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# CRISIS RESILIENCE STUDY OF POLISH LISTED COMPANIES AFTER THE PANDEMIC

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**ABSTRACT**

**Businesses' response to black swans is crucial to developing a country's economy. Resilience can be defined as the company's ability to adapt and survive despite sudden shocks and environmental changes. Crisis resilience allows companies to overcome emerging shocks, remain competitive, and maintain a sound financial position. Theoretical considerations focus on the essence of crises and the concept of resilience in management sciences. The article aims to assess Polish companies' resilience from the construction sector to the shock caused by the Covid-19 pandemic. The empirical study of Polish listed companies was conducted based on financial statements for 2017-2021, divided into stable and unstable periods. The indicators of liquidity, operational efficiency, and profitability were evaluated. In addition, competitors' market share was considered, using the Herfindahl-Hirschman index to measure industry concentration.**

**KEYWORDS:** *resilience, crisis management, construction industry, Covid-19.*

## 1. INTRODUCTION

Companies have continuously operated in a changing environment, and in recent years, the dynamics of environmental turbulence have increased. Companies are increasingly confronted with a wide variety of crises and disasters. The Covid-19 pandemic was no different, causing global economic and social turmoil. The fast-spreading pandemic, which began in late 2019, led governments in almost every country worldwide to implement various restrictions, including economic shutdowns. The first economic results of the pandemic were seen primarily in a decline in production and consumption and a disruption of labor markets and supply chains. Many companies continue to face various problems, i.e., falling demand for their goods/services, disruptions in the supply chain, cancellation of export orders, shortages of raw materials, and unavailability of workers (Shafi, 2020).

Businesses' response to black swans*** is crucial to developing a country's economy. The ability of companies to adapt and survive despite sudden shocks and changes in the environment is considered their resilience. The resilience of companies to the

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*** This term is used to describe events whose probability of occurrence seems impossible, but which, if they do occur, have enormous implications for the functioning of the world. See more: Taleb, 2007.

crisis allows them to overcome emerging shocks, remain competitive in the market, and maintain sound financial position. Most studies in the literature on the impact of a pandemic address sectors such as the tourism, hospitality, and transportation industries, IT, or the pharmaceutical industry. Several studies refer to the construction sector, which, from our perspective, should be analyzed as a sector that correlates with the economic climate. Intense competitive pressures mean that construction sector companies are characterized by poor financial health and high failure rates (Otola, 2013). We believe it is worth noting how the COVID-19 pandemic additionally affected these companies. The article aims to assess Polish companies' resilience from the construction sector to the shock caused by the Covid-19 pandemic. Thus, the research question is whether Polish listed companies in the construction sector have demonstrated resilience to the shock of the Covid-19 pandemic.



## 2. LITERATURE REVIEW

### 2.1. Crises and disasters

Due to the turbulent business environment, companies are increasingly surprised by unexpected turns and negative social, economic, political, and climatic phenomena that are difficult to predict and control. These phenomena are referred to in the literature as crises or disasters and usually harm companies operating in the market. Crises and disasters are very similar, as many of their characteristics correspond to both (Faulkner, 2001). The term "crisis" comes from the Greek word "krisis" and generally means "a turning point, a decisive moment, a breakthrough, a breakdown of the previous line of development" (PWN). From the perspective of management science, a crisis is an unlikely event with significant consequences that threaten the vitality of an organization and is characterized by ambiguity of cause, effect, resolution, and decision-making under time pressure (Pearson & Clair, 1998). The lexical definition of a disaster refers to a tragic phenomenon that affects a large area and an event that results in extensive property damage or the death of many people (PWN). According to Boin et al. (2018), a disaster is an episodic event collectively interpreted as highly damaging, causing human suffering and damage to infrastructure. Disasters can be divided into natural disasters (landslides, earthquakes, floods, tsunamis, forest fires) and man-made disasters (explosions, large fires in buildings, release of toxic substances, aviation, and railway accidents) (Khan et al., 2020).

They are caused by climate change, environmental pollution, and human activities. On the other hand, the classification of crises is more elaborate. Mitroff & Alpaslan (2003) attempted to classify threats and crises and found that in the 1980s, crises were mainly caused by the occurrence of typical threats (economic, physical, and social crises), while in the 1990s crises caused by atypical (information, criminal and reputation crises) and natural threats dominated.

The distinction between crises and disasters is difficult to grasp, although some claim that the dissimilarity between these terms is related to their origins. This is indicated by the fact that many disasters are caused by random natural factors over which one has little control and whose consequences are inevitable. On the other hand, crises originate in improper actions at the planning and management levels (Faulkner, 2001; Ritchie, 2004)

Leaving aside further discussion on the definition of crisis and disaster, it is worth noting that companies must adapt quickly to new conditions in both cases.

