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# RESTRICTIONS OF ACCESS TO SERVICES AND A DECREASE IN THEIR QUALITY UNDER CRISIS CONDITIONS – STUDY RESULTS

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**Purpose:** The study presents and discusses the results of a survey, the primary objective of which was the Generation Z representatives' perception of the impact of destabilizing factors, such as COVID-19, Ukraine-Russia war and energy crisis on access to or quality of technologies, goods and services.
**Design/methodology/approach**: The survey was carried out in 2022/23 using a CAWI technique and involved a sample of 631 students from Warsaw universities, Generation Z representatives.
**Findings:** The respondents noticed the restrictions resulting from multi-crisis conditions and expressed concerns about the impact of the crises on energy infrastructure and, in consequence, on the lack of or restricted access to goods and services or decline in their quality. The findings indicate a gradation in assessing potential losses. Respondents rated the probability of losses in a pandemic as significant, and even higher for war.
**Research limitations/implications**: The study was carried out at a specific moment in time and under crisis conditions. The sample was limited as well, covering exclusively representatives of the academia.
**Practical implications:** The assessment of the impact of multiple crises on individuals and communities is needed to address the issue of the supply of energy, technology, products and services. The findings of the study may be used by policymakers to cater for the needs of individuals and communities who are most vulnerable in the case of crisis conditions.
**Social implications:** It is crucial to understand that crises may have a direct impact on the energy infrastructure, limited accessibility and decline in the quality of products and services. These losses, in turn, may influence the perception of the comfort and quality of life of individuals and communities.
**Originality/value:** This may be the first study which analyses multiple crisis factors and compares them against the losses which are the result of the flow of time. The research assesses the perception and significance of the impact of the pandemic, war in Ukraine and energy crisis, as perceived by respondents.

**Keywords:** restrictions, loss of access, loss of quality.

**Category of the paper:** Research paper.

## 1. Introduction

Our increasing reliance on technology and digital services in the era of Industry 4.0. (Da Silva et al., 2020) and the new work practices and organizational innovations focusing on the principles of collaboration, openness, community and sustainability enabled by digital tools (Ortar, Flipo, 2023; Przegalinska, Grippa, Gloor, 2020; Camarinha-Matos et al., 2019) have transformed the way we live, work, and connect with each other. However, this dependence examined in many studies (Păvăloaia, Necula, 2023; Lee et al., 2018; Almufarreh, Arshad, 2023; Wang, Li, 2023; Sá et al., 2021) also exposes us to potential consequences when energy crises occur since "electricity is a resource of strategic importance to the entire world". It is important to note that "most industries, critical facilities, as well as institutions and households cannot function without access to electricity" and "an unstable electricity market affects every area of life and industry (Niestabilna sytuacja..., 2023). The latter is particularly true during times of crisis, the COVID-19 pandemic, geopolitical or economic instability and uncertainty as well as energy crises.

The Ukraine-Russia war has shown that the previously functioning energy infrastructure has been destabilized as a result of the destruction of the supply chain and rising prices due to sanctions and geopolitical conditions. The COVID-19 pandemic has stressed how reliant individuals and communities have become on technology and, as a consequence, also on energy resources. The above conditionings prove that seeking sustainable solutions such as local and alternative energy sources should be seen as a priority for policymakers. On the one hand, the transition towards more sustainable alternative energy sources may be seen as positive. However, the pace and scope of the changes taking place are not in line with the increased demand related to energy supply as well as the availability and quality of technology-based products and services.

As H. Lovell indicates, "people-technology interaction innovation theories relevant to the energy sector cover two main topics: innovation in large-scale sociotechnical systems (electricity networks, transport infrastructures, gas networks), and small-scale human-technology interactions" (Lovell, 2022). This paper will focus on the second area of energy-technology interactions.

The implementation and use of technologies depend on stable and sustainable energy supplies, on the other, technologies can provide alternative solutions to better manage available energy resources, even under crisis conditions (Gitelman, Kozhevnikov, 2023). This article explores the consequences of energy crises on our technology-dependent society, aiming to foster discussions and strategies for a sustainable and resilient future.

The COVID-19 pandemic, economic crises and energy shortages have significantly impacted societies worldwide, causing disruptions and limitations in accessing essential services and technologies. According to the PwC Report, the energy sector has also been

