods by containers.

**Strengths:** Cheap transportation over short distances - In Georgia, which is a relatively small country, road transportation is relatively cheap, especially for container cargo. Competition increases when international prices for petroleum products are low, especially given our low excise duty on petroleum products and low taxes on road transport. **Flexibility** - Transporting cargo to a specific destination is an inherent advantage of road transport.

**Weaknesses:** Safety issues - Rail transport is safer and more environmentally friendly than road transport. Expensive transportation - In the case of bulk cargo transportation, the rail route is cheaper than – the road.

Based on the above, we believe In modern competitive conditions, the task of the New Silk Road or the Transcaucasian Transit Corridor should be to increase its role in the direction that when choosing a route by the cargo

owner, in other equal conditions, to increase the advantageous factors of Georgian corridor. Impeding factors may include:

A - The total length of the route is 10 thousand kilometers (Central China - Poland) and from here the route to Georgia is only 400 kilometers;

B – We do not have any tools that will influence the formation of the route, price or time. Means terminals, rolling stock or vessels (vessels have a considerable influence on price formation; for example, transporting cargo by 10,000 tonnes to a destination allows for a handling of at least \$ 30 per tonne compared to a 50,000 tonne vessel);

C – Insufficient conditions for trader and logistics companies.

### **3.2 Based on transit potential, traffic composition and shipping changes, predicting the probability of possible bankruptcy of the railway business using the Z-model**

Taking into account its central geographical location, Georgia can take advantage of some of the trade flows from west to east and, conversely, expand its participation in the international value chain by providing logistics services.

In 2013, the estimated total volume of total cargo flow in the New Silk Road, or Transcaucasian Transit Corridor, estimated by GNIA was 126 million Tons per year. About 55% cargo comes from Central Asia to Europe (including Eastern Europe, the Balkans and Turkey) and exports to the rest of the world; 28% corresponds to exports from the Caucasus to Europe and the rest of the world.

**Liquid Cargo** - The estimated volume of directed liquid cargo flow is 100 million Tons per year. About 50% of this volume comes from exports from Central Asia to Europe; And 20% correspond to exports from the Caucasus to Europe.

**Dry cargo (massive)** - The estimated volume of targeted dry cargo flow is 17 million tons per year. About 28% comes from exports from Central Asia to the rest of the world (ROW) and 25% comes from exports from Central Asia to Europe.

**Cargo placed in a container** - The estimated volume of directed cargo flow is 8.5 mln. tons Per year. About 35% comes from exports from the rest of the world (ROW) to the Caucasus and Central Asia and 17% from exports from Europe to Central Asia (World Bank Group 2014).

Cargo is transported from Asia to Europe using the Georgian Railway Corridor and vice versa in 15 countries. These countries are: Azerbaijan, Turkey, Belarus, Estonia, Turkmenistan, Latvia, Lithuania, Moldova, Russia, Armenia, Tajikistan, Uzbekistan, Ukraine, Kazakhstan, Kyrgyzstan. In 2020, Azerbaijan is in the first place with 27.96% of the transit cargo transported through the Georgian corridor, Russia is in the second place with 17.47% and Turkmenistan is in the third place with 16.65%.

