

Adaptation of logistics companies to operation under the Covid-19 pandemic restrictions

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Abstract: The COVID-19 pandemic has made the problem of companies adapting to operate under restrictions more acute. Logistics companies were the special focus of researchers because of the specifics of the COVID-19 pandemic. The article aims to determine the features of the management of logistics companies to adapt them against the background of the COVID-19 pandemic restrictions. The methodological background of the analysis is the analysis of financial ratios — Total Revenue Growth; Capital Expenditure Growth; Working Capital Growth; Debt/ Equity ratio; Equity/Total Assets, as well as the case method — a description of the business situation of the company in the sample of JD Logistics, which have successfully adapted to changes against the background of the COVID-19 pandemic. Analysis of the financial statements of the surveyed companies revealed several trends in their financial management during the pandemic — a decline in net income from sales after the pandemic; an increase of capital investments in 2019-2021; reduction of working capital growth rates after 2019; growth of the debt-to-equity ratio after the beginning of the pandemic; maintaining the equity to assets ratio at a stable level in 2019-2021. A set of factors influencing the exogenous and endogenous environment is identified in support of the logistics companies adaptation programme under the COVID-19 pandemic restrictions by the following blocks: “government action and regulatory policy”; “support of the company’s operation”; “company finance”; “customer relations”; “relations with suppliers”. Prospects for further research involve studying financial and market factors influencing the practice of adaptation of logistics companies in a pandemic, as well as studying the problem of adaptation of companies in the post-crisis phase after the COVID-19 pandemic.

1 Introduction

The COVID-19 pandemic broke out in late 2019 in Wuhan, China and quickly spread to more than 100 countries out of 67,500 cases by February 2020 [1]. In 2021, more than 517 million cases of infection and more than 6 million officially recorded deaths from coronavirus disease were recorded globally. The World Health Organization [1] reported the following number of cases of infection in some regions of the world for 2021: Southeast Asia — about 41 million cases, America — almost 83 million cases, Europe — more than 64 million cases.

At the same time, the largest national economies were most affected by the COVID-19 pandemic. According to the analytical platform Epidemic Stats [2] in April 2022, the TOP-5 countries (excluding China) were USA (83,567 thousand cases), India (43,102 thousand cases), Brazil (30,558 thousand cases), France (28,928 thousand cases), Germany (25,337 thousand cases). Accordingly, the largest national economies have been significantly damaged: the rate of economic activity in all sectors of the economy in general and logistics in particular is declining.

The COVID-19 pandemic has entailed a large-scale socio-economic crisis with a wide range of consequences.

The restrictions imposed to combat the effects of the COVID-19 pandemic and to limit the spread of coronavirus disease have one of the most significant consequences. The above-mentioned restrictions affected all economic agents: households, corporations, governmental and non-governmental organizations. However, different sectors of the economy have been affected by the COVID-19 pandemic restrictions with varying degrees of severity depending on the specifics of their work and integration into the global economy. The logistics sector is one of the most severely affected by the COVID-19 pandemic restrictions. Restrictions involved complete or partial shutdowns of logistics companies, their contractors and supply chain partners, restrictions on access to transport infrastructure, strict public health and staff access regulations, increased morbidity of logistics company staff and their partners as a result of physical contacts necessitated by the specifics of work, etc.

All the foregoing affected the pace of development of logistics companies, their market and financial position, prospects for future growth and the ability to create value for stakeholders. These effects of the COVID-19 pandemic restrictions have a negative impact on the state of logistics companies, as well as encourage the development and implementation of adaptation programmes in response to constraints imposed with the aim of combating the spread of coronavirus and reducing the socio-economic burden of combating COVID-19. Current changes occurring in the exogenous and endogenous environment encourage companies and governments to implement short- and long-term adaptation plans. In the short term, such changes involve restrictions imposed with the purpose of reducing the spread of the virus, optimizing staff, attracting support through government programmes, adapting to changes in human behaviour in a pandemic, ensuring the company's financial stability, establishing relationships between counterparties and customers which have been disrupted by the pandemic. In the long run, the adaptation plans provide measures for digitalization, robotization, ensuring the stability of the company's business model.

In the context of the COVID-19 pandemic, the management of logistics companies faces the difficult task of developing and implementing an adaptation programme in order to provide a comprehensive response to socio-economic challenges at both micro and macro levels. The key steps involve adequate determination of the company's current market and financial position, understanding of exogenous and endogenous drivers that affect the company during the COVID-19 pandemic, planning of short- and long-term measures in response to the challenges underlying the decision on ensuring the company's long-term growth and enabling value creation for stakeholders. The need to take into account the trends of the modern economy creates an additional complication, which have had and will have an impact on the development of companies in the future regardless of the epidemiological situation, in particular, the digitalization trend. This

context necessitates a detailed study of the specifics of the adaptation of logistics companies to the COVID-19 pandemic restrictions. Much attention is paid to the main aspect of business process optimization based on logistics concepts and technologies [3] and the development of process optimization based on integrated pulling logistics technology [4].

Despite considerable attention to the problem of operation and adaptation of logistics companies under the pandemic restrictions, researchers do not cover the issue of adaptation of logistics companies in the long run, in particular in the context of digitalization. There is also a significant lack of practical guidance on comprehensive adaptation measures for logistics companies, especially with regard to the impact of the COVID-19 pandemic restrictions and their effects in both the short and long run.