affected by the coronavirus (PwC COVID-19 US CFO Pulse Survey, 2020), which was further exacerbated by the Russia-OPEC price war (EU energy security and the war..., 2023). Zakeri et al. indicate that the geopolitical crisis related to Russia's invasion on Ukraine on 24 February 2022 also "triggered concern over the EU's energy security" (Zakeri, Paulavets, ..., 2022), and further exacerbated the situation related to energy pricing, supplies and stability. Another study (Basdekis, Christopoulos, ..., 2022) suggests that "the coronavirus pandemic and the war in Ukraine constituted the first generalized cases of black swans for the global economy in the 21st century". According to Baskedis et al., "after the end of the lockdown due to the pandemic and the return to 'normality', the war broke out in Ukraine, followed by the imposition of serious sanctions between the Western states and Russia, resulting in the beginning of a new crisis, the energy crisis, with concern about the emergence of another severe recession[...]". The article published in April 2022 (What the war..., 2022) suggested that Russia's invasion on Ukraine "has caused a short-term spike in prices, but could prompt a long-term shift towards sustainability". However, these forecasts were not fulfilled since, according to World Economic Forum, the consequences were much more serious than expected since "energy prices have surged since the Russia-Ukraine war, leading to an increase in household energy costs" and "the slow progress in the energy transition and dependence on fossil fuel imports have amplified the severity of the cost-of-living crisis" (Energy Transition..., 2023). The author of another paper (Sadowska, 2022) stresses that "the increase in energy prices also impacts the overall economy because energy is a price-affecting factor. Growing energy prices are a major contributor to the widespread inflation and the slowdown in the economic growth in the EU". E. Sadowska also claims that "in order to increase the security of energy supplies, it is important to finalize and streamline the interconnection of European gas and electricity networks, fully synchronize the different energy networks across the EU, and strengthen EU contingency planning".

The PWC report states that "for companies in all parts of the energy, utilities and resources sectors, it will be vital to combine effective scenario-planning with an examination of how different developments could affect their business in the short, medium and long term" (Energy industry...). Also, individuals and communities experienced difficulty in accessing vital services, leading to disruptions in education, healthcare and economic activities. Thus, the COVID-19 pandemic can be seen as a significant obstacle to accessing new technologies and high-quality services by different entities and across various sectors.

Increasing energy costs make it difficult for individuals and organizations to afford and maintain technological devices. Low-income households and marginalized communities may find it even more challenging to access essential technologies, increasing existing socio-economic disparities (Pryce et al., 2021). According to recent reports, the present geopolitical crisis, i.e. the war in Ukraine further contributed to already challenging circumstances due to uncertainty (Global Energy..., 2022) and the fact that "rising energy prices may price out many developing countries, with a high level of impact on the most vulnerable citizens, from energy

markets" (Brief No. 3..., 2022). Additionally, businesses heavily reliant on technology for their operations may face financial constraints that restrict their ability to invest in the necessary equipment and infrastructure, adversely affecting their productivity and competitiveness.

These interconnected and multifaceted crises have created significant challenges, affecting various aspects of daily life and strengthening existing inequalities. As individuals and communities face the consequences of these crises, understanding the limitations as regards accessing services and technologies becomes vital for addressing the increasing socio-economic disparities and implementing practical and timely solutions.

## 2. Literature review

To date, the impact of COVID-19 and other interconnected or concurrent crises has been extensively explored from various perspectives, across different sectors, and in numerous countries (Malec et al., 2021; Ghiani et al., 2020; Zhang et al., 2020) and regions (Narajewski, Ziel, 2020; Akrofi, Antwi, 2020). However, to the authors' knowledge, there are still very few articles which would focus on the impact of the COVID-19 pandemic, economic and energy crises leading to limitations and barriers to access to advanced technologies and high-quality services.

The works have mainly focused on the impact of the abovementioned crises on the electricity systems in Europe and particular countries, examining the changes and consequences in the form of fluctuating power demand, generation capacity, consumption levels, general stability of the sector or forecasts related to the immediate and more distant future. These works (Bompard et al., 2020; Bahmanyar et al., 2020; Abu-Rayash, Dincer, 2020) have shed light on the challenges faced by the European electricity sector and provided insights into potential strategies for enhancing resilience in the face of future crises.

It is important to indicate that the times of pandemics are characterized by certain specificities in the energy market due to the fact that "industrial demand for energy falls, but household consumption rises". In consequence, at that time, according to sources, $CO_2$ production also decreased. For example, "during the pandemic, demand for electricity in the German economy fell by 20%, while CO2 emissions were reduced by around 25 million tonnes (W czasie pandemii…, 2020). During the pandemic, electricity consumption in private households increased. When individuals need to stay at home due to the coronavirus threat, they spend entire days at home and the Internet is one of the few leisure activities still available to them. The amount of time they spend using both devices, mainly laptops and smartphones (Jak COVID-19..., 2020), and the Internet is increasing and, in consequence, also the level of energy consumption, i.e. electricity is higher.

Another study (Pandemia przyspieszy..., 2020) conducted by the Polish Economic Institute (Polski Instytut Ekonomiczny) involving energy market experts focuses on the importance of renewable energy under the conditions of the COVID-19 pandemic. As many as 95 per cent of experts claim that "increasing the share of renewable sources in the so-called 'energy mix' to 30 per cent will greatly assist Poland's development" and 67 per cent of respondents are of the opinion that "the pandemic will accelerate the decarbonisation of the energy sector". The research carried out by EY indicated that the COVID-19 pandemic has posed significant threats to both the energy sector and the services it provides. They include "falling energy demand, particularly for electricity, higher price volatility, due to increased uncertainty" (Wajer, 2020)

Due to the planned transformation towards a low-carbon economy, new projects are expected to be implemented in Poland in the near future in the energy (e.g. photovoltaic power plants, onshore and offshore wind farms, etc.) and hydro-technical segments. Irrespective of the coronavirus pandemic, in the coming years, we may observe a significant impact of ecology and technological changes on the design and implementation of construction investments, with smart home solutions and energy efficiency improvements becoming more and more popular (Wpływ pandemii..., 2021).

