

Key sur(VIR)val factors in water supply companies: some lessons from Poland

Paweł Chudziński, Szymon Cyfert, Wojciech Dyduch and Maciej Zastempowski

ABSTRACT

This paper presents the outcomes of research on managerial decisions that were made as a first reaction to the economic crisis caused by the SARS-Cov-19 virus (the coronacrisis). The research was carried out among 116 companies from the water supply sector operating in Poland that includes water supply and sewage. The results indicate which elements were perceived by managers as key factors for survival and further functioning. It is clear that the most frequent managerial decisions made were reducing investments and sending employees for home office work, as well as prolonging the payment deadlines. Interestingly, investment reductions were accompanied by sustaining the R&D expenses, as the researched organisations desired to stay competitive and innovative right after the crisis. Only a few of the water supply companies decided to make workers redundant, as the majority declared the intent to protect the workforce, e.g. by sending employees on leave. The research has also shown that the companies approached the coronacrisis rather methodologically and systematically, which indicates a good level of managerial decision-making under pressure, overall enterprise preparedness for crisis situations, as well as staff involvement. Based on our research, we offer some recommendations concerning how the water supply sector organisations can prepare for similar crises in the future. Our research indicates that the decisions made had the following goals in mind: protecting workforce and sustaining cash flow, as well as securing competitive position after the crisis. Our research also focuses on the necessary decisions to be made in water supply companies before the next crises.

Key words | coronacrisis, managerial decisions, sur(VIR)val, water utilities

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HIGHLIGHTS

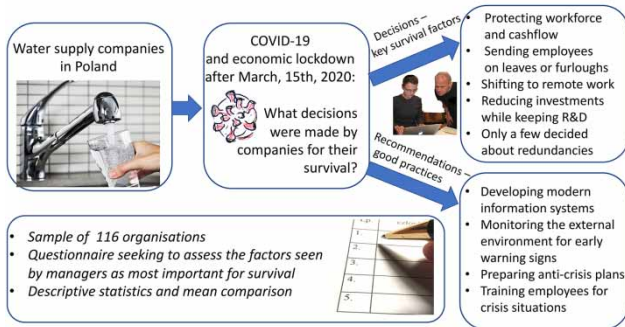
- COVID-19 lockdown has impacted waterworks in Poland, requiring them to respond to the coronacrisis.
- The researched companies reacted by protecting workforce, securing cash flow and sustaining their competitive position.
- The majority reduced investments, kept R&D expenses, only few made redundancies.
- Firms turned to remote working, shortened worktime or sent employees on leave.
- Firms were ready for crisis, acted quickly under pressure with the help of staff.
- In the future, crisis plans and communication plans are needed to prepare for crises.

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GRAPHICAL ABSTRACT

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INTRODUCTION

The high level of uncertainty and risk resulting from crises means that in the face of crisis factors threatening the survival of organisations emerge, negatively affecting the ability of managers to make rational decisions and challenging the development of adaptive management solutions.

Similar mechanisms can be observed for epidemic crises. The limited response time to unexpected phenomena means that in an epidemic, the identification and assessment of key survival factors become critical. There is no doubt that the complexity of operations requiring a crisis response depends on the dynamic capabilities of organisations that require coordinated action at different levels of the organisation (Lai 2012).

The objective of this paper is to present the results of research on managerial decisions that were taken in water supply companies in Poland as the first reaction immediately after the outbreak of the coronavirus epidemic. Thus, our research indicates which of the factors were perceived by managers as key factors of survival and further functioning.

In an attempt to diagnose the condition and situation of enterprises during the coronacrisis, the starting point was to carry out literature research on business turbulence caused by epidemics in the last 25 years, with particular focus on SARS in the Far East. Analysing the conclusions that business drew from the SARS epidemic in 2003, Day *et al.* (2004) found that hardly any enterprise developed a comprehensive epidemic response plan, and those that prepared it,

did so rather incidentally and to a limited extent (e.g. by limiting investments which reduced costs or increasing inventory materials for production, which caused an increase in the costs). Analysing the response of Hewlett Packard Canada (a company that provides computing and imaging solutions for commercial and residential use) to the threat of the SARS epidemic in 2003, Hollands *et al.* (2007) found that in addition to introducing restrictions resulting from separating infected employees and taking care of them and their families, company managers placed particular emphasis on ensuring continuity of supplies of raw materials and semi-finished products, as well as on obtaining advance information in this regard from their suppliers.