**Table no. 2 – Share of local rail shipments in total freight transit by countries**

Share of local rail shipments in total freight transit (by countries)										
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
<b>Total freight transit</b>	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%
Share of Local transportation	17,45%	17,85%	15,71%	19,11%	21,52%	20,38%	23,49%	23,01%	16,74%	20,38%
<b>Total transit</b>	82,55%	82,15%	84,29%	80,89%	78,48%	79,62%	76,51%	76,99%	83,26%	79,62%
Azerbaijan	28,68%	31,82%	32,00%	40,18%	37,15%	33,81%	28,95%	31,22%	28,96%	27,96%
Turkey	5,33%	5,58%	5,96%	4,77%	4,67%	4,54%	3,46%	5,73%	7,20%	10,24%
Belarus	0,28%	0,22%	0,23%	0,17%	0,15%	0,17%	0,23%	0,23%	0,21%	0,28%
Estonia	0,02%	0,01%	0,01%	0,00%	0,01%	0,00%	0,01%	0,01%	0,01%	0,01%
Turkmenistan	8,77%	8,24%	8,50%	7,94%	11,62%	23,07%	9,62%	9,35%	10,13%	16,65%
Latvia	0,06%	0,02%	0,02%	0,01%	0,01%	0,00%	0,01%	0,03%	0,34%	0,00%
Lithuania	0,08%	0,04%	0,04%	0,26%	0,14%	0,17%	0,26%	0,24%	0,21%	0,20%
Moldova	0,02%	0,02%	0,04%	0,02%	0,01%	0,04%	0,03%	0,04%	0,19%	0,25%
Russia	5,11%	5,19%	5,87%	7,57%	9,27%	10,26%	13,43%	18,47%	21,93%	17,47%
Armenia	11,01%	11,30%	11,22%	11,37%	11,43%	11,97%	14,88%	15,21%	15,22%	13,15%
Tajikistan	3,09%	3,00%	3,40%	1,83%	1,24%	1,26%	0,72%	1,04%	0,46%	0,89%
Uzbekistan	0,37%	0,23%	0,56%	1,46%	1,19%	1,38%	1,09%	0,69%	1,05%	1,17%
Ukraine	6,22%	5,07%	5,71%	5,67%	4,21%	5,91%	5,55%	5,19%	4,29%	3,34%
Kazakhstan	30,91%	29,01%	26,34%	18,52%	18,78%	7,21%	21,52%	12,21%	9,39%	7,94%
Kyrgyzstan	0,06%	0,25%	0,11%	0,23%	0,11%	0,20%	0,24%	0,35%	0,41%	0,46%

Source: prepared by authors, according to data of Georgian Railway

Between the years 2011-2020, the average share of transit cargo transported through the Georgian Railway Corridor (out of total shipments) by countries was:

- Azerbaijan - 32.07%
- Turkey - 5.75%
- Belarus - 0.22%
- Estonia - 0.01%
- Turkmenistan - 11.39%
- Latvia - 0.05%
- Lithuania - 0.16%
- Moldova - 0.07%
- Russia - 11.46%
- Armenia - 12.68%
- Tajikistan - 1.69%
- Uzbekistan - 0.92%
- Ukraine - 5.12%
- Kazakhstan - 18.18%
- Kyrgyzstan - 0.24%

Liquid and dry cargo is transported in the Georgian railway corridor. By 2020, the share of liquid cargo in total shipments will be around 30%, while dry cargo will be 70%. One of the main sources of liquid cargo transportation is the production of oil and its related products in the Caspian region

(Kazakhstan, Turkmenistan and Azerbaijan), which have large reserves of oil.

Liquid cargo is divided into 2 parts: oil and petroleum products and crude oil. Petroleum products are the main constituent mass of liquid cargo (96% of the volume of liquid cargo transportation by 2020). They are mainly transported by rail, as it is practically impossible to transport those type of products by pipelines. The main producers of oil products transported by rail by 2020 are Azerbaijan, Turkmenistan, Russia and Kazakhstan. In 2020, the main part of crude oil transported by the Georgian Railway came from Azerbaijan (about 94%).

General national economic conditions and economic development in Georgia or its partner countries (Azerbaijan, Armenia, Turkmenistan, Kazakhstan and other CIS countries) are the main drivers of dry cargo transportation in the Georgian railway corridor. The following categories of dry cargo will be transported in the corridor: ore, grain and grain products, non-ferrous metals and scrap, sugar, chemicals and fertilizers, building materials, industrial cargo, cement and more.

Between the years 2011-2020, the structure of cargo transported in the Georgian Railway Corridor underwent some changes. Below is shown the average geometric increase (CAGR%) of the cargo transported by the countries in the mentioned years.