Every year, global electricity consumption is increasing and there is no indication that this trend is likely to change in the near future. Unsurprisingly, the production, sale, and distribution of energy play a critical role in ensuring the energy security of the European Union and individual countries. The energy systems within the European Union (EU) and individual countries are complex, comprising a diverse range of sources, infrastructure, and policies. It is important to examine specific countries also with regard to their access to technology and services, which are related to the energy ecosystem and transformation. This perspective becomes particularly important due to our increasing reliance on energy systems and their technological advancements, as it highlights disparities and opportunities that exist, ultimately shaping the energy landscape and its sustainability. The present study aims to address the issue and considers the opinions of young people, Generation Z representatives, who are not only highly skilled and open to using new technologies and services but also, according to research findings, aware and concerned about the present circumstances and future development of the society, environment and technology, all of which are considered in this study.

# 3. Methodology

## 3.1. Research methods, techniques, and tools used

The research presented in this study aims to analyze the limitations experienced by users in accessing services and technologies under the conditions of the COVID-19 pandemic, economic crises, and energy shortages. By analyzing the findings of the survey carried out in 2022/23 involving a sample of 631 students at the University of Warsaw, and other capital universities, the authors aimed to identify the main problems and barriers encountered by individuals and communities. The study was conducted with the application of a CAWI technique using convenient and purposeful sampling.

The obtained results were analyzed using the SPSS software. First of all, the methods of descriptive statistics were used, and the significance of differences between the groups was tested.

The research aims to recommend strategies that promote general and inclusive access to services and technologies, mitigating the impact of the abovementioned crises and strengthening socio-economic resilience in the face of adversity.

## 3.2. Characteristics of the research sample

A total of 821 questionnaires were collected, but some of them were not fully completed. Therefore, the authors decided to use only 631 questionnaires for further analysis. The vast majority of people (97%) are representatives of the Z Generation. It was assumed for the purposes of the study that these people were born between 1995 and 2009. They were all students, i.e. individuals with at least secondary education. Their specific characteristics included:

- gender,
- place of residence (divided into the following categories: village, a town with up to 20,000 inhabitants, a town with 21-50,000 inhabitants, a town/city with 51-200,000 inhabitants, a city with a population of more than 200,000),
- field of study (indicated here: social sciences, exact sciences, humanities, technical sciences and others),
- attitude towards respondents' current material situation (which could be described generally as: very good, good, satisfactory, rather satisfactory, bad).

On this basis, the following variables were distinguished:

- gender,
- place of residence,
- field of study,
- material situation.

A detailed overview of the numbers of answers and individual homogeneous groups is presented in Table 1-5.

**Table 1.**
*Number of answers*

| | | ID | Gender | Place of residence | Field of study | Material situation |
|---|---|---|---|---|---|---|
| N | important | 631 | 631 | 631 | 631 | 631 |
| | no data | 0 | 0 | 0 | 0 | 0 |

Source: own study.

**Table 2.**
*Number of groups by gender of respondents*

| | N | % |
|---|---|---|
| no answer | 1 | 0,2% |
| man | 251 | 39,8% |
| woman | 379 | 60,1% |

Source: own study.

**Table 3.**
*Number of groups by respondents' place of residence*

| | N | % |
|---|---|---|
| village | 107 | 17,0% |
| small town (<20.000) | 47 | 7,4% |
| medium town (<50.000) | 70 | 11,1% |
| town/city (50.000-200.000) | 39 | 6,2% |
| city (>200.000) | 368 | 58,3% |

Source: own study

**Table 4.**
*Number of groups by field of study*

| | N | % |
|---|---|---|
| humanities | 3 | 0,5% |
| social science | 463 | 73,4% |
| exact sciences | 147 | 23,3% |
| technical sciences | 18 | 2,9% |

Source: own study.

**Table 5.**
*Number of groups by respondents' material situation*

| | N | % |
|---|---|---|
| rather satisfactory | 32 | 5,1% |
| satisfactory | 122 | 19,3% |
| good | 357 | 56,6% |
| very good | 120 | 19,0% |

Source: own study.

Thus, the study sample consisted of 60.1% women and 39.8% men, more than half of respondents (58.3%) are residents of a large (by European standards) city with over 200,000 inhabitants. Most of them were students of social sciences (73.4%). Most individuals who participated in the study (56.6%) assessed their financial situation as good. Among the respondents, there was not a single person who would negatively assess their financial situation.

### 3.3. Dependent variables

Respondents were asked how they assessed the probability of broadly defined losses. These losses would be caused by two very specific crisis situations, namely: pandemic and war. In addition, they were asked about the losses that may result from the natural passage of time.

Respondents had a chance to express themselves using a 10-point scale. This study focuses on the analyzes that concern the possible loss of access to various types of services (including generally understood energy) and the deterioration of the quality of these services. Here are the dependent variables:

1. Loss or limitation of access to goods and services due to the pandemic.
2. Loss or limitation of access to goods and services due to the war.
3. Loss or limitation of access to goods and services due to the passage of time.
4. Loss of quality of goods and services due to the pandemic.
5. Loss of quality of goods and services due to the war.
6. Loss of quality of goods and services due to the passage of time.