### 2.2. Covid-19 as a disruptive event

In the face of the COVID-19 pandemic, the governments of many countries have imposed special restrictions to protect the population's lives by limiting the transmission of the virus. Restrictions on the free movement of people were imposed, including a ban on public gatherings. Some manufacturing and service sectors' activities and public institutions' activities were completely suspended or partially restricted (Debata et al., 2020)and (c. These decisions had a critical impact on the global economy. However, it should be emphasized that the consequences of the pandemic outbreak affected different sectors of the economy and society in different ways (Donthu & Gustafsson, 2020). The lockdowns and travel restrictions devastated hospitality, tourism, the catering industry, and air transport (Donthu & Gustafsson, 2020; Verma & Gustafsson, 2020; Neise et al., 2021).

Another visible effect of the pandemic was the disruption of global supply chains. Companies' previous activities focused on seeking higher efficiency in their operations by downsizing their organizations and reducing costs, which was often interpreted as moving production to countries with lower labor costs and was also related to the availability of resources. This approach has increased the complexity and interdependence of supply chains, making them more vulnerable to external factors. Early research on supply chains indicated that, according to complexity theory, they are more sensitive to disruptions and even minor perturbations (Ivanov et al., 2014). The literature highlights the COVID-19 pandemic as one

of the most extensive disruptions to global supply chains in recent decades (Araz et al., 2020; Ivanov, 2020). Unavailability and shortages of materials, critical raw materials and components, and supply delays occurred almost overnight, spreading rapidly and lasting for an extended period (Ivanov, 2020; Li et al., 2022).

All these inconveniences were also reflected in consumer demand. The situation in the construction sector is similar. In most countries, production in the construction sector has declined, and several reasons have contributed to this situation. One such factor was the shortage of workers due to their health situation and the limited availability of workers abroad due to the border closures. A second major factor was the disrupted supply chains regarding the availability and timely delivery of construction materials (Nový & Nováková, 2022). This, in turn, has affected delays in construction projects and problems in paying current liabilities, subsequently leading to payment bottlenecks. In such a situation, construction companies should conduct an ongoing analysis of projects while maintaining constant communication with stakeholders to closely monitor delays and payments (Sierra, 2022). However, it is also essential to highlight the opportunities for the companies. Companies have started looking for alternative materials sourced from local suppliers and manufacturers to reduce the risk of project delays (Alsharef et al., 2021).

Although the pandemic has caused many adverse effects and brought many companies to the brink of collapse, it has also forced companies to adopt adaptive behaviors and implement changes, and, most importantly, it has accelerated technological progress. It is emphasized that digital technologies such as the Internet of Things, artificial intelligence, big data analytics, and 3D printing have become tools for implementing change to survive and also develop further (Verma & Gustafsson, 2020; Amankwah-Amoah et al., 2021; Xie et al., 2022). Crises and disasters, in addition to their adverse effects, also trigger and drive adaptation and transformation processes that lead to new prosperity and socioeconomic well-being (Luthe & Wyss, 2015; Jiang et al., 2021). A key benefit of studying crises and disasters is understanding how these events unfold, affect individuals and organizations, and, most importantly, how individuals and organizations respond to regain balance.

### 2.3. Resilience of companies

The concept of resilience is multifaceted and multidisciplinary. Research on resilience is conducted in many scientific disciplines, including engineering, psychology, sociology, ecology, complex adaptive systems, business, urban planning, and others (Martin-Breen & Anderies, 2011; Iftikhar et al., 2021). Even within the management sciences, research on resilience points to some subdisciplines in which the understanding of resilience varies. The most common are works that focus on the impact of organizational resilience on the supply chain, human resources, organizational behavior, strategic management, and resilience as a disaster and crisis management tool. A very general definition of resilience, which is reflected in the presence of the term in many domains, refers to the ability of an individual or system to recover from an event that disrupts its condition (Hosseini et al., 2016). The word resilience comes from Latin, and according to the Oxford English Dictionary, the term's original use is found in scientific papers from the 18th century.



The literature emphasizes that the definition of resilience comes from Holling (1973), who recognized it as a feature of complex socio-ecological systems in his seminal work. "Resilience determines the persistence of relationships within a system and is a measure of the ability of these systems to absorb changes of state variables, driving variables, and parameters, and persist" (Holling, 1973). In a later paper, Holling (2001) points to three characteristics that shape a system's cyclical adaptation and future state, namely, i. the inherent potential of a system, ii. the internal controllability of a system, iii. the adaptive capacity. In this way, the adaptive capacity is seen as the resilience of a system, a measure of its vulnerability to unexpected or unpredictable disruptions. Since then, multidisciplinary studies have been conducted to conceptualize resilience, meaning it is impossible to describe it in all fields straightforwardly. An analysis conducted by Hosseini et al. (2016) of the numerous definitions of resilience in the literature shows that most of them focus on the system's ability to "absorb" and "adapt" to disruptive shocks, but the "recovery efforts" of the disrupted system also play an essential role.