- Azerbaijan -7.06%
- Turkey - 0.23%
- Belarus -6.69%
- Estonia -18.06%
- Turkmenistan - 0.10%
- Latvia -31.39%
- Lithuania - 2.76%
- Moldova - 27.28%
- Russia - 6.85%
- Armenia -4.94%
- Tajikistan -18.88%
- Uzbekistan - 5.81%
- Ukraine -13.03%
- Kazakhstan -19.86%
- Kyrgyzstan - 18.02%

Out of the 15 countries listed, the increase of the transit cargo (CAGR%) is shown in the direction of 7 countries - Turkey, Turkmenistan, Lithuania, Moldova, Russia, Uzbekistan, Kyrgyzstan. The transit traffic (CAGR%) decreased in the direction of the other 8 countries in 2011-2020.

**Therefore, the increase in cargo turnover to / from the above 6 countries was due to:**

- ✓ To / from Turkey - methanol (methyl alcohol), LPG - petroleum gases, quartzite, aluminum ores and concentrates (bauxite), aviation fuel, sulfur, fuel oil, barium sulphate (barite), plastics and parts thereof, ferrous metals, ferrous metals and Shipping of fruits and nuts, citrus, stone, plaster, cement, asbestos, carcass or similar materials and other cargo;
- ✓ To / from Turkmenistan - by increasing the transportation of sulfur, urea, aviation fuel, diesel, plastics and their products, diesel fuel;
- ✓ To / from Lithuania - with an increase in shipping of mineral waters and non-alcoholic beverages, gasoline;
- ✓ To / from Moldova - by increasing shipments of ferrosilicomanganese, urea, gasoline, vegetables, fruits, nuts or other plant products;
- ✓ To / from Russia - by increasing shipments of ferrosilicomanganese, mineral waters and non-alcoholic beverages, urea, sulfur, fruits and nuts, citrus, plastics and their products, gasoline, coal, diesel fuel and other cargo;
- ✓ To / from Uzbekistan - Mineral water and non-alcoholic beverages, sugar, manganese ore, pipes made of ferrous metals, copper and articles thereof, other ores and concentrates and other cargo;

- ✓ To / from Kyrgyzstan - with an increase in mineral water and non-alcoholic beverages, meat and food by-products, ferrous metal products, flour and confectionery, vegetables, fuel oil and other cargo.

**The decrease in cargo turnover to / from the other 8 countries was caused by:**

- ✓ To / from Azerbaijan - Iron and alloy steel, ferrosilicomanganese, sugar raw materials, plastics and their products, stone, gypsum, cement, asbestos, kars or similar materials, ceramic products, diesel, diesel By reducing shipping of various oils and other cargo.
- ✓ To / from Kazakhstan - by reducing shipments of various oils and crude oil.
- ✓ To / from Ukraine - Mineral water and non-alcoholic beverages, ferrosilicomanganese, ferrous and alloy steel, salt, coal products, reduced shipments of ferrous metals and other cargo.
- ✓ To / from Latvia - by reducing the transportation of corn and wheat.
- ✓ To / from Tajikistan - by reducing shipments of aluminum oxide (glynazium-clay), meat and food by-products, raw aluminum.
- ✓ To / from Armenia - Sugar raw materials, ferrous and non-alloy steel, aviation fuel, ceramics, crude aluminum, silicon and quartz sand, Copton and other solid wastes, ferrous metal wastes and scrap stone, ashes, stone, asbestos By reducing shipments of materials and other cargo.
- ✓ To / from Estonia - by reducing shipments of ferrous metal products, dairy products, poultry eggs, animal feed and other cargo.
- ✓ To / from Belarus - by reducing shipments of mineral water and non-alcoholic beverages, ferrosilicomanganese, malt and other cargo.