Aim

The aim of the article is to determine the peculiarities of the adaptation of the operation of logistics companies under the COVID-19 pandemic restrictions. The aim involved the fulfilment of the following **research objectives**:

- analyse the market and financial condition of the selected logistics companies during the COVID-19 pandemic;
- analyse the factors of exogenous and endogenous environment that affect the adaptation of logistics companies during the COVID-19 pandemic;
- provide propositions for improving the practice of adaptation of logistics companies under the COVID-19 pandemic restrictions.

2 Literature review

There is a significant number of studies on the economic essence of the COVID-19 pandemic and its impact on business, in particular, logistics companies. Authors [5] study the impact of the COVID-19 pandemic on investment flows. A number of researchers study the economic essence of the logistics system and the impact of the pandemic on supply chains, in particular, the problem of pandemic restrictions for logistics systems. Researchers [6] note that the pandemic has caused significant restrictions imposed by the governments in terms of economic activity, particularly in companies' operations and logistics. This puts more strain on the infrastructure and logistics system. Authors [7] emphasize that the pandemic has placed a significant punch to the global production network and caused disruptions in the global logistics system.

Some authors [8] note that supply chains are a system of vessels of economic activity in the global economy. In [9], it is also stated that the restriction on freedom of movement, which directly affects the logistics system, is a major factor in the pandemic's impact on the logistics system. Researchers [10] emphasize that supply chain management is critical for companies, especially those

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operating regionally or globally. A wide range of exogenous and endogenous factors influence supply chains. The pandemic has significantly affected supply chain flexibility.

There is a number of studies that cover the problem of socio-economic effects of the pandemic for different sectors of the economy, industries, markets. Author [11] notes that companies have to deal both directly with the effects of the pandemic and the socio-economic effects of the crisis. Some researchers [10] distinguish closed borders between countries as the key negative effects of the pandemic restrictions. Authors [12] note that disruptions in transport and logistics have entailed significant disruptions in the proper operation of supply chains.

In [13], De Vos points out that the restrictions imposed by governments in response to the pandemic have disrupted stable economic ties and affected transport networks in the sea, rail, air and road transport. Prokopenko and Miśkiewicz [14] pay special attention to the study of the adaptation of shipping in the context of the COVID-19 pandemic. It was indicated that the COVID-19 pandemic has caused a number of serious disruptions in the transport and logistics sectors, including the cancellation of flights, which in turn has limited air freight transportation, disrupted global trade, caused labour shortages, and slowed down customs clearance [15]. Some authors [16] explore options for solutions in the transport sector.

A number of works focus on the peculiarities of the restrictions and socio-economic effects of the pandemic. In work [17] authors emphasize that the pandemic has had a number of socio-economic effects: the shutdown of production sites, the suspension and closure of businesses. According to [17], China was the first to experience supply chain failures, which subsequently affected global supply chains in different regions of the world and individual countries in the early 2020. In [18], it was noted that the COVID-19 pandemic waves resulted in numerous cases of suspension in various industries and chronic unforeseen disruptions in supply chains. In [19], authors state that disruptions in logistics systems caused by the pandemic are significantly different from the usual disruptions at the global and cross-sectoral levels, as well as the company level. In [20], Tucker, notes that lockdowns and business restrictions have resulted in numerous bankruptcies. According to [21], the pandemic has imposed restrictions on passenger traffic, has caused an economic downturn in the tourism sector.

A set of studies deal with the problem of limited supply chains, which is particularly pronounced during global crises such as pandemic, and their subsequent transformation. In [10], researchers emphasize that the sudden nature of significant negative factors of the exogenous environment pose additional difficulties in the context of a pandemic. As a result, the pandemic has revealed significant limitations in global supply chains. In turn, this requires companies to provide the effective management of supply chains. In [19], Craighead et al.

substantiate that although supply chains may have sufficient margin of safety to operate fully in cases of emergency, the ability of supply chains to painlessly adjust during global and all-encompassing crises such as the COVID-19 pandemic is objectively low. In addition to the above, it was advanced the following thesis: supply chains are vulnerable to unexpected sudden and spontaneous crises [10]. This is why the pandemic has aggravated supply chain constraints and has urged the need to adapt them adequately to the challenges of the exogenous environment.

Industry analysis, in particular, the analysis of air transport, is a particular focus in terms of problems of operation and adaptation of the logistics system during a pandemic. In [22], Tay et al. points out that the COVID-19 pandemic has significantly affected the aviation industry, which is a key component of the global logistics system. This affects the entire value chain in logistics, as well as related industries. In [23], it was noted that airlines are reorienting their aircrafts from passenger traffic to freight. Hamza [24] indicates that 90% of airlines have reduced or suspended their passenger flights as a result of the pandemic. According to [24], this directly impacts the global logistics system and world trade, because 50% of all cargo transported by air is transported by passenger flights.