A comprehensive definition of resilience was provided by Williams et al. (2017), who defined it in terms of "the process by which an actor (i.e., individual, organization, or community) builds and uses its capability endowments to interact with the environment in a way that positively adjusts and maintains functioning prior to, during, and following adversity." Organizational resilience is described in the literature as adaptability, characteristic, outcome, process, behavior, strategy or approach, type of performance, or a combination of these (Hillmann & Guenther, 2021). Resilience is a term that must be considered when considering an event or research subject. Research must, therefore, be about the (Hillmann & Guenther, 2021; Martin-Breen & Anderies, 2011)When considering the reference object

for resilience, one can distinguish between individuals, groups, communities, institutions, businesses, infrastructure, and society (Morsut et al., 2022). On the other hand, an event is a shock, disruption, or disturbance that does not allow the normal functioning of the object under study. Furthermore, such an event should be described by dimensions such as the type of event, the place of occurrence, the extent of the impact, the duration, and the scale/size of the impact (Duchek, 2020).

A more common approach to resilience analysis is based on different research perspectives. One of the approaches was presented by Hosseini et al. (2016), who distinguished four research perspectives:

- Organizational, whose task is the reaction of companies to the rapidly changing business environment,
- Social, which analyses the resilience capacity of individuals, groups, and communities to cope with external stresses and disruptions in the face of turbulent changes,
- Economic, which depicts the ability of an entity or system to continue its operations in the face of a significant shock and to maintain an acceptable path of growth in production, employment, and financial performance,
- Engineering indicates the ability of technical systems to adjust their functionality in the face of internal and external disruptions and unforeseen changes.



When considering resilience from the perspective of ongoing research, the literature on this topic distinguishes between two approaches: i. resilience as a set of characteristics of an individual/organization, ii. resilience as a process (Do et al., 2022; Jiang et al., 2021). The first approach refers to individual characteristics of the organization, such as alertness, endurance, resourcefulness, adaptability, and flexibility, which translate into the results of an organization. The second approach frames resilience as an ongoing adaptive coping process with crises or specific disruptions (Duchek, 2020; Jiang et al., 2021). However, resilience is a concept that primarily explains how organizations consistently achieve positive results despite existing risks and barriers to adaptation (Sutcliffe & Vogus, 2003; Williams et al., 2017).

## 3. METHODS

The construction sector was selected for the study because it is one of the sectors that significantly impacts the Polish economy's development. Due to its specific nature, particularly its contract-based activities and long-term investment process, this sector is highly exposed to risk factors. The situation in the construction sector stimulates or inhibits other domestic industries, depending on the trend. Therefore, if there is a downturn in the construction sector, there is a high probability that it will significantly impact other sectors of the economy. This downturn also applies to employment levels in this sector due to the highly fragmented nature of construction companies. In describing the construction sector's role in the national economy, it has been observed over the years that this sector has a stable share in generating GDP at around 7% (NBP, 2022). Therefore, it is essential to investigate how the pandemic has affected the resilience of the construction sector.

The construction sector is among the most represented sectors on the Warsaw Stock Exchange (WSE). The empirical part of the study examined the joint-stock companies listed on the WSE that belong to the construction sector. The companies listed on the WSE have diversified business activities and focus on general construction, housing, roads, energy, railways, and civil engineering. They mainly operate on the domestic market (over 82% of sales revenue) and have a small share of the foreign market (mainly neighboring countries) (www.stat.gov.pl). The general information about the sales revenue and total assets of the selected companies is presented in Table 1. The construction sector at the WES is represented by 45 entities, with 41 entities not related by capital selected for analysis. Economically independent entities, i.e., those that compete, can be selected for the study to measure concentration. According to the principles of concentration research, two related entities should be treated as a single company in economic terms from the moment they share areas of activity, and the principle of cooperation prevails over competitive relationships (Jackowicz & Kowalewski, 2002). This means neither company is capital-dependent on the other listed company under examination. The resilience of these companies to emergency and unpredictable situations, as seen during the COVID-19 pandemic, was determined in the financial context. Data from 2017-2021 were analyzed. It was assumed that 2017-2019 was a stable pre-pandemic period, while 2020-2021 was an unstable period when companies operated during the Covid-19 pandemic. The research was carried out to analyze the degree of concentration of the sector under study and selected aspects of the assessment of the financial situation of companies.