As it is widely well aware, the reduction of freight traffic in the railway corridor in itself has a negative impact on the railway business. Reduction of the cargo itself leads to crisis situations in the economy, as the results of railway business activity are an important part of the formation of state budget revenues. This is where the crisis and bankruptcy must be separated. Crisis is not bankruptcy because the bankruptcy is the extreme result of its development. The crisis can develop in three directions, namely:

- Overcome the crisis;
- Stabilize the crisis;
- Crisis leads to insolvency / bankruptcy of a business entity and liquidation.

Based on the reduced shipping trend in 2013-2019, using the Z-model (Altman Z-Score), the probability of possible bankruptcy of the Georgian railway business was determined.



Table no. 3 - Z- score Results							
Description	2013	2014	2015	2016	2017	2018	2019
Z- score Results	1.076	1.066	1.168	1.111	0.450	(0.675)	0.555

Source: prepared by authors

As the results show, the Georgian railway business using the Z-model (Altman Z-Score) method is in the 1.1 area of the Z-Score in 2013-2019, which suggests that the probability of a possible transition from crisis to bankruptcy is high. This result is caused by internal and external factors, including:

- Due to the reduction of cargo transportation in the Georgian railway corridor in recent years;

- With a significant increase in the liabilities of the Georgian Railway;
- By reduction of retained earnings;
- By reducing the operating profit of the company and so on.

At the same time, with the reduction of freight traffic in the transit corridor in recent years, the railway company has had an average revenue of 1 ton / km over the years.

Table no. 4 – Average income of Georgian Railway per 1 ton / km by years							
	2013	2014	2015	2016	2017	2018	2019
Total cargo turnover (million tons)	18,185,000	16,673,300	14,142,700	11,881,600	10,672,600	10,004,700	10,861,000
Average income per 1 ton / km	6.517	6.6	8.367	7.9	7.767	8.6	11.7
Slope	-58.57%						

Source: prepared by authors, according to data of Georgian Railway

As a result of the study, based on the regression analysis, it was found that the SLOPE logarithms of the reduction of cargo turnover and average revenue (1 ton / km in USD) amounted to -58.57%, which means that in 2013-2019, when the average revenue of the railway company was increased by an average of 1% for 1 ton / Per km (in US dollars) at the same time, cargo turnover in the corridor was decreased by an average of 58.57%.

#### IV. DISCUSSION / INTERPRETATION OF RESEARCH RESULTS

##### 4.1 Prospects for oil flow and dry cargo

Most researchers agree that One Belt One Road, which colloquially became known as The New Silk Road, would create economic value, i.e. improve economic conditions in participating countries, although no one can predict precisely how economic gains would be distributed or even in what time period would invested funds be returned. Many scholars claim that if this project becomes a reality it could bring peace to many of the stakeholder countries that are currently in turmoil. However, it is difficult not to imagine that rise of such a global superpower (as China would definitely become) would not trigger some kind of response of other global superpowers whose influence would be diminished. A response does not necessarily involve conflict. It would more likely induce different types of economic clashes and political reassignments in search of geostrategic and geopolitical partnerships. Due to many potential roadblocks previously described, it is difficult to expect complete development of the project. It will more

likely develop in the restricted sphere of East and Central Asia. Because of that, its direct economic, political and cultural changes will be restricted to those countries, while causing much weaker and only indirect impact to countries of the western hemisphere (Zoran *et al.*, 2018).

It is widely accepted fact that the efficiency of this or that transport corridor depends on the growth of dry and container cargo shipments, as the cost of these cargoes on the world market far exceeds the cost of liquid cargoes (oil and oil products). Given this argument, currently, against the background of the tendency to reduce cargo flows, the priority of the countries in the transport corridor to Georgia should be the policy of targeted replacement of the oil flow with dry cargo.

In this regard, the question is logically heard: is there a possibility to attract dry cargo through the corridor to Georgia? Answering this question requires multidimensional research, which includes: analysis of freight flows in the corridor countries, and the study of aspects of existing and expected infrastructure throughput, tariff policy coordination, and competitiveness.