Research conducted by Koltun *et al.* (2015) concluded that systemic weaknesses during the crisis caused by the Ebola virus epidemic in 2013 were (1) inability to mobilise responses at an international level quickly, (2) lack of adequate production capacity at the national level and (3) low level of readiness to react.

Analyses demonstrate that the crises that companies have gone through in the past have hit all enterprises in a different way, e.g. some of them have both increased and decreased investment expenditure (OECD 2009). It points to exploratory behaviour, e.g. searching for new markets or offering new products and/or services, which may increase the company's innovation during an economic recession (Archibugi *et al.* 2013).

The crisis or economic recession is also a time when entrepreneurs and employees more often turn their attention to remote work. Unemployment or the threat of unemployment stimulates them to plan for higher mobility in the future. Therefore, it provides a greater opportunity to access the labour market (Ravaleta *et al.* 2017). The process of preparation of companies to face the SARS pandemic in the Far East in 2003 was nowhere ahead. Enterprises operating there implemented survival strategies involving remote work and separating employees (Wozniak 2003). A concept of flexible or temporary work under crisis has been given attention (Trappe 2020) as it allows to increase the speed of acting and to react by shifting employees in uncertain economic conditions. What is more, flexible work allows to retain the most qualified workers.

While conducting research on the impact of SARS on the hotel industry, Leung & Lam (2004) noticed that from the human resource management perspective, one of the responses to the threat was the reduction of employment and reduction of employees' remuneration. On the other side, in hotels in South Korea, measures have been taken to reduce the level of investment (Kim *et al.* 2005) as well as to reduce employment among workers temporarily employed.

Although problems in manufacturing activities due to the SARS epidemic were anticipated, they occurred on a smaller scale than expected because some enterprises had prepared for problems with the supply of raw materials. As a result, relatively few enterprises in the Far East went bankrupt due to the SARS epidemic; at the same time, this epidemic caused a dynamic increase in production in enterprises undertaking protective measures (Tan & Enderwick 2006).

Ongoing research links crises with unemployment (e.g. Dominguez *et al.* 2011). However, when analysing changes in employment during the 2008–2009 crisis, some cross-country differences have been found: even though the GDP drop was more significant in Germany than in the United States, German enterprises kept their employment roughly unchanged, while American firms made redundancies (Burda & Hunt 2011). The crisis time typically pushes managers to taking decisions about employment: redundancies, shifting human resources or reducing worktime (Dominguez *et al.* 2011). Some studies even claim that

there is a necessity to reduce employment in order to beat uncertainty with lean and effective teams in simple structures, while keeping highly trained specialists (Lieber 2009). Unfortunately, crises can result in investment reductions, as well as job performance (Heshmati & Kim 2011). However, reducing investments is implemented hand in hand with higher R&D expenses to improve existing products or develop innovative ones for the after-crisis time (Flagg *et al.* 2011).

Many studies have analysed the impact of the financial crisis on working capital management methods and company results. Some of them show that the survival of the crisis is largely influenced by practices in the area of maintaining financial liquidity of the enterprise (Oseifuah & Gyekye 2018). A review of the literature indicates that the most common actions taken by enterprises in the face of crises include those presented in Table 1.