The evaluation of the concentration degree was carried out based on the Herfindahl-Hirschman Index (HHI), which is defined as the sum of the squares of the shares of the individual entities in the total value of the characteristic under study (Belobaba & Van Acker, 1994):

**TABLE 1.** Sales revenue and total assets of companies (in ooo PLN)

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| | **Sales revenue** | | | | |
| **Min** | 28 764 | 27 631 | 250 | 133 | 159 |
| **Median** | 375 023 | 370 919 | 374 038 | 370 809 | 386 669 |
| **Max** | 6 369 309 | 7 387 137 | 7 569 663 | 7 709 106 | 7 911 192 |
| | **Total assets** | | | | |
| **Min** | 17 310 | 18 188 | 16 668 | 18 361 | 20 593 |
| **Median** | 369 110 | 390 875 | 409 564 | 404 118 | 494 036 |
| **Max** | 5 997 356 | 5 456 351 | 6 673 959 | 7 462 240 | 6 863 318 |

Source: Authors.

Note: Min - minimum value, Max - maximum value.



$$HHI=\sum_{(i=1)}^{n} u_i^2 \quad (1)$$

where $u_i$ denotes the share of the value of the analyzed characteristic for the i-th object in the total value of the studied characteristic for all n analyzed units. The HHI takes values within the range of (1/n; 1). The higher its value, the stronger the concentration. According to the recommendations of the Department of Justice and the Federal Trade Commission in the United States, there are three basic types of markets by level of concentration (Horizontal Merger Guidelines, 2010):

- <0.15 (non-concentrated market) – acquisitions and mergers have no negative impact on the effects of competition in the market
- 0.15-0.25 (moderately concentrated market) – acquisitions or mergers that increase the HHI by more than 0.01 may threaten competition in the market
- >0.25 (highly concentrated market) – acquisitions or mergers that increase the HHI by 0.01-0.02 can significantly threaten competition in the market.

Data from the consolidated financial statements of entities not related to each other by capital were selected for analysis. This choice assumed that, in the concentration study, these companies should be treated as a single entity. In the case of entities not linked by capital and not preparing consolidated financial statements, data from individual financial statements were included.

The financial position of companies in the construction sector, which determines their resilience to the events and risks caused by the COVID-19 pandemic, was assessed to assess the entity's current operating activities (the analysis of long-term financing sources was excluded from the study). The following indicators were chosen for the study:

- market share in terms of revenue, which is the ratio of sales revenues of a particular company to the value of sales revenue of the entire sector,
- market share in terms of assets, which is the ratio of the value of a company's assets to the value of the assets of the entire sector,
- quick ratio, which is the ratio of highly liquid assets (which are current assets after excluding inventories) to current liabilities of a given company,
- cash ratio, which is the ratio of cash and cash equivalents to current liabilities of a given company,
- operating profit margin, which is the ratio of operating profit to the sales revenues of a company,
- net profit margin, which is the ratio of net income to sales revenue of a given company,
- return on assets, which is the ratio of net income to average assets of a given company,
- cash conversion cycle, which is the difference between the operating cycle (the sum of accounts receivable and inventory turnover in days) and trade liabilities turnover ratio of a given company in days,
- working capital ratio, which is the share of the difference between current assets and current liabilities in the total value of a company's assets,
- asset utilization ratio is the ratio of sales revenue to the average assets of a company.

Measures of the location of the observations, i.e., the first quartile, the median, and the third quartile, as

well as the minimum and maximum values in a given year, were determined for the above ratios. Furthermore, to comprehensively illustrate the examined companies' condition, each indicator calculated for a given company was assigned a score based on dividing the given set into six parts using centiles. Thus, a rating scale from 1 to 6 depicting the company's situation was determined: 1 – completely unacceptable, 2 - unacceptable, 3 – rather unacceptable, 4 - rather good, 5 - good, and 6 - excellent. Based on the scale used and the weights assigned to each indicator, a total value was determined to create a ranking of the companies.



## 4. RESULTS

The Herfindahl-Hirschman Index (HHI), which represents the degree of concentration of the construction sector, was determined in terms of characteristics representing the size of assets and sales revenues of these companies (Table 2).

The analysis of the Herfindahl-Hirschman concentration index values carried out for total assets and sales revenue demonstrates that the values of these ratios did not exceed the level of 0.15 points. Thus, the sector under study can be considered unconcentrated in stable and unstable periods. Furthermore, the degree of concentration of the studied characteristics was similar.

The market share determined in terms of sales revenue exhibited similar values throughout the period under study. The median of this indicator fluctuated by 1%. On the contrary, a slight upward trend can be seen at the third quartile level. It was found that 75% of the companies in the construction sector listed on the Warsaw Stock Exchange have a share of no more than about 3% in the total sales revenue of the entire sector. The maximum market share was also comparable in the stable and unstable periods. Its value fluctuated between 20% and 24%.