**In terms of cargo flow analysis,** There are significant prospects of attracting the sulfur from Kazakhstan, from Kashagan field. Today, a significant portion of Kazakh sulfur is transported via an alternative route through Russia through the corridor to the Baltic Sea, the port of Ust-Luga and the Volga-Don Canal to the port of Caucasus. Similarly,

Kazakh Zinc will be transported from the Kurik port of Kazakhstan to Novorossiysk via the transport arteries via Russia, depending on its final destination, it would be more appropriate to transport it via the Baku-Tbilisi-Kars railway.

In the port of Batumi, there are real opportunities to load Turkmen urea to load the released capacity. By 2022, Turkmenistan intends to increase urea production to 2.3-2.5 million tons. For its part, the port of Batumi is ready to receive and process 1.5 million tons.

There is a real prospect of an additional impetus in terms of the Baku-Tbilisi-Kars railway section, which is a branch of the transport corridor to Georgia and an integral part of it; In particular, with the involvement of the railways of Russia, Georgia, Azerbaijan and Turkey, using the Baku-Tbilisi-Kars section, 400 thousand tons of grain will be transported annually from Russia to Turkey.

**In terms of competitiveness,** In current conditions, against the background of the Russia-Ukraine controversy (due to Russia's unilateral restriction of shipments from Ukraine to Central Asia due to Russia's debt), the most optimal direction is the full organization of ferry shipments on the Black Sea, with a capacity of only 20%. The main reason is the high fares on ferry lines and ships. For reference, the fee for each voyage on the Baltic Sea for ships of similar volume is 6.3 times cheaper than - on the Black Sea. In addition, the capabilities of the Viking container train connecting the Black and Baltic Seas are virtually unusable. 1 million tons of cargo was transported within the framework of the Viking project in 2017. In the first six months of 2018, more than 33% of containers were transported compared to the previous year. On opportunity.

**In terms of tariff policy,** The prospects of the transport corridor to Georgia are revealed even by the "aggressive" tariff policy pursued by Turkmenistan, specifically in the form of dry cargo, which crosses the territory of Turkmenistan in transit from Kazakhstan to Uzbekistan and Tajikistan. The same policy is pursued for Turkmen exports, with their railways imposing an "additional" 50% tariff exemption. The example of the tariff policy implemented by Turkmenistan is a clear proof that achieving high competitiveness of the transport corridor does not depend on the reduction of tariffs by an individual country, but on the coordination of tariff policy with other countries in unison.

**In terms of infrastructure through capacity,** The existence of logistics centers in the places of collection and distribution of cargo flows is important for the full functioning of the corridor to Georgia. In this regard, it is important to put into operation the Absheron logistics center with a capacity of 11 million tons per year near Azerbaijan this year. It is mainly focused on dry cargo, where it is possible to store 2400 containers at a time, with a storage capacity of 8100 m<sup>2</sup>. At the same time, the railway junction near the logistics center

can handle 3.5 million tons of cargo per year and 125,000 trucks, which is equivalent to 2 million tons of cargo per year.

## V. CONCLUSIONS AND RECOMMENDATIONS

This study shows that based on the reduced number of the cargo transported between the years 2013-2019, using the Z-model (Altman Z-Score), the probability of possible bankruptcy of the Georgian railway business was determined. Georgian railway business using the Z-model (Altman Z-Score) method in 2013-2019 is in the 1.1 area of the Z-Score, which allows to conclude that the probability of a possible transition from crisis to bankruptcy is high. This result is caused by internal and external factors, including:

- reduction of freight traffic in the Georgian railway corridor in recent years;
- With a significant increase in the liabilities of the Georgian Railway;
- By reduced retained earnings;
- By reduced the operating profit of the company and so on.

Also, based on the regression analysis, it was found that the SLOPE logarithms of the reduction of cargo turnover and average revenue (in USD / ton / km) amounted to -58.57%, which means that in 2013-2019, when the average revenue of the railway company's 1 ton / Km (in US dollars) increased by an average of 1%, at the same time, cargo turnover in the corridor decreased by an average of 58.57%.

