COVID-19 as a trigger for global transport infrastructure digitalization

E M Medyakova¹, N A Kislitskaya¹, S G Kudinova² and V A Gerba²

¹ South-Russian Institute of management – branch of the Russian Academy of national economy and state service under the President of the Russian Federation, 70 Pushkinskaya street, Rostov-on-Don, 344002, Russia
² Gzhel State University, 67 village Electroizolyator, Ramensky district, Moscow region, 140155, Russia

E-mail: cpkglav@mail.ru

Abstract. The global transport infrastructure has evolved in recent years, gradually incorporating digital innovations into traditional processes and services. However, everywhere the process of digitalization was hindered by the priority and low cost of classic forms of transport services, the absence of strict requirements for compliance with the conditions of contactless movement of products and prevention of the spread of infections. According to the authors, the vector for total digitalization was taken after the spread of the SARS-CoV-2 virus. The authors analyzed the implementation of digital tools until 2019, assessing the degree of implementation and coverage of digital innovations in the global transport industry. Having studied the transport system of Russia, as one of the world's largest systems, in the context of the COVID-19 pandemic, the authors showed how the structure of cargo turnover by the mode of transport has changed and which industries have suffered the most damage. Having calculated the forecast of digitalization growth and the dynamics of the share of digitized processes in the global transport infrastructure, the authors have come to the conclusions about the acceleration of the accumulated potential of digitalization of the transport sector in the context of the COVID-19 pandemic.

1. Introduction

The increased global trade associated with the international division of labor brought about rapid growth in transport services, which has not stagnated even in the current quarantine action period. Transport is a key area in global economy, satisfying the vital need for society to move people and goods. It is transport that provides the framework for effective foreign and domestic trade, industrial relations development, passenger and cargo transportation. However, the rapid and extensive transmission of the SARS-CoV-2 virus has become a serious test of strength for the existing economic models and chains of interaction in the global economy.

2. Trends in the transport system digitalization

The digitalization in the global transport infrastructure was brought into focus over a decade ago and has become established in the international economy. However, in the transport sector, some business models did not require urgent digitalization. Until 2019, a few of conservative industries had operated in traditional formats due to low economic efficiency of such investments.
Before the pandemic, the trends in transport digitalization included the following forms: digitalizing roads with automated traffic control systems; citizens using Big Data for travelling in public transport; operations of taxi services aggregators. The Catapult Transport System analysts define the “intelligent mobility” market as emerging, with a favorable projection of its volume of £900 billion per year [1] by 2025. In view of this, the UK developed the Capability Delivery Plan, envisaging the introduction of real-time data collection procedures, to develop a new niche in the national transport infrastructure. Retail is also a key driver for restructuring transport infrastructure formats. The online services of trading and delivering products to the final consumer have led to new solutions to the “last mile” problem. Over the past four years, the five largest food retailers in the Russian Federation have remained the same, each of them has its own digital transformation format (See Table 1).

Table 1. Top 5 food retailers in Russia[2]

| Company name | % market share 2016 | % market share 2017 | % market share 2018 | % market share 2019 | The share of digital services in the total volume of retail services at the beginning of 2020, % |
|--------------|---------------------|---------------------|---------------------|---------------------|-------------------------------------------------|
| XS           | 8                   | 9,5                 | 10,7                | 11,5                | 10,0                                            |
| MAGNIT       | 7,4                 | 7,5                 | 7,6                 | 7,6                 | 1,0                                             |
| LENTA        | 2,1                 | 2,5                 | 2,8                 | 2,5                 | 2,1                                             |
| AUCHAN       | 2,9                 | 2,2                 | 1,9                 | 1,5                 | 3,5                                             |
| DIXI(DKBR)   | 2,4                 | 2,1                 | 5,1                 | 5,7                 | 3,1                                             |

In the 2019 report, XS, Russia’s largest grocery retailer, noted that about 20% of investments are directed to the development of digital business models with great economic potential, including the active development of express delivery services. The company’s plans – by 2022 the said digital projects should account for more than 10% of annual revenue growth – represent the need to modernize urban transport infrastructures. However, data analysis shows that even before the massive spread of the SARS-CoV-2, the share of digital services even among the largest retailers was insignificant.