Table 1 | Steps undertaken by firms after crises and epidemic breakouts

Description	References
Reducing the level of investments	Heshmati & Kim (2011)
Decisions concerning R&D	Flagg <i>et al.</i> (2011); Heshmati & Kim (2011)
Closing part of the plant	Softić (2010)
Sending employees on mandatory leave	Perry Work Report (2009)
Shortening the worktime	Dominguez <i>et al.</i> (2011); Sacchi <i>et al.</i> (2011)
Redundancies	Softić (2010); Burda & Hunt (2011); Dominguez <i>et al.</i> (2011); Kildienė <i>et al.</i> (2011)
Production decrease	Kildienė <i>et al.</i> (2011)
Looking for new markets	Archibugi <i>et al.</i> (2013)
Offering new products/services	Archibugi <i>et al.</i> (2013)
Prolonging the payment deadlines	Softić (2010)
Shifting into telecommuting and home offices	Ravaleta <i>et al.</i> (2017); Trappe (2020)
Securing employment level	Lieber (2009); Sherman (2010); Bosch (2010)
Securing cash flow	Oseifuah & Gyekye (2018)
Securing supply continuity	Howard <i>et al.</i> (2020); Hollands <i>et al.</i> (2007)

Of course, we are aware that the list presented in Table 1 is not exhaustive or conclusive. It only embraces these decisions or actions that seem to be taken most commonly taken by managers during crises. Other actions such as making response plans or appointing crisis management teams appeared in the literature occasionally. Therefore, for our research, we have decided to take into consideration these decisions that were most often mentioned in our literature research. Hence, in the next section of this paper, we present the research carried out among 116 water supply companies in Poland right after the coronacrisis breakout in March 2020. The research results will indicate which factors – among these identified in the literature – were seen as most important by managers of the water utilities for survival and further functioning.

METHODS AND ANALYSIS OF RESULTS

Data collection

The empirical studies were conducted in April 2020, as a part of a surVIRval research project. Below, we present a fragment of the research concerning managerial decisions that were taken just after the economy lockdown. The main part of the research was conducted using the Computer Assisted Web Interview method and a sample of 116 Polish water supply companies, whose characteristics are presented in Table 2. The questionnaire consisted of 17 statements assessed by the managers on the 7-point Likert

Table 2 | Structure of the sample

Characteristics	%
Firm size (employees)	
10–49	24.1
50–249	62.9
250 and more	12.9
Managerial experience (years)	
up to 10	24.1
11–20	36.2
21–30	28.4
31 and more	11.2

scale (e.g. ‘Please assess the influence of the following so far undertaken actions onto the survival of your company: (1) Liquidation of part of the plant, (2) Sending employees on leaves ...’). When the company did not undertake certain action, the statement was assessed as ‘0’. The intensity of undertaken actions was assessed between 1 (low impact) and 7 (high impact).

Results

The variables constituting the firm’s activities were assessed from the perspective of their impact on ensuring business’s survival, and the following ordinal scale was used: 0 – no action taken, 1 – no impact and 7 – very big impact. As a first step, Cronbach’s alpha test, the Kaiser–Meyer–Olkin test and Barlett’s test were conducted (Table 3).

As it can be seen in Table 3, Cronbach’s alpha and Kaiser–Meyer–Olkin test results confirm the reliability of the research tool. On the other hand, the factors selected for this study are correlated with one another, which confirms the statistical significance of Barlett’s test.

In the next step, a statistical description of the variables studied was made. We used the mean, standard error (SE), median (M), mode (D), standard deviation (SD), variance (SD²) and sum (Σ). Their results are presented in Tables 4 and 5.

The analysis of the results shows that among the 12 possible activities of water supply companies analysed during the coronacrisis, eight of them were not undertaken by more than half of the enterprises (M = 0, D = 0). This group includes activities related to liquidating part of the plant, reducing working time, reducing employment, reducing production, searching for new markets, offering new products and/or services, reducing the expenditure on research and development and searching for alternative distribution methods. In turn, the group of actions undertaken relatively often included reducing the level of investment

Table 3 | Properties of the measures

Variable	Cronbach’s alpha test	Kaiser–Meyer–Olkin test	Barlett’s test
Actions	0.744	0.729	308.286*

* $p < 0.000$.