The findings of the study have discovered cargo is transported from Asia to Europe using the Georgian Railway Corridor and vice versa in 15 countries. These countries are: Azerbaijan, Turkey, Belarus, Estonia, Turkmenistan, Latvia, Lithuania, Moldova, Russia, Armenia, Tajikistan, Uzbekistan, Ukraine, Kazakhstan, Kyrgyzstan. In 2020, Azerbaijan is in the first place with 27.96% of the transit cargo transported through the Georgian corridor, Russia is in the second place with 17.47% and Turkmenistan is in the third place with 16.65%.

By 2020, the share of liquid cargo transported in the Georgian transit corridor in total shipments is about 30%, and dry cargo - 70%.

Therefore, the findings of the study show the increase in the number of cargo transit (CAGR%) from the presented 15 countries is shown in the direction of 7 countries - Turkey, Turkmenistan, Lithuania, Moldova, Russia, Uzbekistan, Kyrgyzstan. The transit traffic (CAGR%) decreased in the direction of the other 8 countries in 2011-2020.

The following recommendations for research are based on the study findings:

1. Lack of development of the country's transport and logistics infrastructure leads to a decrease in the competitiveness of the transport corridor of Georgia.

2. There are a number of objective reasons why the cargo will not pass through our corridor: the frequency of the customs crossings, the frequency of transfers from one means of transport to another and finally the limited number of ferries.
3. The Trans-Caspian International Transport Route runs from China via Kazakhstan, the Caspian Sea, Azerbaijan, Georgia, Turkey and then to Europe. The focus here should not be on China's land freight alone, as China is more interested in shipping and, for the most part, cargoes by sea. China is not the most important market for us in terms of attracting cargo flows, but more importantly Kazakhstan, Uzbekistan and Turkmenistan. The largest enterprises in these Central Asian countries today, including sulfur, metal, aluminum, and wheat, are state-owned. Therefore, Georgia and Azerbaijan should hold negotiations with these countries. For example, the cargo flow of Kazakhstan, which passes through Russia, totals 100 million per year.
4. Strengthen the function of the Georgian transit corridor and compensate for "failures" in cargo turnover. Additional cargo flows in the direction of Azerbaijan-Europe, such as iron ore, cement, Kazakhstan-Europe in the direction of wheat, Turkmenistan-Europe in the direction of oil, coke, potassium in Ukraine, potassium in Ukraine, With shipments of sunflower oil, various wheat, soybean, rye, barley, corn, rice, buckwheat and other container shipments to Ukraine-China and Asia.
5. In terms of transit shipping, big risks offer greater opportunities - If Iran is interested in the European market, we should know that Georgia is the only country in the region that has a free trade agreement with the EU. If China is interested in the Turkish market, we should know that in the whole region there is only Georgia, which has a free trade agreement with both China and Turkey. Turkey has no such agreement with either China or the European Union.
6. Due to the lack of practice in Batumi and Poti terminals, in order for the port to be maximally loaded, it will be necessary to develop warehousing farms, where logistics centers should be developed first.
7. If we want to achieve the progressive economic growth, the country must shift from a transit load to the strategy of value-added creation. That is, the economy must create added value, in the form of infrastructure and innovation centers, which, as the economy grows, will increase exports and create additional jobs in Georgian Economy.
8. Railway freight transportation itself requires the development of Georgia's logistics sector. Most of the freight companies operating in Georgia provide 2PLs type carriers that carry cargo from point A to point B. There are already 3PLs companies in our neighboring countries that, in addition to shipping goods, own terminals, carry out brokerage, customs clearance and other procedures. In developed countries, there are already 6PLs, such as Alibaba and other similar companies, which provide a variety of services. Therefore, according to the World