Challenges in the development of urban delivery systems have given rise to other modes of transport. In 2016, the German postal company Deutsche Post (DP) established a new niche in the automotive market, having independently developed electric trucks for parcel delivery. Now StreetScooter, owned by the Deutsche Post, provides cost-effective and environmentally friendly electric cars for both the company’s needs and for sale. However, this area of company activities has faced high-risk situations: with the outbreak of the COVID-19 pandemic, its operation has been significantly limited and economically unprofitable.

Another area of development is autonomous transport, both by air and by road. The air delivery is dominated by the delivery of goods by drones. Thus, in 2019, Wing in the USA obtained the right to provide services for the delivery of goods by drones, based on an Air Carrier Certificate [3]. Similar developments by Amazon (Prime Air) in the USA and Google (Project Wing) in Australia and the USA have been known since 2015.

According to the projections, made by the General Accounting Office of the USA, the profit for the country’s economy from the introduction of drones in the US airspace is expected to amount to $82.1 billion by 2025[4]. The first digitally controlled autonomous truck in the USA was flown back in 2016. As regards freight transportation automation, the Russian Railways tested fully automated sorting cars at the Ust-Luga transport hub. This trend is being taken forward in warehouse operations, reshaping the economy and technological processes of warehousing. Mass production is projected for the mid-20s.
The COVID-19 pandemic has shown that the said trend is cost-effective, ensuring greater safety for the consignees’ health and reducing risks of infection and cargo delays caused by compliance with the quarantine requirements.

Another trend, which was observed even before the COVID-19 pandemic, presented itself in integrated transport and logistics platforms covering aviation, road and rail transport. Major vehicle manufacturers offer their own platforms – Siemens (Mindsphere platform), GE (Predix platform), MAN (Rio platform), Airbus (Skywise platform), Boeing (Analytics platform). Among others one should note the Australia Post at the E-Commerce Platform Neto – 2016; Alibaba Group – 2017; IBM and Maersk consortium – 2017, as well as platform solutions in the passenger taxi market, with Uber, Lyft, Yandex.Taxi as leaders. Findings show that the trend is prevented from realizing its full potential by the complexity of the task to ensure the aggregated data security.

In today’s economic situation, the transport operation when objects are simply moved from place to place is not good enough: the buyer of transport products wants to purchase a comprehensive service from one provider. Therefore, in the global transport market the focus is on service issues and quality. A striking example of such a project is the development of Hitachi Rail Europe, which replaced traditional English trains with “train-as-a-service”.

“Train-as-a-service” involves the modernization of rolling stock using means of collecting, storing and analyzing data around the clock in real time. An important role in this process was played by the development of cloud technologies, cheaper sensors and the growing availability of analytical tools.

An interesting project of the Russian Gazprom Neft is the Digital Fuel Truck. “Digital fuel truck” is collaborating on a set of digital solutions to ensure the safety and quality of motor fuel transportation by road based on a fuel truck, which is no longer considered as an ordinary container for transporting petroleum products, but as a platform for testing modern remote delivery control systems. An American startup FlexPort, specializing in high-tech logistics and freight information software, would be an example of a comprehensive service. The logistics operator FlexPort has developed and introduced a multi-level system of services: software, expert services and infrastructure elements, which allows customers to build their internal supply chains using their electronic platform.

The revolutionary digital twin technology also reveals great potential for transport infrastructure, which allows to create complete vehicle simulation models and evaluate all operational characteristics. Digital twin technology saves time and money spent on testing and overproduction, allows manufacturers to recreate and pre-test each stage of development to identify possible problems and failures before the actual production process begins and has already been implemented in Siemens, General Electric, Alstom, etc.

Digital doubles are also used in intelligent cars, for example, in Tesla cars. The IoT sensors (Internet of things) installed in the vehicle can transmit information from its digital twin, and the information collected in this way allows to monitor the working condition of the car, as well as identify its problems in the early stages, in order to avoid costly repairs [5]. The global trend of globalization also affected the transport sector. Even before the coronavirus pandemic, specialists observed the trend towards collaboration, cooperation, and service integration.