A number of works study the problems of adaptation of companies to the pandemic restrictions, including constraints in the logistics system. In [25], Betti and Ni emphasize that the pandemic has urged the need to make companies more efficient and sustainable. In [9], it was pointed out that the pandemic has revealed not only the weakness of global supply chains, but also the urgent need to implement operational efficiency programmes aimed at inventory optimization, the introduction of flexible production systems, providing reliable sources of raw materials. In [26], Wang notes that the implementation of innovative solutions that promote the increasing quality of logistics services becomes especially relevant, which facilitated by digitalization. In [10], authors indicate that unexpected events that negatively affect supply chains can cause serious disruptions in the operation of a manufacturing company. This encourages the company's management to take measures to maintain secure stocks and uninterrupted production, as well as to look for alternative supply chains. In [27], Hrechyn et al. offer economic and environmental valuation models to improve supply chain performance. Research is carried out on the example of specific logistics processes for the collection and processing of woody biomass. Their result allows you to identify the most vulnerable points of the logistics system, opening up great opportunities for improving other supply systems. In addition to this thesis, researchers in [19] emphasize that supply chains also have their margin of safety and a certain extent of flexibility, but they have a low ability to quickly adapt to significant negative factors of the exogenous environment.

All these considerations and strategies are subsumed in the term of Supply Chain Risk Management (SCRM) that can be understood as "a part of Supply Chain Management which contains all strategies and measures, all knowledge, all institutions, all processes, and all technologies, which can be used on the technical, personal, and organizational level to reduce supply chain risks." [28]. The main objectives of SCRM is to increase the transparency and robustness of processes to withstand any kind of supply chain disruptions [29, 30]. Researchers are developing a number of approaches to the evolution of SCRM systems for logistics that gained importance in response to pandemic-related disruptions. In [31], Dolgui et al. propose the concept of supply chains that are open to reconfiguration because they are flexible, digitalized and efficient. In [29], was pointed out the potential of blockchain technology together with the use of smart contracts to face supply chain risks and to improve the transparency. In [32], Philipp et al. showcased how smart contracts can substitute intermediaries in the supply chain making the logistics system less vulnerable in time of pandemic. In [33], authors propose an approach to the adaptation of logistics companies during a pandemic based on effective risk management, in particular in inventory management, management of subcontractors, backup transportation route management.

The problem of complexity of programmes of the companies' adaptation in times of crisis is separately emphasized. In [34], Margherita et al. point out that having an effective adaptation plan is a critical success factor for a company in a turbulent environment, such as a pandemic. In [35], was emphasized the importance of the resistance of economic agents in the context of crisis adaptation and examines the external — social and commercial — factors of resistance. In [36], Shin and Park studied the role of top managers in successful adaptation of their companies to pandemic restrictions. In [37], authors deal with the drivers of companies' flexibility and efficiency in terms of their adaptation during the pandemic. In [38], Ketudat and Jeenanunta explore different cases of adaptation of logistics companies in a pandemic, focusing on the competitive advantages and features of the business model. Okamoto [39] states a complexity of managing both at micro and macro levels in the light of COVID-19. In [14], authors discuss the main aspects of business process optimization based on logistics concepts and technologies.

The issue of uncertainty and risk for logistics companies in the light of COVID-19 pandemics is developed in several research papers. In [40], authors consider peculiarities of managing business under uncertainty caused by COVID-19 pandemics. Shahbaz et al. [41] analyse an issue of managing supply chain under novel risks in the light of COVID-19 pandemics. In [42], authors further consider transformative response of logistics companies in the context of COVID-19. Wattanakul et al. [43] study uncertainty aspect in managing containerized logistics under COVID-19 pandemics. Was

analyzed innovative capabilities in managing logistics companies in the context of Industry 4.0 paradigm [44]. Liu et al. [45] study uncertainty of post-COVID-19 era in managing logistics companies. In [46], authors develop operational risk management tool for logistics companies in the light of COVID-19 pandemics. Kilpatrick et al [47] study specific tools for logistics companies in overcoming exogenous and endogenous disruptive effects of COVID-19 pandemics. Was outlines a need for multidimensional tool for managing risks in the context of COVID-19 [48].

However, previous studies lack research on the adaptation practices of logistics companies during the COVID-19 pandemic based on an analysis of their financial standing combined with the implementation of their short- and long-term market strategy. It makes this study topical.

3 Methods

We describe the procedure, methodological background and information background of the analysis in accordance with the aim and objectives of the research. The study of the problem of adaptation of logistics companies to the COVID-19 pandemic restrictions involved synthesis method to identify trends in the selected companies during a pandemic, as well as economic and statistical methods to process statistical information and financial statements of selected companies.

The methodological background of the analysis is the method of analysis of financial ratios, which includes the following indicators:

- Total Revenue Growth;
- Capital Expenditure Growth;
- Working Capital Growth;
- Debt/ Equity ratio;
- Equity/Total Assets.

The sample includes the leading Chinese logistics companies (5 companies), which are open joint-stock companies, regularly publish financial statements, have high quality disclosure for external stakeholders. This sample size is sufficient for analysing the practice of adaptation of companies to changes in exogenous and endogenous environment. The sample consists of the following companies:

- Deppon Logistics Co., Ltd. (China);
- JD Logistics, Inc. (China);
- STO Express Co., Ltd. (China);
- YTO Express Group Co., Ltd. (China);
- ZTO Express (Cayman), Inc. (China).

The results of the adaptation of the selected companies were studied by analysing the official financial statements of these companies, namely by analysing the financial

ratios for 2018-2021 and identifying trends before and after the COVID-19 pandemic.

The case method is another component of the methodological background of this study—a description of the business case of *JD Logistics* included in the sample, which has successfully adapted to changes during the COVID-19 pandemic. The main criteria for selecting this particular company from the sample were the high performance of the company compared to other selected companies which were identified by analysing the financial ratios of the sample companies for the analysed period. In particular, this is a positive dynamics of Total Revenue Growth and Capital Expenditure Growth of *JD Logistics*, as well as ensuring the development of the company through adequate financing.