Bank logistics index, Georgia is only in 119th place with 2.44 points from the point of view of the development of the logistics. In terms of the development of the logistics field, it is interesting for Georgia to learn from:

- ✓ **Belarus model** - the state did not adapt the development of the logistics system to the private investor, but rather worked out plan where the logistical centers must be located in terms of the territory. Concluded necessary research and studies and approved action plan, regarding the strategy, location, capacity, etc of such centers.
- ✓ The development of private terminals around the port - meaning the **Rotterdam model**, where refrigerated and dry warehouses are owned by private individuals.
- ✓ The same strategy is used by the neighboring Azerbaijanis when the Absheeron Logistics Center was set up and still operating.

Taking into account the financial resources that those countries have, for Georgia it would be better to start the arrangement of the logistic system by stages or phases. With the less financial risks and a higher return forecast for the invested resources.

Note 1. The compound annual growth rate (CAGR) is the rate of return that would be required for an investment to grow from its beginning balance to its ending balance, assuming the profits were reinvested at the end of each year of the investment's lifespan.  
<https://www.investopedia.com/terms/c/cagr.asp>

## REFERENCES

- [1]. Aggarwal, R., & Ranganathan, P., 2017. Common pitfalls in statistical analysis: Linear regression analysis. *Perspectives in clinical research*, 8(2), p. 100–102. <https://doi.org/10.4103/2229-3485.203040>
- [2]. Altman, E. I., 2013. Predicting financial distress of companies: revisiting the Z-Score and ZETA® models. Chapters, in: Adrian R. Bell & Chris Brooks & Marcel Prokopczuk (ed.), *Handbook of Research Methods and Applications in Empirical Finance*, chapter 17, pp. 428-456, Edward Elgar Publishing.
- [3]. Altman, E., 1968. Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy. *Journal of Finance*, September 1968;
- [4]. Altman, E., R. Haldeman, R., and Narayanan, P., 1977. Zeta Analysis: A New Model to Identify Bankruptcy Risk of Corporations. *Journal of Banking & Finance*, 1, 1977.
- [5]. Bersenev, A., Chikilevskaya, M., Rusinov, I., 2020. Silk Road Rail Corridors Outlook and Future Perspectives of Development. *Procedia Computer Science*, 167, p. 1080-1087. <https://doi.org/10.1016/j.procs.2020.03.407>
- [6]. Bewick, V., Cheek, L., Ball, J., 2003. Statistics review 7: Correlation and regression. *Critical Care*, 7, pp. 451-459. <https://doi.org/10.1186/cc2401>