3. The transport system of Russia in the period of the COVID-19 pandemic

Russia’s transport system has the following ratings in the global economy[6]:

- Russia is second in the world in terms of the length of inland waterways (101 thousand km). In Russia, water transport contribution to cargo turnover amounts to 2% only, while in China and in the USA it accounts to 50% and 10% of shipment volumes respectively.
- Russia ranks third in the world in terms of the length of public railway lines (86 thousand km).
- Russia ranks third in Europe in terms of transshipment volumes (155 million tons). Despite the high growth rates of the Russian stevedoring industry, Russia’s seaports lag far behind the world leaders in the cargo turnover. The volume of cargo transshipment in US ports is three times larger than in Russia, and transshipment in Chinese ports is 10 times higher.
Russia is fifth in the world in terms of road length (1529 thousand km). The three key freight transport types in Russia are pipeline, rail and road. The leading position of pipeline transport is explained by the hydrocarbon orientation of Russian exports, with the key oil and gas fields located at a far distance from energy resources consumers (See Table 2).

Table 2. The freight turnover in Russia by modes of transport 2015-2019[7]

| Year | Freight turnover | railway | automotive | marine | waterway | aviation | pipeline |
|------|------------------|---------|------------|--------|----------|----------|----------|
| 2015 | 5089.6           | 2305.5  | 232.1      | 39.8   | 62.6     | 5.4      | 2444.2   |
| 2016 | 5181.8           | 2344.1  | 234.5      | 42.8   | 64.7     | 6.6      | 2489.1   |
| 2017 | 5476.7           | 2493.0  | 250.9      | 107.6  | 103.4    | 120.6    | 2614.9   |
| 2018 | 5639.5           | 2597.3  | 250.9      | 106.4  | 64.5     | 7.6      | 2667.8   |
| 2019 | 5669.1           | 2601.8  | 259.0      | 104.4  | 96.0     | 9.2      | 2686.2   |

Cargo turnover in Russia has been developing steadily since 2015, with the highest indicator in 2017. Analyzing the statistics for 2019, it is possible to note the growth in freight turnover for road transport (+ 5.8%) and pipeline (+ 0.7%), and some positive dynamics in the freight turnover for railways (+ 0.2%). In the same period, the cargo turnover for sea, inland water and air dropped by 1%, 4.9% and 4.6% respectively.

Thus, road transport was the only one to show a real increase in freight turnover. In fact, its strong performance prevented the overall figures for all modes of transport from going negative, and ensured +0.6% growth compared to 2018. In general, positive dynamics without a sharp increase was predicted for 2020, but according to the results of January 2020, freight turnover in Russia decreased by 4.4% compared to that of January 2019, and by 5.2% compared to that of previous December.

Rosstat also published operational data on the freight turnover of various modes of transport in the first quarter of 2020 (See Table 3):

Table 3. The freight turnover of various modes of transport, the 1st quarter of 2020[8]

| Mode     | March 2020 | March 2019 in % to | I quarter of 2020 | March 2018 in % to |
|----------|------------|-------------------|-------------------|-------------------|
| Freight turnover | 459.5 | 92.9 | 105.1 | 96.0 | 102.5 | 112.6 | 102.3 |
| railway   | 214.8 | 92.8 | 108.7 | 95.4 | 103.1 | 115.7 | 102.4 |
| automotive| 20.7 | 88.7 | 102.4 | 99.8 | 118.0 | 126.0 | 108.6 |
| marine    | 3.0  | 98.6 | 109.8 | 95.0 | 103.4 | 112.8 | 91.7  |
| waterway  | 2.4  | 105.6 | 130.0 | 102.8 | 108.5 | 105.7 | 111.2 |
| aviation  | 0.6  | 93.3 | 179.1 | 91.8 | 102.0 | 153.8 | 90.9  |
| pipeline  | 218.0 | 93.2 | 101.6 | 96.3 | 100.6 | 108.6 | 101.7 |

Forecasting methods allow to project that the losses in Russia’s transport sector may exceed 520 billion rubles at the beginning of July 2020, with the aviation segment (which practically halted operations) hit the hardest. Stevedores and trucking companies also found themselves in a difficult situation.
Table 4. Calculation of pandemic-related revenue losses in the RF transport industry