The market share analysis in terms of assets shows a similar trend of changes in this indicator's value as in the market share in terms of revenue. The results obtained from these two indicators are also similar in all quartiles. Thus, it should be noted that sales revenue generated by the companies in the construction sector is close in value to the available assets used in their operations.

The analysis of the quick liquidity of companies in the construction sector demonstrates that in all the years studied, at least half of the companies had assets with a higher degree of liquidity corresponding to the value of current liabilities. In this regard, a slight difference can be observed between the stable and unstable periods. In 2017-2019, current assets, consisting of short-term receivables and cash and cash equivalents, were less than 10% higher than current liabilities. In contrast, the level rose to 12% and 14% in the unstable years, respectively. When comparing the transitional years, it can be noted that the level of the quick ratio increased in the first quartile, the median, and the maximum value, while the minimum value decreased significantly. The above interpretation of the data allows us to conclude that most of the examined companies have maintained or increased their quick liquidity.

The examination of the cash ratio shows a slight improvement at the median, the third quartile, and the maximum value. At the beginning of the stable period, 25% of the entities could settle their current liabilities with a minimum of 34% from their cash and cash equivalents. In contrast, in 2021, this percentage of entities could settle more than 47% of short-term liabilities. A significant difference was observed in the maximum value. None of the entities examined at the beginning of the research period could pay their current liabilities fully from their most liquid assets.

In contrast, in subsequent years, the maximum value exceeded 1, and in 2021, the value of cash and cash equivalents was 2.79 of current liabilities. Regarding liquidity described by the cash ratio, the years 2019 and 2020 are characteristic of the analyzed companies. The transition from a stable to an unstable period was characterized by a significant increase in the degree of liquidity in question, already at the level of the first quartile.

The operating profit-to-sales revenue ratio analysis shows an emerging gap between stable and unstable years at the median and maximum levels. In half of the entities surveyed, the value of the operating profit margin ratio was close to 4%. In contrast, it increased significantly to nearly 7% in 2020 and reached 5.45% in 2021 despite a decrease in value. After the increases in the years 2017 - 2019, the maximum value of this ratio recorded a slight decline during the unstable period but did not approach the 2017 level. Furthermore, the first and third quartiles recorded a steady increase in operating profit margin throughout the study period.

In summary, it can be noted that in 75% of the companies in the construction sector, the value of the ratio in question did not exceed 10%. In 25% of these entities, the analyzed profitability was not higher than 3%. At the same time, the operating loss resulted in at least one entity showing no profitability at the operating profit margin level.

The increasing profitability in the years under study was also demonstrated at the level of net profit margin. In 2017, 25% of the entities recorded a negative value for this indicator. However, positive net profit-to-sales revenue ratio values were observed

**TABLE 2.** Herfindahl-Hirschman (HH) concentration ratios of total assets and sales revenue

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| The concentration of total assets | 0.07505 | 0.07989 | 0.08471 | 0.08651 | 0.08014 |
| The concentration of sales revenue | 0.07704 | 0.06806 | 0.07659 | 0.08784 | 0.07404 |

Source: Authors.

**TABLE 3.** Market share concerning revenue

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Min | 0.0009 | 0.0009 | 0.0000 | 0.0000 | 0.0000 |
| Q1 | 0.0057 | 0.0047 | 0.0062 | 0.0060 | 0.0056 |
| Median | 0.0123 | 0.0115 | 0.0118 | 0.0117 | 0.0107 |
| Q3 | 0.0283 | 0.0353 | 0.0316 | 0.0334 | 0.0311 |
| Max | 0.2096 | 0.2282 | 0.2398 | 0.2443 | 0.2195 |

Source: Authors.

Note: Min - minimum value, Q1 - first quartile, Q3 - third quartile, Max - maximum value.

**TABLE 4.** Market share concerning assets

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Min | 0.0006 | 0.0007 | 0.0006 | 0.0006 | 0.0006 |
| Q1 | 0.0068 | 0.0071 | 0.0077 | 0.0071 | 0.0056 |
| Median | 0.0135 | 0.0144 | 0.0140 | 0.0137 | 0.0154 |
| Q3 | 0.0301 | 0.0332 | 0.0325 | 0.0317 | 0.0287 |
| Max | 0.2195 | 0.2008 | 0.2275 | 0.2529 | 0.2139 |

Source: Authors.

Note: Min - minimum value, Q1 - first quartile, Q3 - third quartile, Max - maximum value.

in the following years. However, half of the entities recorded a ratio below 2% in 2017 and above 4% in 2021. In 75% of the construction sector companies, the level of the net profit margin increased steadily during the stable period and was close to 6%. During the unstable period, this growth was more dynamic. At the end of 2021, the ratio level was 8.24%.