The obtained results were examined using the methods of descriptive statistics.

## 4. Results

This study focuses on analyses that address the issue of a possible loss of access to various types of services (including those relating to energy in general) as well as the deterioration in the quality of these services. Respondents were given the opportunity to provide their responses using a 10-point scale. A value of 1 indicated the lowest and a value of 10 the highest probability. The results were tested using popular descriptive statistics methods.

### 4.1. Descriptive statistics

**Table 6.**
*Loss or limitation of access to goods and services – descriptives*

| | N | Min. | Max. | Mean | | Skewness | | Kurtosis | |
|---|---|---|---|---|---|---|---|---|---|
| | Statistics | Statistics | Statistics | Statistics | Standard deviation | Statistics | Standard deviation | Statistics | Standard deviation |
| Due to the pandemic | 631 | 1 | 10 | 4.95 | 2.375 | .164 | .097 | -.662 | .194 |
| Due to the war | 631 | 1 | 10 | 7.27 | 2.305 | -.836 | .097 | .158 | .194 |
| Due to the passage of the time | 631 | 1 | 10 | 3.40 | 2.241 | .820 | .097 | -.077 | .194 |
| N Important (exclusion by observations) | 631 | | | | | | | | |

Source: Own study.

**Table 7.**
*Loss or quality of goods and services – descriptives*

| | N | Min. | Max. | Mean | | Skewness | | Kurtosis | |
|---|---|---|---|---|---|---|---|---|---|
| | Statistics | Statistics | Statistics | Statistics | Standard deviation | Statistics | Standard deviation | Statistics | Standard deviation |
| Due to the pandemic | 631 | 1 | 10 | 6.72 | 2.045 | -.323 | .097 | -.429 | .194 |
| Due to the war | 631 | 1 | 10 | 8.50 | 1.810 | -1.754 | .097 | 3.588 | .194 |
| Due to the passage of the time | 631 | 1 | 10 | 2.58 | 1.785 | 1.296 | .097 | 1.217 | .194 |
| N Important (exclusion by observations) | 631 | | | | | | | | |

Source: Own study.

### 4.2. Separation by homogeneous groups

Next, the obtained data was analyzed, broken down into four groups: by the respondents' gender, place of their residence, field of study and financial situation. First, questions about difficulties in access to goods and services were checked, and then questions about the loss of quality of goods and services.

#### 4.2.1. Gender

Fig 1, and Fig 2 show the distribution of results in groups separated by gender. Fig. 1 illustrates the loss or limitation to goods and services. Fig. 2 describes the expected loss in quality of goods and services. The greatest concern is war, while the pandemic may also have a significant impact on the described losses.

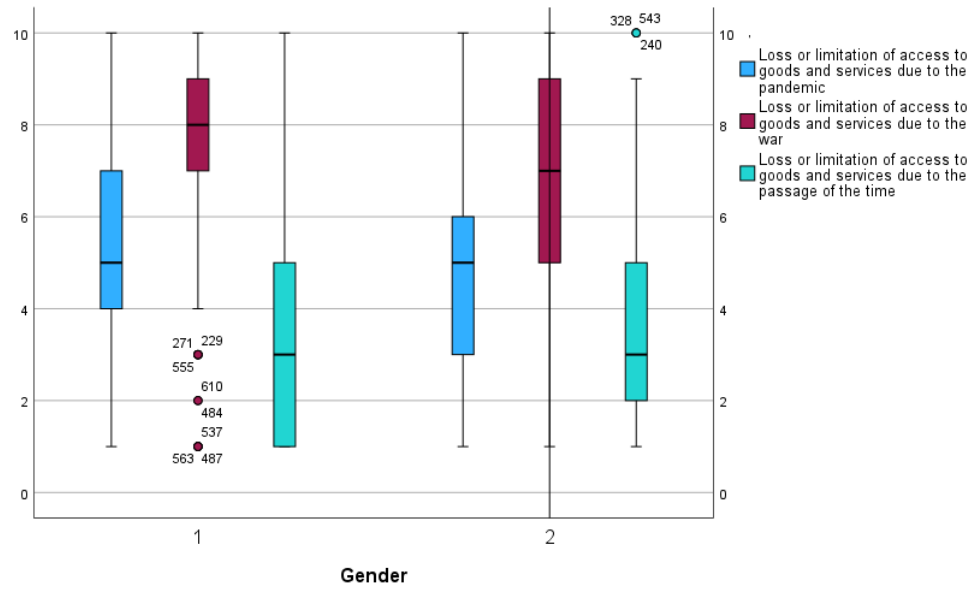


**Figure 1.** Loss or limitation of access to goods and services according to gender: 1 – men, 2 – women. Source: own study.