| Industry                     | The volume of losses since the introduction of restrictions and until May 31, billion dollars | Share of losses in the industry's annual revenue, % | Reasons for the decline in income                                                                                                                                 |
|------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Airports                     | 0.73                                                                                             | 19.2%                                                | Reduction of internal and external passenger traffic, suspension of flights with foreign countries, introduction of self-isolation in most Russian regions |
| Airlines                     | 3.88                                                                                             | 19.2%                                                | Reduced passenger traffic on suburban and long-distance flights (closing many routes) due to self-isolation, reduced cargo traffic |
| Railway                      | 0.94                                                                                             | 3.3%                                                 | Reduced volumes of tourist and cruise passenger traffic compared to last year due to self-isolation. Restrictions on cargo transportation are likely to have minimal impact |
| Inlandwaterways              | 0.04                                                                                             | 3%                                                   | Drop in traffic on toll highways due to self-isolation mode                                               |
| Tollroad                     | 0.02                                                                                             | 6.1%                                                 | Reduced passenger traffic first due to the transfer of some employees to remote work, then due to self-isolation of the population |
| Metro                        | 0.31                                                                                             | 12.8%                                                |                                                                                                             |
| Urbangroundtransport         | 0.46                                                                                             | 11.2%                                                |                                                                                                             |
| Taxi                         | 0.98                                                                                             | 9.2%                                                 |                                                                                                             |
| Carsharing                   | 0.04                                                                                             | 13.8%                                                |                                                                                                             |

Figure 1. The volume of losses from the moment the restrictions were introduced until May 31, billion dollars

Figure 2. The share of losses in the annual revenue in the industry, %

Source: data from the Russian government, Rosstat, SPARK, relevant authorities and companies, analysis and calculations by Infraone[9]

The COVID-19 pandemic hit the airline industry more than any other sector. The air cargo turnover decreased back in 2019, responding to the entire macroeconomic situation. A number of production sectors, where the demand for air cargo (relatively expensive) is usually growing, showed stagnation. The high price of jet fuel, the drop in the purchasing power of the
population, the shift to alternative modes – rail or sea transport – to reduce costs, but to the detriment of delivery time, reflects stagnation.

Adding to the above, are the 2020 quarantine measures and an almost complete termination of international air traffic (by 90%). Cargo airlines are operating, however, a decrease in cargo flow forced many businesses work on a charter schedule and use tariffs with a higher coefficient, for example, two or three [10].

The sea freight sector has also faced problems. New standards of the IMO 2020 were introduced in January 2020, which envisage a transition to a more environmentally friendly type of fuel; freight rates have decreased due to the pandemic. The Russian shipping industry suffered a significant blow: exports fell by 3%, imports by 9%. The total turnover of container shipping to / from St. Petersburg fell by more than 6%, the indicators of the Black Sea and the Far East ports are even lower[11].

The spread of coronavirus infection opens up new possibilities for railway transport, and this is a worldwide trend[10]. This type of transport is becoming more attractive both in price and in transit time. The cancellation of passenger trains allowed to release the schedule for the running of freight trains. It was the railway that became an important logistics channel and ensured uninterrupted trade between China and Europe and the delivery of anti-epidemic drugs.

The pandemic had a serious impact on the truck’s delivery time across the border. Several countries introduced a direct ban on the entry of any vehicles, including commercial freight vehicles. Under these conditions, rail transport is considered the only reliable alternative for ensuring foreign trade, as well as providing essential goods. But in general, there has been an overall decline in demand for cargo transportation, brought about by quarantine shutdown of the client enterprises. Given that railway transport does not have “door-to-door” delivery, there is a need for using road transport in any case.

Road transport also showed a negative value in terms of cargo turnover, but to a lesser degree than other means. The volume of traffic between the regions of the Russian Federation and within them has not yet been significantly reduced, the structure of the goods that need to be delivered varying. This type of transport has obvious advantages: high mobility, the ability to deliver "door to door", which is currently absolutely essential.

Most states have created certain conditions for the passage of goods. All this requires redrawing the logistics schemes, revising the delivery dates, and sometimes even looking for new contracts (if the company or entrepreneur is engaged in import-export of goods, which got into focus of the European Commission)[12]. Therefore, despite the fact that the borders are open for international freight shipments, strict checks, quarantine and other measures slow down the speed of delivery by road. The turnover of transport is falling, there is a shortage of goods due to a halt in production and a fall in consumer demand. In addition, not all companies are able to go online, the physical delivery of goods, the provision of work and services in some cases cannot be replaced by a digital service.

The authors worked out three scenarios (basic, risky and negative) of the industry development in Russia in 2020-2021. They estimated that the 2020 revenue in the freight and forwarding segment will decrease under basic conditions by 10% compared to 2019 (in the risky scenario up to 15%); the volume of air transportation of goods and mail will show a decrease of 8-10% (in the risky scenario – down to -15%). Therefore, the restoration of the previous level of traffic before the end of the year is unlikely to happen.