The methodological background selected for the analysis of the said financial ratios is based on the OECD methodological study entitled *Guidance on the Transfer Pricing Implications of the COVID-19 Pandemic* [50], where it is recommended to use financial indicators among the key performance indicators in the study of corporate governance in a pandemic. In particular, this is Total Revenue Growth as an indicator of business success and adaptation to the pandemic.

The analysis of financial ratios of the selected companies was carried out for 2018-2021 on the basis of the financial statements. Table 1 provides an explanation of the analysed financial ratios. The *Yahoo! Finance app* and *MS Excel* software packages were used to analyse the financial statements of the selected companies.

Table 1 Financial ratios used in the economic and statistical analysis of the selected companies

| <i>Financial ratio</i> | <i>Comment</i> | <i>Calculation formula</i> |
|--------------------------------------|---------------------------------|--|
| <i>Total Revenue Growth, %</i> | Revenue growth rate | <i>Revenue t / Revenue t-1</i> |
| <i>Capital Expenditure Growth, %</i> | Capital expenditure growth rate | <i>Capital expenditure t / Capital expenditure t-1</i> |
| <i>Working Capital Growth, %</i> | Working capital growth rate | <i>Working capital t / Working capital t-1</i> |
| <i>Debt/ Equity, times</i> | Debt to equity ratio | <i>Bank loans/Equity, times</i> |
| <i>Equity/ Total Assets, times</i> | Equity to assets ratio | <i>Equity/Assets, times</i> |

Source: prepared on the basis of author's analysis

4 Results

The results of adaptation of logistics companies during the COVID-19 pandemic based on data from selected companies are provided below. Analysis of the financial ratios of the companies included in the sample revealed the following:

Decline in the Total Revenue growth rate of the sample companies after the pandemic with the resumption of growth in 2021;

Increase in Capital Expenditures of most sample companies after the onset of the pandemic;

Reduction of Working Capital Growth of most sample companies after 2019;

Growth of the Debt-to-Equity ratio of most sample companies after the onset of the pandemic;

Maintaining a stable Equity to Assets ratio of most companies in the sample in 2019-2021.

Table 2 summarizes the results of the analysis consider in more detail.

The success of the adaptation programme is reflected primarily in the dynamics of Total Revenue (Figure 1) – with “years” for axis X and “dynamics of Total Revenue Growth of *JD Logistics*” in % for axis Y. We provide illustrative material on the example of *JD Logistics* included in the sample, which most effectively implements the adaptation programme during a pandemic, as the analysis evidences. *JD Logistics* successfully develops its business on the basis of R&D, in particular, digitalization. The Total Revenue Growth most clearly indicates the success of the companies’ adaptation to the pandemic restrictions.

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Table 2 The results of the analysis of financial statements of logistics companies in the sample, 2018-2021

| Ratio | 2018 | 2018 | 2020 | 2021 |
|------------------------------------|-------------|-------------|-------------|-------------|
| <i>Deppon Logistics Co., Ltd.</i> | | | | |
| <i>Total Revenue Growth, %</i> | 9.7% | 12.6% | 6.1% | 14.0% |
| <i>Capital Expenditure Growth</i> | 57.1% | 81.0% | 36.7% | 54.3% |
| <i>Working Capital Growth</i> | -47.3% | -69.2% | -56.6% | -100.0% |
| <i>Debt/ Equity, times</i> | 0.2 | 0.3 | 0.3 | 0.7 |
| <i>Equity/ Total Assets, times</i> | 0.5 | 0.4 | 0.5 | 0.4 |
| <i>JD Logistics, Inc.</i> | | | | |
| <i>Total Revenue Growth, %</i> | 27.1% | 31.4% | 47.7% | 42.6% |
| <i>Capital Expenditure Growth</i> | -10.3% | -26.2% | 80.0% | 31.6% |
| <i>Working Capital Growth</i> | -31.3% | -42.9% | -51.9% | 100.0% |
| <i>Debt/ Equity, times</i> | 0.0 | 4.2 | 4.4 | 0.4 |
| <i>Equity/ Total Assets, times</i> | 0.0 | 0.1 | 0.1 | 0.5 |
| <i>STO Express Co., Ltd.</i> | | | | |
| <i>Total Revenue Growth, %</i> | 21.4% | 35.7% | -6.6% | 17.1% |
| <i>Capital Expenditure Growth</i> | -15.4% | -29.6% | 20.7% | 19.8% |
| <i>Working Capital Growth</i> | -81.3% | -164.1% | 136.4% | 58.0% |
| <i>Debt/ Equity, times</i> | 0.0 | 0.1 | 0.4 | 0.8 |
| <i>Equity/ Total Assets, times</i> | 0.7 | 0.7 | 0.6 | 0.4 |
| <i>YTO Express Group Co., Ltd.</i> | | | | |
| <i>Total Revenue Growth, %</i> | 8.7% | 13.4% | 12.1% | 29.4% |
| <i>Capital Expenditure Growth</i> | 9.8% | -3.6% | 55.2% | 6.6% |
| <i>Working Capital Growth</i> | -17.1% | -25.2% | -12.5% | -4.4% |
| <i>Debt/ Equity, times</i> | 0.3 | 0.2 | 0.1 | 0.2 |
| <i>Equity/ Total Assets, times</i> | 0.6 | 0.6 | 0.7 | 0.7 |
| <i>ZTO Express (Cayman), Inc.</i> | | | | |
| <i>Total Revenue Growth, %</i> | 11.2% | 25.6% | 14.0% | 20.6% |
| <i>Capital Expenditure Growth</i> | 52.8% | 31.3% | 76.2% | 1.3% |
| <i>Working Capital Growth</i> | -4.7% | -16.6% | -3.3% | -56.3% |
| <i>Debt/ Equity, times</i> | 0.0 | 0.0 | 0.1 | 0.1 |
| <i>Equity/ Total Assets, times</i> | 0.9 | 0.8 | 0.8 | 0.8 |