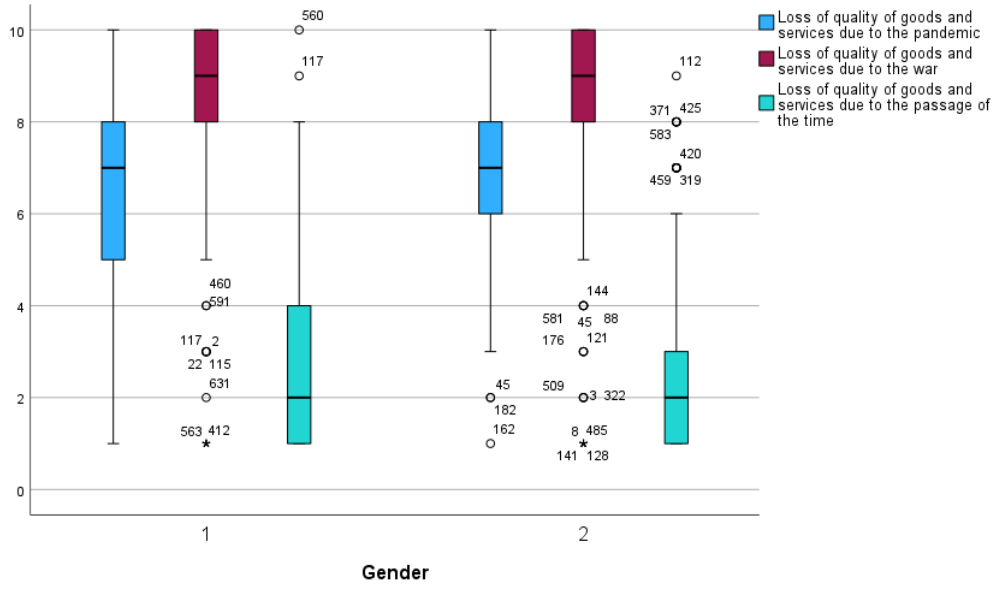


**Figure 2.** Loss in quality of goods and services according to gender: 1 – men, 2 – women. Source: own study.

The data was tested for normal distribution using the Shapiro-Wilk test and z score. In each case, the distribution wasn't normal (p was even less than 0.01). Therefore, the Kluskal-Wallis test was used.

### 4.2.2. Place of residence

Fig 3, and Fig 4 show the distribution of results in groups separated by place of residence. Fig. 3 illustrates the loss or limitation to goods and services. Fig. 4 describes the expected loss in quality of goods and services. And again: the greatest concern is war, while the pandemic has also a significant impact.

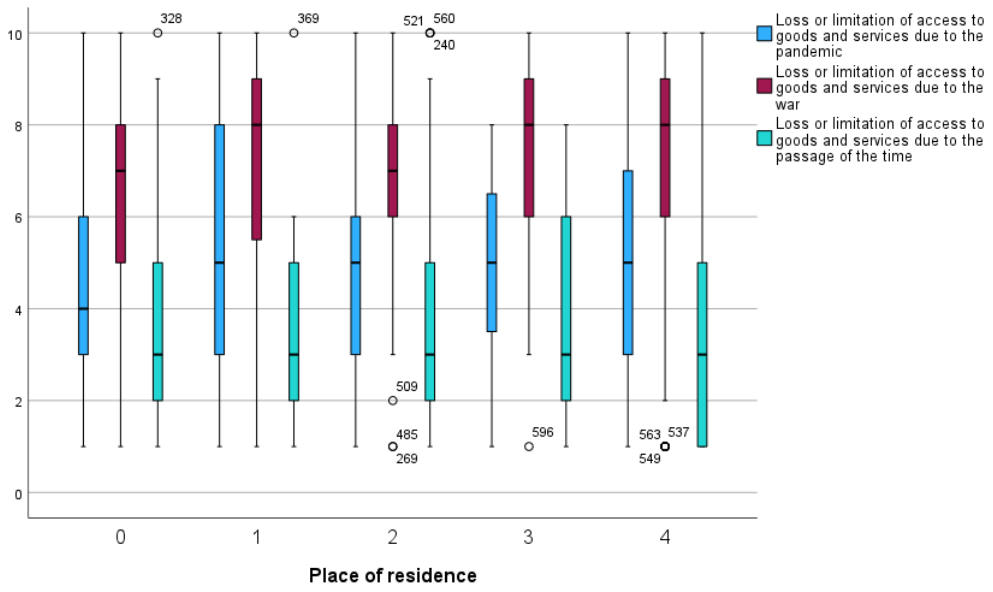


**Figure 3.** Loss or limitation of access to goods and services according to place of residence: 0 – village, 1 – town (<20,000), 2 – town (20,000-50,000), 3 – town/city (50,000-200,000), 4 – city (>200,000).

Source: own study.