Table 4 | Descriptive statistics

Variables	Mean	SE	M	D	SD	SD ²	Σ
1. Liquidation of part of the plant	0.10	0.041	0.0	0.0	0.445	0.198	12
2. Sending employees on leave or furlough	2.59	0.205	2.0	0.0	2.207	4.869	301
3. Working time reduction	1.57	0.204	0.0	0.0	2.196	4.821	182
4. Employment reduction	0.35	0.098	0.0	0.0	1.057	1.117	41
5. Production reduction	1.21	0.180	0.0	0.0	1.936	3.748	140
6. Searching for new markets	0.33	0.061	0.0	0.0	0.656	0.431	38
7. Offering new products and/or services	0.48	0.106	0.0	0.0	1.138	1.295	56
8. Extension of payment deadlines for commitments	1.97	0.211	1.0	0.0	2.269	5.147	228
9. Reduction in research and development expenditure	0.95	0.168	0.0	0.0	1.807	3.267	110
10. Investment level reduction	3.47	0.204	4.0	4.0	2.197	4.825	402
11. Searching for alternative distribution methods	0.53	0.128	0.0	0.0	1.373	1.886	62
12. Changing work to become remote	3.66	0.206	4.0	4.0	2.214	4.903	425

Scale: 0, no action taken; 1, no impact – 7, very big impact.

Table 5 | Shares of responses

Variables	Share of responses (%)							
	0	1	2	3	4	5	6	7
1. Liquidation of part of the plant	93.1	5.2	0.0	1.7	0.0	0.0	0.0	0.0
2. Sending employees on leave or furlough	23.3	15.5	13.8	15.5	10.3	7.8	6.9	6.9
3. Working time reduction	54.3	11.2	6.0	7.8	7.8	3.4	4.3	5.2
4. Employment reduction	86.2	4.3	2.6	4.3	1.7	0.0	0.0	0.9
5. Production reduction	62.9	6.9	9.5	6.0	4.3	5.2	2.6	2.6
6. Searching for new markets	75.9	17.2	5.2	1.7	0.0	0.0	0.0	0.0
7. Offering new products and/or services	77.6	8.6	7.8	4.3	0.0	0.0	0.9	0.9
8. Extension of payment deadlines for commitments	46.6	5.2	8.6	18.1	4.3	7.8	2.6	6.9
9. Reduction in research and development expenditure	68.1	10.3	7.8	1.7	5.2	1.7	1.7	3.4
10. Investment level reduction	16.4	2.6	13.8	15.5	20.7	11.2	7.8	12.1
11. Searching for alternative distribution methods	78.4	11.2	2.6	1.7	2.6	0.9	0.9	1.7
12. Changing work to become remote	11.2	10.3	11.2	10.3	17.2	16.4	11.2	12.1

Scale: 0, no action taken; 1, no impact – 7, very big impact.

(81%, (M = 4, D = 4)), changing work to become remote (78.5%, (M = 4, D = 4)), sending employees on leave or furlough (61.2%, (M = 2, D = 0)) and extending payment deadlines for commitments (48.2% of respondents (M = 1, D = 0)).

Analysing the intensity of the implemented actions indicates – which is no surprise – that the decisions made most often are ones that are expected to increase cash flow relatively rapidly. On the other hand, actions insignificant to

financial performance are rarely chosen. This suggests a rational approach of managers, even during the crisis.

Changing office work to remote work with concurrent actions taken to protect the level of employment and to keep the competence potential suggests high managerial attention to human resources, social responsibility as well as strategic thinking. At the same time, the pursuit of reducing the level of investment indicates the will to maintain financial liquidity necessary to long-term survival.

Applying the company size as a control variable to assess the intensity of measures taken by water supply companies (see Figure 1) allows the following relation to be noted: while the intensity of all activities undertaken by small companies is the lowest, in the case of large companies the intensity of all activities is the highest. This result can be explained by referring to the level of company flexibility and responsiveness, which in the case of small companies, is relatively high due to limited resources and a lower level of formalisation. It can also be assumed that in the case of large companies, high intensity of activities results not only from a higher level of acceptable risk but also from a broader knowledge of the environment phenomena and more developed dynamic capabilities.