Source: calculated on the basis of official financial statements of the sampled companies

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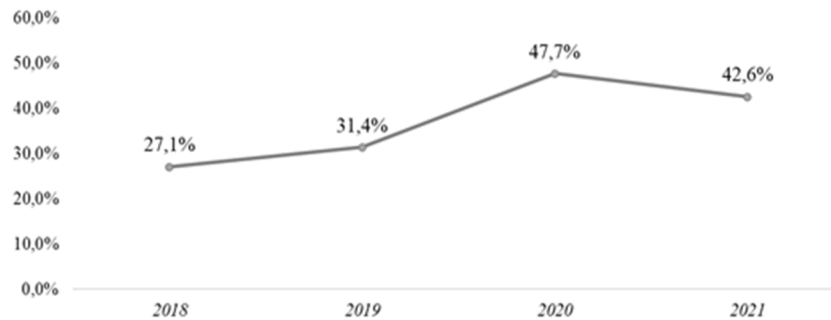


Figure 1 The dynamics of Total Revenue Growth of JD Logistics, %, 2018-2021
 Source: calculated on the basis of official financial statements of JD Logistics

Another important criterion for success of the logistics company’s adaptation programme is the dynamics of Capital Expenditure. JD Logistics increased its capital expenditures in 2020-2021 during the pandemic in response to the challenges of the socio-economic crisis (Figure 2) – with “years” for axis X and “dynamics of

Capital Expenditure Growth of JD Logistics” in % for axis Y. Increasing capital expenditures allows for the effective implementation of an adaptation programme based on the creation of competitive advantages. The company is unable to maintain market leadership in the long run without capital expenditures.

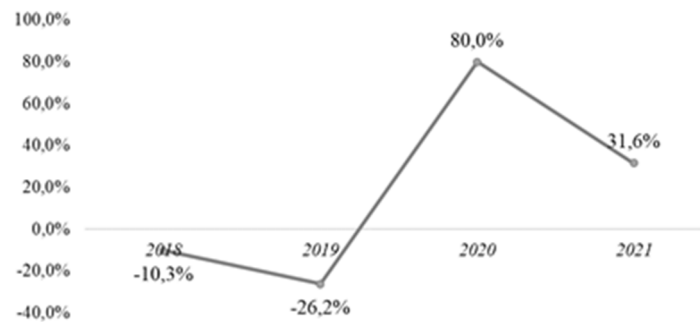


Figure 2 The dynamics of Capital Expenditure Growth of JD Logistics, %, 2018-2021
 Source: calculated on the basis of official financial statements of JD Logistics

The dynamics of Working Capital is another criterion for the implementation of the adaptation programme of the logistics company. The common practice of crisis management indicates the urgent need to increase the company performance, which is primarily implemented through the optimization of working capital in order to avoid the immobilization of funds in excess stocks. It should be noted that JD Logistics reduced the amount of working capital throughout the analysed period, except for

2021 (Figure 3) – with “years” for axis X and “dynamics of Working Capital Growth of JD Logistics” in % for axis Y. The reason is the company’s ambitious development goals in the market and high development rates, which results in the growth in inventories and accounts receivable. This thesis is confirmed by the dynamics of Total Revenue Growth, which was significantly higher than in other companies in 2021.

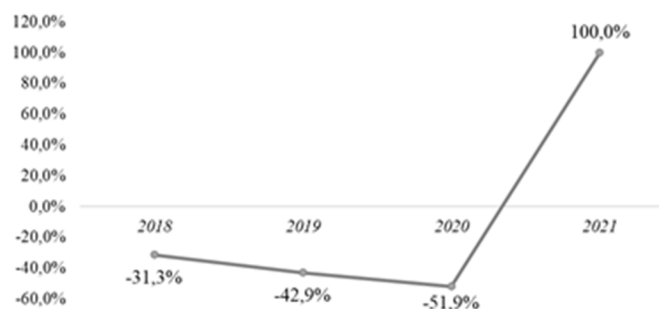


Figure 3 The dynamics of Working Capital Growth of JD Logistics, %, 2018-2021
 Source: calculated on the basis of official financial statements of JD Logistics

The company’s anti-crisis management activities entail the growth of the Debt-to-Equity ratio, especially in the context of the implementation of its adaptation programme. There are two underlying reasons for that. First, companies tend to attract additional funding to overcome the negative consequences in their exogenous and endogenous environment during a socio-economic crisis. Second, additional debt financing is attracted to

expand the company’s adaptation programme in a rapidly changing environment. JD Logistics actively attracted debt financing as part of the adaptation plan during the COVID-19 pandemic (Figure 4) – with “years” for axis X and “dynamics of Debt/Equity ratio of JD Logistics” in times for axis Y. The reason for the decline in the Debt-to-Equity ratio in 2021 is a significant increase in equity.