The total volume of transportation in 2020 will fall by 3.5% under basic conditions, in negative case it is expected to drop up to 10%. As in 2019, vehicles can show mild conditions and relatively positive results (a fall of 1% under basic conditions), and air transport will become the most affected area (under basic conditions no less than 15%). The transport performance is likely to be restored by 2021, provided that quarantine restrictions are lifted by the beginning of the 3rd quarter in 2020 and the domestic and international demand renews its growth.
4. Pandemic-related acceleration of implementing the digitalization potential in the transport sector

Digitalization of the world economy was gaining momentum when the COVID-19 pandemic broke out. The widespread coronavirus infection has become a challenge to the economy and management of each country and has already caused a drop in global economic indicators. Before the outbreak of the COVID-19 pandemic, the estimated real world GDP growth in 2020 was low, approximately 2.3%. Undoubtedly, the impact of coronavirus on the economy is changing the situation, and now the global production is assumed to decrease by 2.5% compared with the global financial crisis.

Restrictive measures, closed borders, illnesses and negative consumer and business sentiment will suppress demand, on the other hand, the obvious reduction in production and destruction of supply chains creates bottlenecks in supplies. Thus, experts at the Center for Macroeconomic Analysis and Short-Range Forecasting believe that before the pandemic onset, the world economy was already at that point of cyclical development, which can be described as overheating, with excessive indicators of debt growth and indicators of overheating, which attracted attention of many international organizations, including the World Bank [13]. But the pandemic was not the cause of the current crisis; signs of a structural crisis in the global economy were observed even before the spread of SARS-CoV-2. The pandemic only pushed it toward a more rapid development of crisis phenomena in all areas of the world economy.

Globalization, simplification of chains and transparency of the digital economy, dependence on commodity supplies, synchronization of events regardless of their geographical location – all these may be considered distinctive features of the current stage of relations, which have become weak links for the spread of coronavirus and global recession in all key sectors. The current stage of economic development witnesses reduction in production volumes, followed by the fall in demand and lower oil prices, stock market problems, bankruptcy of small and medium-sized businesses, including those in the transport sector, and active search for innovative, predominantly digital solutions.

The spread of SARS-CoV-2, on the one hand, exposed all the problem areas of the global economic processes, and on the other, triggered accelerated realization of the accumulated potential in the use of digital technologies. In addition, it was instrumental in working out new solutions to combat the virus and its destructive impact on society and economy. There was a rapidly growing awareness that extrapolation of traditional methods would be ineffective and unproductive and the challenge called for a totally new approach.

Figure 3. The projected digitalization growth, the share of digitized processes in the global transport infrastructure, billion dollars

Source: Bloomberg data, authors’ calculations

The SARS-CoV-2 pandemic resulted in destruction of the well-established links between manufacturers and consumers around the world and introduction of restrictions on the movement of products and passengers across all state borders. There have been dramatic changes in business operations for transport and logistics companies.
This process allowed participants in economic relations to focus on domestic markets, and switch from transporting their products by air to shipping by rail and river. Meantime, the global logistics chains, carefully built and successfully tested for years, were seriously affected. The spread of coronavirus, which caused a large-scale suspension of global production, also dealt a significant blow to the service supply chains of raw materials and finished products, which ensured goods flows movement. Digital solutions, currently in use in the logistics market, now form the basis for aggressive price dumping in the freight market, as the amount of goods decreases and transport is idle. This is one of the competitive advantages, as well as an additional incentive for the company development. A possible optimization solution in this regard is the shift of most employees to remote work full time. This will require optimization and automation of all business processes in the transport company. Involving employees in the company development by establishing digital platforms for the exchange of ideas will help reinforce team spirit in the organization, create transparent and streamlined business processes. During the COVID-19 pandemic, the accumulated potential and the initiatives discussed above led companies to structured use of IT platforms for logistics companies in order to exchange tariffs and rates, which dramatically changed the approach to providing services. In the pandemic period, “intelligent technologies” enabled companies to conduct an operational analysis, for example, of the passenger traffic in public transport, and the schedules for the highway operation. Forced collaboration measures (consignment reduction, idle equipment) lead to an increase in demand for “groupage goods” services and their digital support. The trend towards highly automated supply chains continued to develop via simplifying access to transportation orders. Now, a mobile application, which is a digitalized logistics platform, allows to place an order in one click. “Mobile carriers” service is emerging. In Russia, this digitalized logistics platform is already used by Russian Post, Dostavista, Garantbox, Take’n’go, Boxberry, Scooter, Yandex Delivery. Courier delivery services are getting a new opportunity to offer contactless delivery with no human involvement. In this area, the slow development gave way to active use of digital instruments. During the pandemic in China, most door-to-door deliveries were performed by "drones", which proved safe and highly efficient under the circumstances[14]. According to Fitch, China’s investment plans envisage launching major digitalized infrastructure projects in the new five-year period (development of the metro, roads, railways, construction of 5G networks and data centers).