It should be noted that in each year analyzed, at least one entity did not generate a positive financial result. Thus, the value of the net profit margin was negative. Furthermore, in 2019, one company recorded a significant positive net income from investments, which consequently increased the value of net profit to a level that exceeded sales revenue.

The analysis of the profitability of assets demonstrates a similar trend of change in the value of this indicator in stable and unstable periods as in the case of the net profit margin. In addition, levels of the net profit-to-asset ratio can be observed to be similar to the net profit-to-revenue ratio. This demonstrates the comparable size of assets and sales revenue in the analyzed entities. A significant difference in the levels of these indicators can be observed only regarding the maximum value during the unstable period. Regarding asset profitability, one company recorded a significant deviation from the average value of this indicator, with a value of 24.7% in 2020 and 30.6% in 2021.

The examination of the cash conversion cycle showed steadily declining values for this indicator in both stable and unstable periods. In 2017, 25% of the entities reported a 31-day gap between the payment of trade payables and the cash inflow of receivables. On the other hand, in 2021, for this percentage of entities, the indicated difference was not more than 23 days. The median cash conversion cycle decreased in value from 52 to 46 days. The positive and significant decrease of 23 days in the value of this indicator in

**TABLE 5.** Quick ratio

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Min | 0.1434 | 0.1458 | 0.0035 | 0.0023 | 0.0044 |
| Q1 | 0.8146 | 0.8221 | 0.8307 | 0.9133 | 0.9009 |
| Median | 1.0950 | 1.0804 | 1.0934 | 1.1200 | 1.1426 |
| Q3 | 1.3851 | 1.2365 | 1.1971 | 1.3625 | 1.2782 |
| Max | 3.0081 | 2.9794 | 2.9941 | 2.9218 | 3.1474 |

Source: Authors.
Note: Min - minimum value, Q1 - first quartile, Q3 - third quartile, Max - maximum value.



**TABLE 6.** CASH RATIO

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Min | 0.0058 | 0.0010 | 0.0005 | 0.0006 | 0.0038 |
| Q1 | 0.1178 | 0.0824 | 0.1127 | 0.1703 | 0.1030 |
| Median | 0.1992 | 0.1519 | 0.1779 | 0.2768 | 0.2009 |
| Q3 | 0.3413 | 0.2505 | 0.2745 | 0.4256 | 0.4749 |
| Max | 0.8055 | 1.2163 | 1.3279 | 1.8539 | 2.7976 |

SOURCE: AUTHORS.
NOTE: MIN - MINIMUM VALUE, Q1 - FIRST QUARTILE, Q3 - THIRD QUARTILE, MAX - MAXIMUM VALUE.

**TABLE 7.** Operating profit margin

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Min | -4.1953 | -0.2662 | -17092.36 | -1103.06 | -989.5472 |
| Q1 | 0.0021 | 0.0045 | 0.0246 | 0.0277 | 0.0300 |
| Median | 0.0378 | 0.0436 | 0.0380 | 0.0693 | 0.0545 |
| Q3 | 0.0760 | 0.0799 | 0.0858 | 0.0935 | 0.0953 |
| Max | 0.1539 | 0.2495 | 0.2574 | 0.2310 | 0.2008 |

Source: Authors.
Note: Min - minimum value, Q1 - first quartile, Q3 - third quartile, Max - maximum value.

**TABLE 8.** Net profit margin

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Min | -4.3618 | -0.7612 | -19494.76 | -4566.203 | -1208.8679 |
| Q1 | -0.0210 | 0.0047 | 0.0146 | 0.0182 | 0.0158 |
| Median | 0.0198 | 0.0315 | 0.0291 | 0.0484 | 0.0436 |
| Q3 | 0.0471 | 0.0596 | 0.0612 | 0.0678 | 0.0824 |
| Max | 0.1516 | 0.2101 | 3.8817 | 0.1527 | 0.1388 |

Source: Authors.
Note: Min - minimum value, Q1 - first quartile, Q3 - third quartile, Max - maximum value.

**TABLE 9.** Return on assets (ROA)

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Min | -0.8369 | -0.1744 | -3.3535 | -0.8060 | -1.4137 |
| Q1 | -0.0229 | 0.0025 | 0.0145 | 0.0150 | 0.0196 |
| Median | 0.0251 | 0.0268 | 0.0340 | 0.0532 | 0.0467 |
| Q3 | 0.0577 | 0.0621 | 0.0610 | 0.0721 | 0.0772 |
| Max | 0.1603 | 0.2227 | 1.0383 | 0.2472 | 0.3063 |

Source: Authors.
Note: Min - minimum value, Q1 - first quartile, Q3 - third quartile, Max - maximum value.