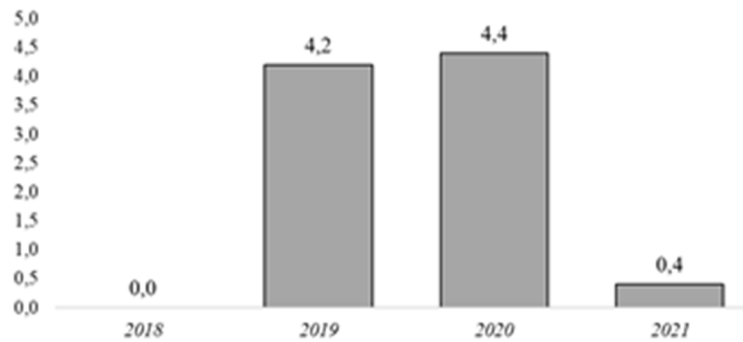


Figure 4 The dynamics of Debt/Equity ratio of JD Logistics, times, 2018-2021
 Source: calculated on the basis of official financial statements of JD Logistics

Adaptation to the pandemic restrictions requires maintaining the equity to assets ratio at a stable level, which is due to the urgent need to ensure the financial stability of the business. This is characteristic of most companies in the sample in 2019-2021. The equity to assets

ratio of JD Logistics increased after the onset of the pandemic (Figure 5) – with “years” for axis X and “dynamics of Equity/Total Assets ratio of JD Logistics” in times for axis Y. This indicates support for the company’s adaptation programme in terms of financial stability.

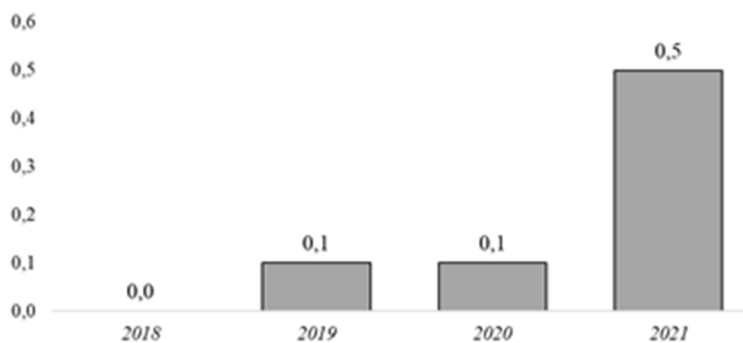


Figure 5 Dynamics of Equity/Total Assets ratio of JD Logistics, times, 2018-2021
 Source: calculated on the basis of official financial statements of JD Logistics

We will describe in more detail the adaptation programme of JD Logistics under the pandemic restrictions in the case format. JD Logistics focuses on the creation and application of innovative logistics systems. The company was the first in the world to open a fully automated warehouse in Shanghai, China, and to launch autonomous delivery vehicles. Other promising technologies such as electronic logistics, artificial intelligence and virtual reality in logistics systems are areas of interest of JD Logistics.

In 2021, JD Logistics presented a new mission: “Applying technology for a more productive and sustainable world.” JD Logistics has invested about \$12 billion in R&D since 2017, being one of the highest

indicators of investment in the development of new technologies among Chinese companies. JD Logistics aims to spread its technology in logistics, supply chains outside of China. Another goal of the company is to give its partners access to a retail platform ecosystem that includes building distribution channels and an international trade platforms [49].

JD Logistics has one of the largest service fulfilment infrastructures. The company uses a network of more than 900 warehouses covered by its open warehouse platform, which enables delivery of 90% of items the very next day after forwarding. An important component of the company’s strategy is the standardized management of the

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entire set of 10,000 delivery points [49]. Delivery points remained a weak spot for the company, especially under the COVID-19 pandemic restrictions.

JD Logistics implemented the following technological complex solution, which is designed to increase the efficiency of management and operation of delivery points: All-in-one solution reduces equipment costs at delivery points (router, WIFI, VPN, firewall).

Accessibility for businesses is enabled by backup to multiple WANs.

Security of data transfer and user access to the Internet.

No need for on-site IT staff to support the system.

Reduced system deployment costs.

Ability to open 1,000 delivery points per month [49].

JD Logistics considers itself as an e-commerce technology company and a leading provider of supply chain technology and services. Some of these technology solutions include warehouse management, transportation, shipping, after-sales service, as well as cloud services and data analytics. JD Logistics believes that the company's competitive advantage is provided by two main factors: quality customer experience and operational efficiency. The core of the company's strategy is aspiration to provide consumers with a wide selection of quality products of authentic origin at adequate prices, which is supported by investment in technology and logistics infrastructure. This is necessary to provide efficient and reliable logistics service fulfilment, which contributes to greater customer loyalty. The key of JD Logistics' value proposition is high-quality, reliable service based on the quality and speed of the delivery network and the work of the company's staff. This is enabled by the company's focus on innovation. JD Logistics has a team of more than 3.5 thousand R&D specialists. The company also has more than 4,000 patents and copyrights for computer software with more than 2,500 patents in the field of automation, robotics and unmanned vehicle control technologies [49].