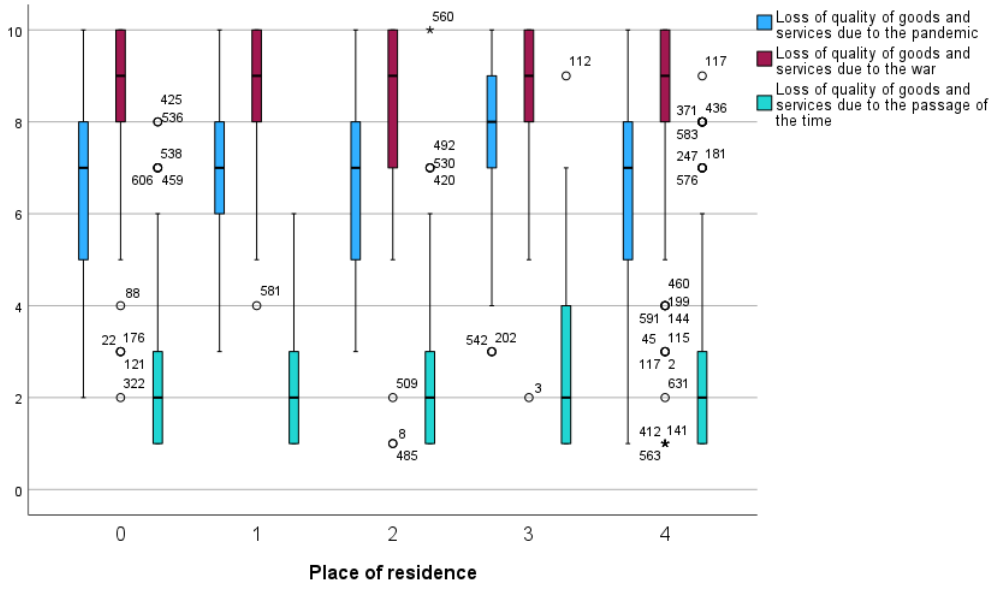


**Figure 4.** Loss or limitation of access to goods and services according to place of residence: 0 – village, 1 – town (<20,000), 2 – town (20,000-50,000), 3 – town/city (50,000-200,000), 4 – city (>200,000).

Source: own study.

In this case and in the following cases, it was decided to use the Kluskal-Wallis for independent groups test, as well.

### 4.2.3. Field of study

Fig 5, and Fig 6 relate to the place of study. Fig. 5 illustrates the loss or limitation to goods and services. Fig. 6 describes the expected loss in quality of goods and services. At Fig. 5 results seems to be quite similar as it was above. But Fig 6. indicates that students of humanities rather ignore influence of war and pandemic on quality reduction. But because the group was not numerous, it can be assumed that it is within the statistical error.

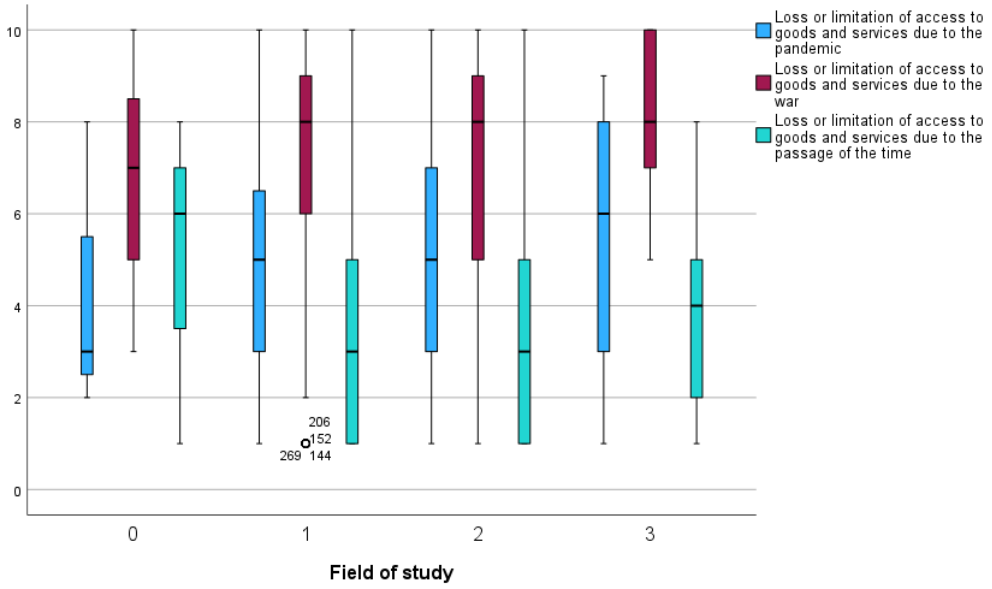


**Figure 5.** Loss of quality of goods and services according to field of study: 0 – humanities, 1 – social, 2 – science, 3 – technical.

Source: own study.