**TABLE 10.** Cash conversion cycle



| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Min | -26.9707 | -420.385 | -242.5811 | -26.9917 | -3631.451 |
| Q1 | 31.3921 | 18.9606 | 24.7637 | 22.1856 | 22.9618 |
| Median | 52.0458 | 45.8006 | 48,7313 | 52.2288 | 46.5503 |
| Q3 | 87.5095 | 69.0653 | 79.9838 | 75.3194 | 64.1830 |
| Max | 516.9437 | 232.2434 | 377886.09 | 20401.77 | 139.677 |

Source: Authors.
Note: Min - minimum value, Q1 - first quartile, Q3 - third quartile, Max - maximum value.

**TABLE 11.** Working capital ratio

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Min | -1.4917 | -1.7167 | -3.5821 | -31.2265 | -50.7803 |
| Q1 | 0.1105 | 0.0882 | 0.0434 | 0.0660 | 0.0721 |
| Median | 0.1618 | 0.1724 | 0.1293 | 0.1506 | 0.1792 |
| Q3 | 0.2346 | 0.2258 | 0.2068 | 0.2186 | 0.2690 |
| Max | 0.4348 | 0.5972 | 0.5314 | 0.6166 | 0.6824 |

Source: Authors.
Note: Min - minimum value, Q1 - first quartile, Q3 - third quartile, Max - maximum value.

**TABLE 12.** Asset utilisation ratio

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Min | 0.1919 | 0.2093 | 0.0000 | 0.0002 | 0.0012 |
| Q1 | 0.8546 | 0.7929 | 0.7994 | 0,8836 | 0.8774 |
| Median | 1.0797 | 1.1799 | 1.1962 | 1.1163 | 1,1062 |
| Q3 | 1.4365 | 1.5190 | 1.5111 | 1.3852 | 1.4433 |
| Max | 6.0141 | 6.4975 | 4.7774 | 2.0215 | 2.2811 |

Source: Authors.
Note: Min - minimum value, Q1 - first quartile, Q3 - third quartile, Max - maximum value.

**TABLE 13.** Financial position by ratio position

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Min | 1.3000 | 1.8000 | 1.5000 | 1.1000 | 1.5000 |
| Q1 | 3.0000 | 3.1000 | 3.0000 | 3.2000 | 2.9000 |
| Median | 3.6000 | 3.6000 | 3.8000 | 3.7000 | 3.6000 |
| Q3 | 4.0000 | 3.9000 | 4.0000 | 4.1000 | 4.2000 |
| Max | 5.0000 | 5.1000 | 4.8000 | 4.8000 | 4.9000 |

Source: Authors.
Note: Min - minimum value, Q1 - first quartile, Q3 - third quartile, Max - maximum value.



**TABLE 14.** The trend of change in the financial position

| Number of companies | 2018/2017 | 2019/2018 | 2020/2019 | 2021/2020 | 2021/2017 |
|---|---|---|---|---|---|
| With a stable financial position | 23 | 24 | 19 | 21 | 21 |
| With a deteriorated financial position | 18 | 17 | 22 | 20 | 20 |

Source: Authors.

the third quartile area should also be noted. In this case, in 2017, 25% of entities waited at least 87 days after paying their liabilities to receive cash from accounts receivable, and in 2021 it was 64 days. Furthermore, in both the stable and unstable periods, the minimum value of the cash conversion cycle was negative. Therefore, at least in one entity, the repayment of trade payables occurred later than the cash inflow of receivables.

The analysis of the working capital ratio allows us to note that its median and third quartile levels increase slightly in unstable and stable periods. In 2017, half of the entities surveyed reported a 16% share of the difference between current assets and current liabilities in total assets. In 2021, the share was almost 18%. On the other hand, for 25% of entities, this ratio was higher than 23% in 2017 and 26% in 2021. Considering the maximum values of the analyzed ratio, it can be seen that since 2018, working capital has represented more than 50% of the asset value in one of the companies surveyed.

Stabilized levels of the asset utilization ratio were found in the surveyed companies. Its values in the stable period were similar to those in the unstable period. Interpretation of the results obtained concerning the first quartile suggests that the ratio of sales revenue to average assets was close to 86% in 2017 and 88% in 2021. Half of the companies generated higher sales revenue than the value of their assets in both stable and unstable periods. However, a significant downward trend was observed in the level of asset utilization ratio for the minimum and maximum values. In 2017, at least one of the entities surveyed had a ratio of sales revenue to average assets close to 20%. On the contrary, in 2021, the level dropped to 0.12%. Furthermore, in 2017, sales revenue was six times higher than the average value of assets in at least one company, and in 2021, slightly more than twice.