5. Conclusion
Despite the ongoing transformation processes, the long-term development trends in the global transport sector have remained unchanged. They are still aimed at expanding the global network of transport communications, increasing their load, improving the synchronization of various modes of transport. Integration and joint operation of various transport modes for intermodal transportation is a perspective trend for the foreseeable future [15].

The impact of the COVID-19 pandemic on the transport infrastructure is recognized as significant. The spread of the virus and its consequences prompted economic agents to accelerate the digitalization of processes, led to the formation of cross-platform digital interaction, outsourcing some traditional operations and the shift to remote work [16], thus reshaping the management of all company resources [17,18]. In the period of COVID-19 pandemic, some of the previously developed areas of business activities became risky and had to be postponed until all quarantine restrictions were lifted. Participants in the transport services market unanimously demonstrated the increased demand for digital instruments to find partners and customers, adjusting internal management systems, communications, control, and adopting best international practices. The pandemic caused the shift of digital transformation focus towards the development of technological aspects in the entire global transport industry. The post-
pandemic transport infrastructure should probably be multimodal and adaptive, allowing for quick transformation.

References

[1] Trafigura foundation annual report 2019: http://touchline.digipage.net/imagine/2017/4-1
[2] X5 retail group annual report 2019: https://www.x5.ru/en/Documents/reports/2019/index.html#main-fs, authors’ calculations
[3] Google Wing drones approved for US home deliveries: https://www.bbc.com/news/technology-48029396
[4] United States Government Accountability Office: Report to Congressional CommitteesContinues Progress toward Integration into the National Airspace2015https://www.gao.gov/assets/680/671469.pdf
[5] Congratulations, It’s a Digital Twin!2018https://www.industryweek.com/technology-and-iiot/article/22026161/congratulations-its-a-digital-twin
[6] Overview of the cargo transportation industry in Russia 2019 https://www.ey.com/Publication/vwLUAssets/ey-transportation-services-2019-rus/$FILE/ey-transportation-services-2019-rus.pdf
[7] Compiled by the authors according to Rosstat data 2020https://www.gks.ru/compendium/document/50801
[8] Rosstat 2020 Information on the socio-economic situation of Russia. https://nangs.org/analytics/rosstat-informatsiya-o-sotsialno-ekonomicheskom-polozhenii-rossii-kratkij-pdf
[9] InfraOne Research Weekly 2020 https://infraone.ru/sites/default/files/analitika/2020/infraone_research_weekly_09_33_08052020.pdf
[10] Transport moves through quarantine 2020:https://www.kommersant.ru/doc/4320861
[11] Sea transport in conditions of coronavirus: how to transport cargo2020: https://sf-logist.ru/poleznoe/morskie-perevozki-v-usloviyah-koronavirusa-kak-perevezti-gruz
[12] Influence of coronavirus on cargo transportation in Russia 2020: https://perevozka24.ru/pages/vliyanie-koronavirusa-na-gruzoperevozki-v-rossii
[13] Belousov D.R. et al. 2020 On the medium term forecast of the Russian economy development in the context of the coronavirus pandemic and possible crisis of the world economyhttp://www.forecast.ru/Forecast/fore052020.pdf
[14] Fitch Ratings-Shanghai2020:https://www.fitchratings.com/research/corporate-finance/china-express-delivery-sector-to-become-capital-technology-intensive-04-03-2020
[15] Ushakov D 2016 Actual Problem of Economy 1(175)pp 94-104.
[16] Ushakov D, Auliandri A T. 2020 IOP Conf. Ser.: Mater. Sci. Eng. 753 082024.
[17] Sitthiwarongchai C, Jadesadalug V, Kongklai C2018The EUrASEANs: Journal on Global Socio-Economic Dynamics 1(8)pp 64-72.
[18] Ushakov D 2016 Int. J. Of Environmental & Science Education 11(18)pp 12937-12945.