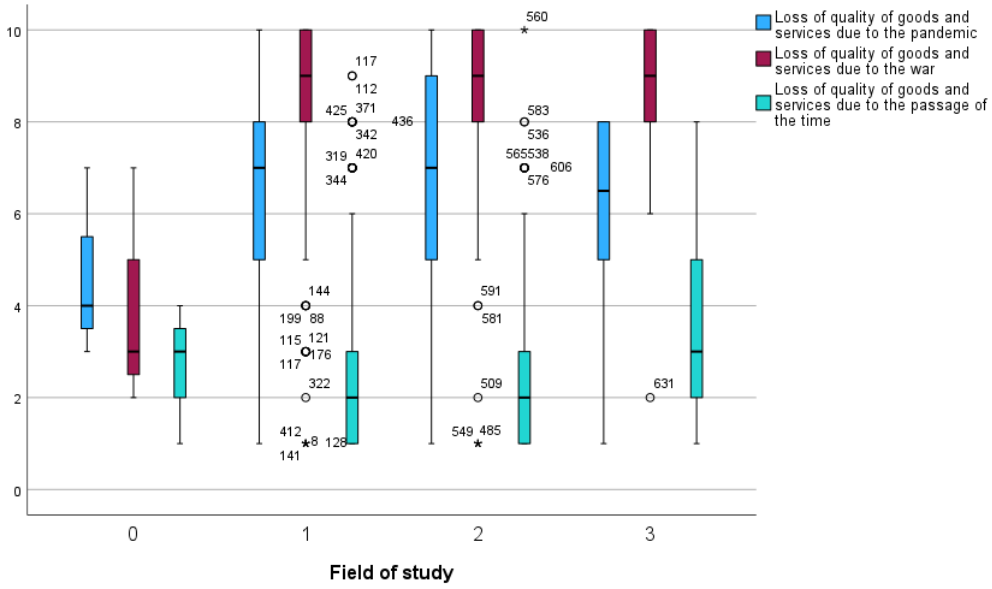


**Figure 6.** Loss of quality of goods and services according to field of study: 0 – humanities, 1 – social, 2 – science, 3 – technical.

Source: own study.

### 4.2.4. Material situation

Fig. 7, and Fig. 8 relate to the actual material status. Fig. 7 shows the loss or limitation to goods and services. Fig. 8 describes the expected loss in quality of goods and services. The results do not seem to differ from those obtained for the previous variables.

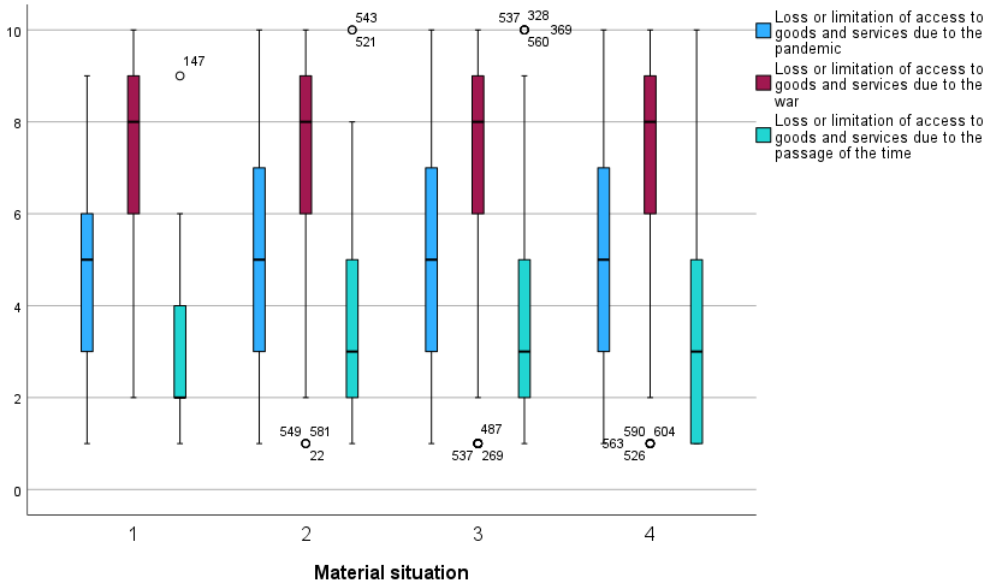


**Figure 7.** Loss of quality of goods and services according to material situation: 1 – rather satisfactory, 2 – satisfactory, 3 – good, 4 – very good.

Source: own study.

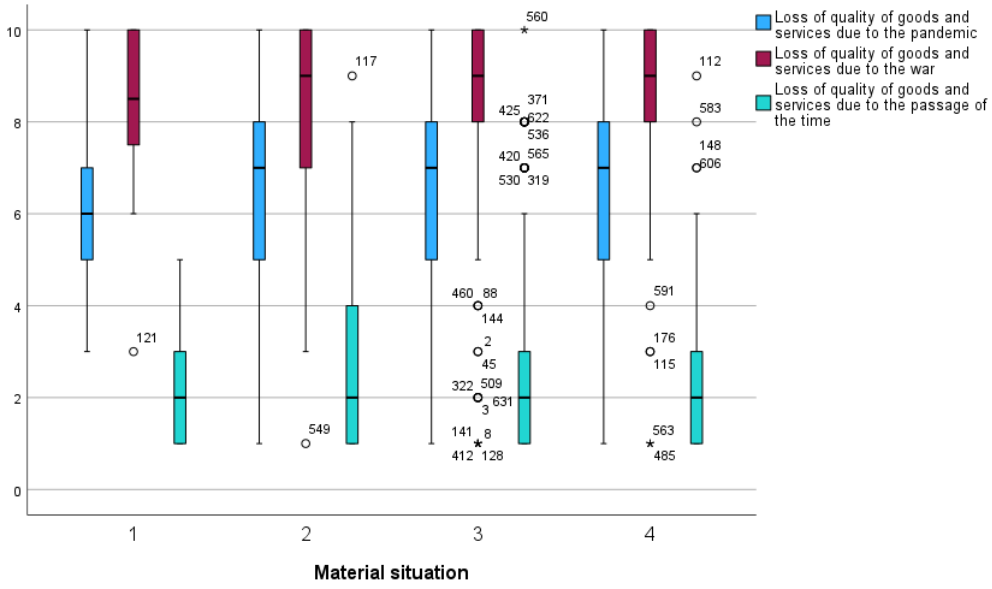


**Figure 8.** Loss of quality of goods and services according to material situation: 1 – rather satisfactory, 2 – satisfactory, 3 – good, 4 – very good.