Our analysis of activities undertaken by water supply companies during the first phase of coronacrisis, from the perspective of managers' experience (measured by the time of their work in managerial positions), indicates the relation between the level of managerial experience and the intensity of implemented responses to the coronacrisis (see Figure 2). With regard to almost all activities (except for activities related to sending employees on leave or furlough, and changing office work to become remote), managers with more experience were willing to take actions characterised by a higher level of intensity. Interestingly, in the case of activities related to sending employees on leave or furlough,

a reversed trend can be observed, indicating that the tendency to send employees on leave or furlough decreases as the level of experience increases. This could suggest that managers with more seniority are more likely to attempt to actively benefit from employee's competences. Another explanation might be that experienced managers seek other ways to protect the company functioning than just re-scheduling work. In the case of changing office work to the remote type, the greatest tendency was observed in the group of managers with experience of 21–31 years, the lowest in the group of managers with experience of 31 years and more. This can suggest that managers with more seniority refrain from remote work.

The lowest differences in managerial decisions (Figure 2) can be observed in activities related to the liquidation of a part of the plant (differences in answers only 2.6%), the search for new markets (3.0%) and the reduction of the level of investment (3.1%). The most considerable discrepancy in the intensity of implemented activities, from the perspective of managers' experience, can be observed in activities aiming at the reduction of the level of production (differences in answers as high as 23.4%) and extending the payment deadlines for liabilities (22.4%). Therefore, managers with greater experience, being aware of the reduction in demand caused by the external crisis, are more inclined to reduce production. Moreover, while

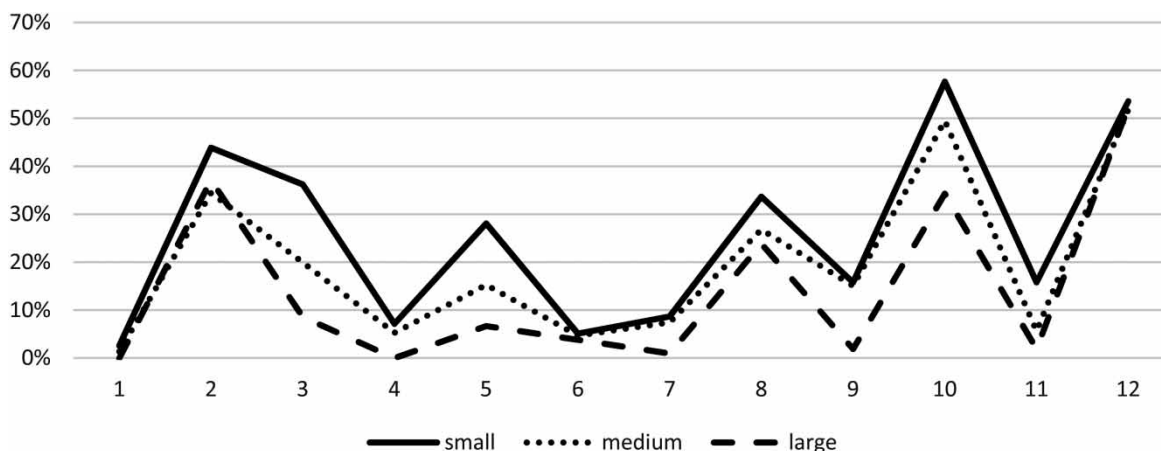


Figure 1 | Distribution of answers according to the size criterion of companies. Variable key: 1 – liquidation of part of the plant, 2 – sending employees on leave or furlough, 3 – working time reduction, 4 – employment reduction, 5 – production reduction, 6 – searching for new markets, 7 – offering new products and/or services, 8 – extension of payment deadlines for commitments, 9 – reduction in research and development expenditure, 10 – investment level reduction, 11 – searching for alternative distribution methods and 12 – changing work to become remote.