The empirical values that show the ranking of companies in the construction sector are presented according to the observation location measures (Table 13), and the trend of change in the condition of these entities over the years is also presented (Table 14).

The general assessment of the financial position of the surveyed entities suggests that it was stable throughout the period under study. No significant differences were found between the stable and unstable periods at the level of the distinguished observation location measures. For 25% of the companies, the total value fluctuated around the value of 3, which represents a relatively poor condition. Half of the companies achieved an overall value between 3.6 and 3.8 in all years, meaning that 50% of the entities were at least close to rather good condition. On the contrary, the highest condition score achieved is five, indicating a sound financial position. None of the companies

surveyed scored six, corresponding to an excellent condition.

Companies with a stable financial position were those whose calculated overall evaluation index remained at the same level or increased in the compared years. On the other hand, companies with a deteriorated financial position were considered those in which the calculated overall evaluation index decreased in the compared years. When analyzing changes in the financial position of the companies, it is noted that between the stable and unstable periods, the highest number of companies with a deteriorated financial position (22 entities) was recorded. Furthermore, comparing the beginning of the stable period (2017) with the end of the unstable period (2021), it can be noted that 21 companies recorded an unchanged or increasing financial position, while 20 entities experienced a decline.

## 5. CONCLUSIONS

The study found slight changes in the values of the indicators adopted for the analysis during the stable and unstable periods. The operation of the companies during the pandemic period did not have a fundamental impact on the change trends in the resilience of the companies surveyed. The number of companies whose financial situation deteriorated remained the same or increased was comparable throughout the study period. However, when discussing the research results in detail, it should be noted that the degree of concentration, measured by sales revenue and total assets, indicates the high competitiveness of the entities studied. The empirical analysis suggests that no dominant company in the market significantly concentrated either sales revenue or total assets. Due to the diversity of its activities (housing construction, road construction, civil engineering), the construction sector was characterized by a greater dispersion and, therefore, a lower concentration of the characteristics studied, implying solid competitiveness among the companies. The area of liquidity analyzed by quick ratio and cash ratio indicators shows a slight improvement in liquidity ratios during the unstable period. Notably, half of the surveyed companies achieved quick ratios below the recommended values, i.e., less than 1. The area of operating efficiency was analyzed using the cash conversion ratio, working capital ratio, and asset utilization ratio. In the vast majority of entities, the cash conversion cycle was positive, and, in addition, half of the companies maintained it at a reasonable level below 60 days. The area of profitability was estimated using the operating profit margin, net profit margin, and return on asset ratios. Profitability was the weakest area of the companies' activities. Their results show that profitability at the operating profit level, as well as at the net profit level, is characterized by low performance. This is because the low concentration of the sector entails high competition, which affects companies' actions even when aware of the low profits.

During the Covid-19 pandemic in Poland, the construction sector was not officially ordered to operate. Therefore, the companies could decide whether and to what extent they wanted to continue the projects they had started. It is worth monitoring this sector because although the pandemic did not have a destructive impact on it, the current turbulences related to the slowdown in investments and the increase in the prices of materials and raw materials may deteriorate the resilience of these entities in the future and thus have a knock-on effect on other sectors of the economy.

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# STUDIJA O OTPORNOSTI NA KRIZU POLJSKIH KOTIRANIH KOMPANIJA NAKON PANDEMIJE



**SAŽETAK**

**Reakcija poslovnih subjekata na neočekivane događaje od iznimne je važnosti za razvoj gospodarstva. Otpornost se može definirati u kontekstu sposobnosti poduzeća za prilagodbu i opstanak, unatoč naglim šokovima i promjenama u okruženju. Otpornost na krizu omogućava poduzećima prevladavanje iznenadnih šokova te održavanje konkurentnosti i dobre financijske pozicije. Teorijska razmatranja usmjerena su na bit kriza i koncept otpornosti u znanosti o menadžmentu. Glavni cilj ovog članka je procjena otpornosti poljskih kompanija iz građevinskog sektora na šok izazvan pandemijom Covid-19. Empirijska studija navedenih poduzeća, izlistanih na tržištu kapitala, provedena je na temelju financijskih izvještaja za razdoblje od 2017. do 2021. godine, podijeljenog na stabilna i nestabilna razdoblja. Vrednovani su pokazatelji likvidnosti, operativne učinkovitosti i profitabilnosti. Također je istražen tržišni udio konkurenta, koristeći Herfindahl-Hirschmanov indeks kao mjeru koncentracije industrije.**

**KLJUČNE RIJEČI:** *otpornost, krizni menadžment, građevinska industrija, Covid-19.*