Source: own study.

### 4.3. Statistical significance tests

Below (in Table 8) there are lists of rejection of zero hypotheses for various variables. For reasons of volume, only the H0 rejections were quoted, because the rejection clearly indicates the occurrence of statistically significant differences between the variables from different groups. All adopted H0 indicate no statistically significant differences.

**Table 8.**
*Rejected zero hypotheses*

| No. | Zero hypothesis (H0) | Significance [ab] | Test | Decision |
|---|---|---|---|---|
| 1 | Distribution Loss or limitation of access to goods and services due to the pandemic is the same for category Gender. | ,019 | Kruskal-Wallis' test for independent groups | Rejected H0 |
| 2 | Distribution Loss or limitation of access to goods and services due to the war is the same for category Gender. | ,009 | | |
| 3 | Distribution Loss of quality of goods and services due to the pandemic is the same for category Gender. | ,033 | | |
| 4 | Distribution Loss of quality of goods and services due to the passage of the time is the same for category Gender. | ,028 | | |
| 5 | Distribution Loss or limitation of access to goods and services due to the war is the same for category Place of residence. | ,006 | | |

a. The significance level is .050.
b. Asymptotic significance is shown.

Source: own study.

As can be seen, statistically significant differences appeared only in some of the respondents' answers. Categories: Gender and Place of residence showed differences in respondents' assessments of losses only in some contexts. On the other hand, belonging to different groups within the Field of study and Material situation categories did not cause statistically significant differences in the answers.

### 4.4. Limitations

The proposed study has certain limitations that cannot be underestimated. The study was carried out at a specific moment in time, and it was a time of uncertainty caused by two situations: (1) the ongoing or subsiding Covid-19 epidemic and (2) the aggression of the Russian Federation against Ukraine - a country directly bordering Poland. The survey covered almost exclusively representatives of the Z Generation. The respondents were students of Warsaw universities. Thus, the conclusions of these analyses are closely related to people, specific circumstances, time and place.

## 5. Discussion

The global impact of the COVID-19 pandemic, coupled with economic crises and energy shortages, has led to considerable repercussions on societies across the globe. These effects have brought about disruptions and constraints in accessing crucial services and technologies. Energy shortages, fluctuating fuel prices or power failures also directly impact the availability

and reliability of services dependent on electricity, such as internet connectivity, communication networks, and digital platforms.

This study is the first one that concerns the study conducted in 2022/23. The study had a much broader context. It covered not only the estimation of losses related to the lack or limitation of access to goods and services and the access to high-quality products and services in crisis situations. Other social, economic, psychological and technological aspects were also included in the study. Not only the context of extreme crisis situations (such as warfare and a pandemic) was analyzed, but also the emergence of new technologies and the natural passage of time. The passage of time and disruptive technologies replacing those currently existing and functioning are also important aspects to be considered in the context of access to technology and high-quality services for individuals in time of multifaceted crises, such as pandemics or war, economic and energy crises. Further analyses related to this study are expected in the near future.

## 6. Conclusions

The analyses conducted lead to the conclusion that there is a clear gradation in the context of estimating losses related to lack of or reduced access to goods and services and a decline in the quality of goods and services in crisis situations. The results for the natural passage of time should be taken as a reference point here. It can be assumed that some losses are inevitable. They will simply take place over time.

Wars and pandemics are tragedies that undoubtedly have a considerable adverse impact on all aspects of human life. This is beyond dispute. However, can these extreme emergencies be compared with each other? In a broad context, certainly not. But in the context of loss or limitations to access to goods and services and a decline in their quality. This difference - derived from respondents' views - is apparent. Namely, the probability of incurring losses in the event of a pandemic was rated as significant by respondents. But an even higher probability of incurring losses was indicated in the face of a war crisis. Accordingly:

- 4.95 (standard deviation is 2.38) for the pandemics and 7.27 (standard deviation is 2.3) for war - in the case of losses associated with restrictions of access to products and services;
- 6.72 (standard deviation is 2.24) for the pandemics and 8.5 (standard deviation is 1.81) for war - in the case of losses related to the decline in the quality of products and services.

Both the nightmare of a pandemic and war are among the hardest experiences. Each can bring significant reductions in consumption. On the basis of this survey, it is war - according to respondents, of course - that impacts countries' critical infrastructure harder than

even a pandemic. We are also talking about the energy services sector. And this could translate into a very high probability of loss of access to goods and services and a decline in their quality. The obtained research results are so promising that it is reasonable to repeat the study in the near future on a different group of respondents.

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