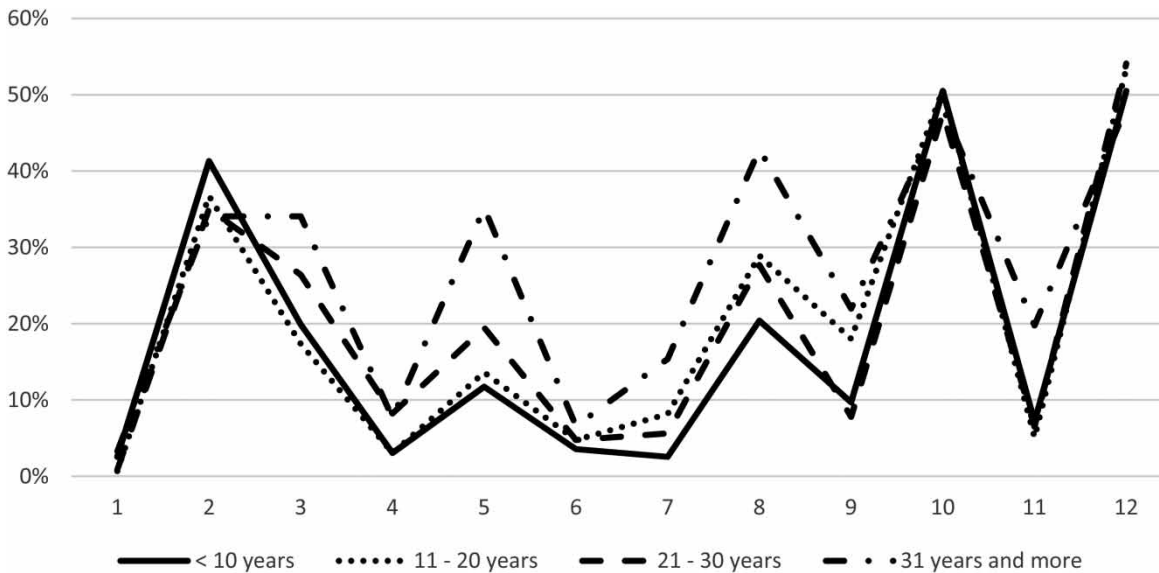


Figure 2 | Distribution of answers according to the experience criterion of managers. Variable key: 1 – liquidation of part of the plant, 2 – sending employees on leave or furlough, 3 – working time reduction, 4 – employment reduction, 5 – production reduction, 6 – searching for new markets, 7 – offering new products and/or services, 8 – extension of payment deadlines for commitments, 9 – reduction in research and development expenditure, 10 – investment level reduction, 11 – searching for alternative distribution methods and 12 – changing work to the remote type.

anticipating the emergence of problems with financial liquidity much more often, they extend payment periods for obligations by actively managing the level of cash flow.

CONCLUSIONS, RECOMMENDATIONS, LIMITATIONS AND FUTURE RESEARCH

The face of the crisis is the most difficult for companies of strategic importance, whose operation is related to securing vital infrastructure, maintaining appropriate hygiene conditions or maintaining work continuity. In cases of this type of enterprises, companies are naturally seeking solutions to overcome unexpected crises.

Our paper presents the research results concerning the managerial decisions that were taken as a first reaction to the coronacrisis and economy lockdown in 116 companies from the water supply sector operating in Poland. The results demonstrate that the most frequent decisions made were reducing investments and sending employees for home office work, as well as prolonging the payment deadlines. We have found that together with investment reductions, the companies kept the R&D expenses roughly unchanged, aspiring to remain innovative right after the crisis. Only a

few of the water supply companies made employees redundant; the majority benefited from leave and furlough, as well as introducing home office or remote work wherever possible. We also noticed that the companies sport a good level of managerial decision-making and general readiness for crisis situations. What was important, the personnel in the water utilities has proven to be helpful, involved, and supportive during the crisis.

Our initial theoretical section has shown some common decisions made during past crises. Some of them – for example, preparing special crisis plans or appointing crisis management teams – did not appear in the literature frequently. When talking to managers of the water supply companies in Poland, they did not mention them either. Therefore, in this section, we would like to extend the scope of the actions taken in order to suggest water supply companies some good practices and recommendations for the future. They do not derive directly from our research, but from some insights in the literature.