JD Logistics' strategy focuses on efficient logistics and provides that the company completely covers the entire supply chain process from the purchase of goods to their transportation and their distribution to end customers. JD Logistics' warehouse network covers almost all counties and districts in China. The company's infrastructure consists of:

- More than 900 warehouses managed by JD Logistics;
- More than 1,400 "cloud warehouses" managed by third-party warehouse owners operators as part of the JD Logistics' open warehouse platform;
- The total area of warehouses is 21 million square metres (including the total area of cloud warehouses);
- More than 240,000 warehouse and delivery employees;
- 190 thousand corporate clients in 2020 [49].

It should be noted that the company did not terminate implementing its strategy after the onset of the pandemic, but rather took measures to adapt to the new conditions of the endogenous and exogenous environment. The JD Logistics continued its market growth even after 2019, as evidenced by the positive dynamics of net income from product sales. The company has decided not to reduce capital expenditures in light of the socio-economic crisis caused by the COVID-19 pandemic as its market leadership is based on technology and powerful infrastructure. The company also needed to develop its fleet of autonomous robotic delivery vehicles in Chinese cities, which is especially relevant under the pandemic restrictions. JD Logistics attracted debt financing in order to solve the problem of limited access to financing, while increasing the level of financial stability, namely the weight of equity capital in the financing structure. The comprehensive adaptation programme allows JD Logistics to maintain leadership in the market and have significant development prospects both in China and in other countries and regions of the world.

It is important to emphasise that the company takes into account various challenges of the exogenous and endogenous environment which helped it to prepare for the socio-economic crisis in general and the COVID-19 pandemic restrictions in particular. JD Logistics ensures its long-term stability, ability to adapt to the challenges of the exogenous and endogenous environment, creates value for stakeholders based on global development trends, in particular, the digitalization trend.

Table 3 presents the factors influencing the adaptation of logistics companies to the pandemic restrictions based on the results of the analysis. The impact factors are divided into the following blocks: actions of governments and regulatory policies, maintaining company's activities, company finances, customer relations, relations with suppliers.

Table 3 Factors influencing the adaptation of logistics companies to the COVID-19 pandemic restrictions

| <i>Impact factor</i> | <i>Explanation</i> |
|---|---|
| <i>Government actions and regulatory policy</i> | Quarantine restrictions |
| | Export control |
| | Restrictions on the operation of the infrastructure |
| | Support of citizens and businesses |
| <i>Maintaining company's activities</i> | Availability of key personnel |
| | Maintaining the operation of critical infrastructure |
| | Ensuring the normal functioning of the production site under quarantine restrictions |
| | Legal support |
| | Adequate risk management |
| <i>Company finances</i> | Ensuring adequate liquidity |
| | Optimizing and increasing operational efficiency |
| | Attracting shareholders' support |
| | Settlements creditor banks |
| <i>Customer relations</i> | Checking the status of the counterparty |
| | Changing the value proposition to meet the new customer needs |
| | Industry analysis of the customer portfolio with a focus on the openness of the industry to pandemic risks |
| | Flexibility in working with customers |
| | Changes to the terms of service and cooperation with customers |
| <i>Relations suppliers with</i> | Status of air carriers (available capacity, financial status of the carrier) |
| | Status of railway carriers (restrictions on crossing the border, financial status of the carrier) |
| | State of marine carriers (availability of containers, financial state of the carrier) |
| | The condition of motor carriers (complicated customs control procedures, health condition of drivers, financial condition of the carrier) |
| | Continuity of warehouse facilities operation |
| | Health condition of employees |

Source: developed on the basis of the author's analysis

The selected factors focus on both the exogenous and endogenous environment. Another advantage of the outlined set of factors is its ability to support the planning and implementation of an adequate adaptation programme by the logistics company in response to macro- and micro-level challenges. Another important aspect that distinguishes the set of factors proposed above is the focus on the short- and long run, which contributes to a more

effective adaptation of the logistics company to changes under the pandemic restrictions. The above-mentioned factors can be evaluated both in quantitative and qualitative terms and applied as part of various analytical tools of strategic and operational management of a logistics company, for example, the Balanced Scorecard.

5 Discussion

So, the importance of the drivers of adaptation of logistics companies to the pandemic restrictions was established, in particular, in terms of the dynamics of capital investments, operational efficiency, financial stability. The results of the study of a sample of logistics companies are confirmed by the previously obtained results, in particular, in terms of the importance of adequate planning of the adaptation programme, organizational flexibility, business efficiency in times of a crisis. According to [34], adequate planning of a comprehensive plan for the adaptation of companies to crisis conditions is of great importance in the pandemic context. In turn, researchers outline the drivers of flexibility and efficiency of companies in terms of their adaptation under the pandemic restrictions [37]. In [38], authors have a close position, who focus on the competitive advantages and peculiarities of the business model of small, medium-sized and large logistics companies, which necessitates individual planning of adaptation to the pandemic restrictions.

A set of factors of exogenous and endogenous environment influencing the adaptation of logistics companies to the pandemic restrictions was also identified. They involve the following blocks: government actions and regulatory policy; maintaining company's activities; company finances; customer relations; relations with suppliers. This thesis is supported by Majid [11], who emphasizes that there is a complex list of factors to be taken into account when the company makes decisions on adaptation provoked both by the pandemic directly and the socio-economic crisis. In turn Choi [17] distinguishes the factor of a significant reduction in economic activity because of the suspension or closure of production sites. In [13], De Vos develops the thesis and emphasizes the comprehensive limitation of the operation of the logistics infrastructure in terms of transportation by air, road, rail, and marine transport. In [15], Gössling et al. agrees with this and separately emphasizes the impact of the reduction in air transportation on the functioning of the logistics system as a whole and the logistics company in particular.