- [7]. Chan, M.H.Th., 2018. The Belt and Road Initiative – the New Silk Road: a research agenda. *Journal of Contemporary East Asia Studies*, 7 (2), pp. 104-123. <https://doi.org/10.1080/24761028.2019.1580407>
- [8]. Church, S.K., 2018. The Eurasian Silk Road: Its historical roots and the Chinese imagination. *Cambridge Journal of Eurasian Studies*, 2018, 2: #XW4ESF. <https://doi.org/10.22261/CJES.XW4ESF>
- [9]. Ebrahim, M. A. and Al-Nasser, A. D., 2005. Estimating The Slope Of Simple Linear Regression In The Presence Of Outliers. *Journal of Modern Applied Statistical Methods*, 4 (2), Article 15. DOI: 10.22237/jmasm/1130804040
- [10]. Georgian Railway Information Technology Agency, 2021. The volume of the freight transported by JSC "Georgian Railway" in 2010-2020. Retrieved from <http://www.railway.ge/en/>
- [11]. Gondauri, D., Moistsrapishvili, M., 2019. Development of Railway Silk Road as a Platform for Promoting Georgia's Economic Growth. *International Journal of Business and Management*, 14(6), pp. 64-75. <https://doi.org/10.5539/ijbm.v14n6p64>
- [12]. Gondauri, D., Moistsrapishvili, M., 2019. Statistical and Financial Analysis of Georgian Railway's Main Performance Indicators in 2006-2019. *International Business Research*, 12 (10), pp. 64-74. <https://doi.org/10.5539/ibr.v12n10p64>
- [13]. Government of Georgia, 2010. State Strategy for the Regional Development of Georgia 2010-2017, Government of Georgia: Tbilisi.
- [14]. Eurostat, 2021. Retrieved from <https://ec.europa.eu/eurostat>
- [15]. Ko, Y., Fujita, H., Li, T., 2017. An evidential analysis of Altman Z-score for financial predictions: Case study on solar energy companies. *Applied Soft Computing*, 52, pp. 748-759. <https://doi.org/10.1016/j.asoc.2016.09.050>
- [16]. Krugman, P., 1991. Increasing Returns and Economic Geography. *Journal of Political Economy*, 99, pp. 483-499.
- [17]. Li, J. & Huang, Z., 2019. On the Way to the Silk Road: Trade, Investment, and Finance in Emerging Economies. *Emerging Markets Finance and Trade*, 55 (14), pp. 3131-3133. <https://doi.org/10.1080/1540496X.2019.1644104>
- [18]. Li, Y. & Schmerer, H., 2017. Trade and the New Silk Road: opportunities, challenges, and solutions. *Journal of Chinese Economic and Business Studies*, 15 (3), pp. 205-213. <https://doi.org/10.1080/14765284.2017.1347473>
- [19]. National statistics office of Georgia. Gross Domestic Product at current prices by 45 activities Retrieved from [http://www.geostat.ge/index.php?action=page&p\\_id=119&lang=eng](http://www.geostat.ge/index.php?action=page&p_id=119&lang=eng)
- [20]. Sternberg, T., Ahearn, A., McConnell, F., 2017. Central Asian 'Characteristics' on China's New Silk Road: The Role of Landscape and the Politics of Infrastructure. *Land*, 6 (3), pp. 55. <https://doi.org/10.3390/land6030055>
- [21]. USAID, 2012. Competitiveness Analysis of the Caucasus Transit Corridor: Improving Transit Potential for Central Asia-Europe Traffic. *USAID Economic Prosperity Initiative*. Retrieved from [http://pdf.usaid.gov/pdf\\_docs/pnadz433.pdf](http://pdf.usaid.gov/pdf_docs/pnadz433.pdf)
- [22]. Vinokurov, E., 2016. Transport Corridors of the Silk Road Economic Belt Across the Eurasian Economic Union: Preliminary Estimates for Transportation Capacity and Investment Needs. Available at SSRN: <https://ssrn.com/abstract=2771587> or <http://dx.doi.org/10.2139/ssrn.2771587>
- [23]. Wetzell, D. and Dunn J., 2001. Decentralisation in the Transition Economies: Challenges and the Road Ahead. *PREM Unit Europe and Central Asia*, World Bank: Washington, DC.
- [24]. World Bank, 2014. *Georgia: Seizing the Opportunity to Prosper*. Retrieved from <http://documents1.worldbank.org/curated/en/206231468030253311/pdf/896080ESW0whit0P14734400PUBLIC00CEM.pdf>
- [25]. Yang, H., Wang, J., Liu, Y., 2001. A new approach for the slope stability analysis. *Mechanics Research Communications*, 28 (6), p. 653-669. [https://doi.org/10.1016/S0093-6413\(02\)00217-3](https://doi.org/10.1016/S0093-6413(02)00217-3)
- [26]. Zheng, X., Jia, L., 2017. An Empirical Study on the Economic Effect of Financial Cooperation among Countries of the "Silk Road Economic Belt", *Inzinerine Ekonomika-Engineering Economics*, Vol. 28(5), pp. 542-551
- [27]. Zoran W., Hrvoje J., Antea, B., 2018. Analysis of characteristics and potential effects of the New Silk Road initiative. *Proceedings International Journal of Arts and Sciences*, 11 (2), Conference of the International Journal of Arts and Sciences, pp. 255-260.