The management practice recommends some general or strategic actions: continuous monitoring of the external and internal environment, preparing anti-crisis plans, setting up a crisis management team, tackling crisis by managers and treating it as a phenomenon that can jeopardise company

goals, training employees for the crisis time and developing a modern information system (Kuzmanova 2016). However, the above recommendations apply to typical business organisations. Our research – as it focused only on water supply companies – has demonstrated that for the future crisis situations, a tailored set of actions would be appropriate: securing and developing the online access to company IT network, securing the internet connection allowing remote work on a larger scale, remote and secure access to company systems and databases (that need to be transformed into digital ones).

Some recommendations concerning human resource management are also required. First, water supply companies should prepare guidelines for flexible work management in the future. Second, there is no urge in making employees redundant since tariffs in water supply companies in Poland are regulated administratively providing relatively stable stream of revenues. And since the work of specialists and employees with high competences is required also during crises, we recommend that water supply companies introduce specialist training programmes adjusted to crisis situations.

Our research suggests that some water supply companies have reduced the level of investment, which – in the short run – could help them in healing the cash flow. Some companies experienced a decrease in revenues that resulted from Covid-19-related problems in tourism and the hotel sector that are significant customers of water supply and sewage sector. However, as the tariffs in the Polish water supply sector are regulated by law, the investments are realised according to investment plans previously approved by regulators. So, even though reduced, the investments will be postponed. Our recommendation points here to a long-term and flexible investment financing that could potentially buffer crisis-related cash-flow disturbances, and secure investment plans in the future.

The water supply companies, as organisations of strategic importance, are specifically required to provide services on a continuous level, especially during crises. This continuity can be secured by attention given to employees and their work. Therefore, remote work, leaves, shorter worktimes and other forms of keeping the workforce stable and healthy is a crucial objective of the water supply sector. Our research indicates that Polish water supply companies

have realised these strategic steps during the first period of the Covid-19 crisis.

Of course, we are aware that our research has some limitations. First, the literature review we have carried out points to the fact that companies act in a hurry, and that they do not have crisis-response plans. However, we did not ask managers about the tailored preparedness for crises. This could be included in future research. Second, there is a limitation concerning the research tool. A questionnaire usually reflects managers' subjective opinions on certain phenomena, not the factual situations. Still, the 7-point scale allows for some parametrization of answers, and generally is accepted on large samples (Martinez-Roman et al. 2011). Finally, the research was carried out in water supply companies in Poland. Their specificity is different from water supply companies in other countries. It would be worth conducting the research internationally and provide some comparative analyses.

Apart from the recommendations suggested above, we can provide some insights for future consideration. There is some research indicating how companies could prepare themselves for future crises. Poslad et al. (2015) claim that a semantic-based, Internet of Things driven, the early warning system can be crucial for crisis management, especially when facing natural disasters. Early warning systems work on data from multiple sources that allow predicting or simulating potential crises. The model-driven decision support tools can also facilitate decision-making in water supply companies during difficult times (Makropoulos et al. 2008).

It is also suggested that decisions overcoming crises can be made upon mathematical models that track managers' preferences can aid decision makers when responding to a crisis. For example, Fertier et al. (2016) posit that a data-based system can support stakeholders in decision-making since – when facing a crisis – they coordinate in a hurry, despite being largely heterogeneous.

Yin & Jing (2014) argue that during a crisis, there is a short time for decision-making, therefore incorporating some routines, procedures and schemes concerning leadership, environmental pressure, information management and coordination are useful for crisis management and developing useful crisis plans in enterprises of strategic importance. All of the areas indicated above can be a foundation for a future research concerning activities to be undertaken by the water supply companies during crises.

Our research was carried out just one month after the economy lockdown in Poland, reflecting the actions taken by the managers as the first responses to Covid-19 corona crisis, and the lockdown of the Polish economy. It would be interesting to analyse how these actions have changed after several months from the first active coronavirus case, yet before the second wave of the pandemic; therefore, we have repeated the survey between May and September 2020 and will see where the managerial attention has gone.

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DATA AVAILABILITY STATEMENT

All relevant data are available from an online repository or repositories (https://docs.google.com/file/d/1_x1du7SJwTKMkC7vCRCYoDPfOnyTRQHR/edit?usp=docslist_api&filetype=msexcel).

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