The importance of adequate market and financial planning of the operational work of the sample logistics companies, in particular, maintaining the dynamics of Total Revenue Growth and an adequate amount of Working Capital, was emphasized. In turn, was in [6] emphasized the importance of maintaining the operation of a logistics company during a pandemic. According to [19], it is necessary to pay significant attention to the problem of inadequate strength of supply chains caused by a large-scale unexpected crisis. Similarly, in [10], researchers emphasized the importance of adequate planning and implementation of supply chain adaptation programmes in the context of COVID-19.

Uncertainty and risk drivers in managing logistics companies under crisis situations, incl. COVID-19 pandemics is also another major area covered in this

research and supported by findings in the papers. This proposal is supported in [43] where was put forward an idea on digitalized ways of handling uncertainty for logistics companies under COVID-19. Authors in [44] further develop issue of uncertainty in managing logistics companies in terms of its innovation capabilities and risks of Industry 4.0 transition. Stewart [48] further emphasizes the need of a multidimensional approach of managing uncertainty in crisis environment for logistics companies. Shahbaz et al. [41] in turn proposes to employ a risk classification tool in terms of managing supply chain under COVID-19 crisis situations. Sharma et al. [40] elaborates on a need for a complex approach towards uncertainty and risk management for logistics companies under COVID-19 pandemics both in its exogenous and endogenous environment. This context is further developed in [42], where is proposed a transformative response for supply chain challenges under COVID-19 business environment.

Need for specific management tools dealing with uncertainty and risks is also emphasized in this paper supported by a body of other research papers. In this context authors in [45] outline a need for an integrated tool in the light of post-pandemic challenges concerning uncertainty for logistics companies. Kilpatrick et al. [47] emphasise need for smart management tools for supply chain risks under high uncertainty caused by COVID-19 pandemics. Nguyen et al. [46] put forward a proposal for usage of an operational risk analysis model in terms of COVID-19 pandemic crisis environment of logistics companies.

The great role of digitalization in the adaptation of a logistics company is also confirmed on the example of JD Logistics included in the sample. In turn, Wang et al. [26] notes the urgency of the implementation of innovative solutions that promote the growth of the quality of logistics services through digitalization. Similarly, in [31], authors justified the concept of supply chains open to reconfiguration due to their flexibility, digitalization and efficiency.

However, unlike previous studies, the results of this study indicate the importance of maintaining a balance between short-term and long-term measures in the adaptation of logistics companies to the pandemic restrictions. The results of the analysis of the dynamics of capital expenditures and the financial stability of the companies selected for this study showed the importance of long-term factors influencing the programme of adaptation to the pandemic restrictions.

6 Conclusions

The problem of adapting the operation of logistics companies to the new conditions of the exogenous and endogenous environment has become especially urgent in the context of the COVID-19 pandemic and the socio-economic crisis, which was caused both by the spread of the pandemic and restrictions imposed by the governments. The results of this study evidenced the high importance of

Adaptation of logistics companies to operation under the Covid-19 pandemic restrictions

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an adequate adaptation programme of logistics companies in the face of the challenges of both the COVID-19 pandemic and global development trends, in particular the digitalization trend. Successful planning and implementation of the adaptation programme of logistics companies under the pandemic restrictions will allow them to ensure the successful survival of the socio-economic crisis in the short run, and the creation of value for a wide range of stakeholders during the COVID-19 pandemic and in the post-pandemic period in the long run.

Analysis of the financial statements of the logistics companies of the sample revealed changes in their market and financial management in order to adapt to the COVID-19 pandemic restrictions. In particular, the analysis of the selected companies revealed:

a drop in the Total Revenue growth rate after the onset of the COVID-19 pandemic, with the recovery of growth rates in 2021;

increasing Capital Expenditures after the onset of the COVID-19 pandemic;

a reduction in the Working Capital growth rate after 2019; the growth of the Debt-to-Equity ratio after the onset of the COVID-19 pandemic;

maintaining the Equity-to-Assets ratio at a stable level in 2019-2021.

The practical value of the results obtained involve the proposed set of factors influencing the exogenous and endogenous environment in terms of adaptation of logistics companies to the COVID-19 pandemic restrictions. The following blocks of impact factors were distinguished: government actions and regulatory policy, maintaining company's activities, company finances, customer relations, relations with suppliers. The importance of planning and implementation of the logistics company's adaptation programme is emphasized both in the short- and long run, which implies different effects of the above-mentioned factors for different time horizons. The described case of JD Logistics included in the sample is also of practical interest, which successfully implemented a programme of adaptation to the COVID-19 pandemic restrictions based on digitalization and the reasonable use of market and financial drivers.

Prospects for further research involve an extended study of the factors influencing the logistics companies' programme of adaptation to the COVID-19 pandemic restrictions. The study of both financial and market factors influencing the practice of adaptation of logistics companies in the context of the COVID-19 pandemic also evoke scientific interest and is a promising research area. Further research should also examine the challenges of post-crisis adaptation of companies after the end of the COVID-19 pandemic.

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Single-blind peer review process.