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# ECONOMIC AND INSTITUTIONAL URBAN RESILIENCE TO COVID-19

## CASE OF POLAND

### ABSTRACT

This article aims to investigate the institutional and economical resilience of Polish cities with powiat rights to COVID-19 between spring 2020 and autumn 2020. Institutional resilience was researched using surveys among crisis management units and economic resilience with K-means clustering method and step-wise regression. Cities demonstrated a large recovery potential in the areas which lay directly under their supervision. Problems arose in the areas coordinated by central government, i.e. access to respirators, or hospital beds. The size of the city and large number of medium-sized companies were the factors of city's immunity. Tourist cities turned out to be less resilient.

**Keywords:** institutional resilience, economic resilience, urban resilience, COVID-19, shocks, urban vulnerability

## INTRODUCTION

The period of the last several decades is characterised by a growing significance of research studies on the development and transformation of cities, which results from the constantly increasing role of cities. According to United Nations estimates, 56% of the population lived in cities in 2018, and in 2050 city dwellers will account for 68% of world inhabitants.<sup>1</sup> Also, cities represent the engine of economic growth<sup>2</sup>, accounting for approx. 80% of global GDP.<sup>3</sup>

Trends in the development of cities are increasingly affected by such global phenomena as climate change, mass migrations, or – as recorded in the last year – epidemics. Therefore, the descriptions of various aspects of the functioning of cities should give consideration to such categories as VUCA: volatility, uncertainty, complexity and ambiguity.<sup>4</sup> Subsequent economic crises, environmental changes, migrations, and domestic and international conflicts create a sense of exposure and vulnerability of local economies to unexpected events. Under these conditions, an increasing attention is given to the concept of resilience. Unlike static concepts, the concept of resilience facilitates an analysis of dynamic events and their impact on development processes. According to Martin and Sunley, *resilience is highly pertinent for analysing how regions and localities react to and recover from shocks and thence for understanding the role such shocks might play in shaping the spatial dynamics of economic growth and development over time.*<sup>5</sup>

For a number of years, the concept of resilience has aroused the scientific interest of researchers. Originally, attention was given to risk assessment, then to an adaptive approach, and in the recent years – the resilience of cities to climate change.<sup>6</sup> Only a limited number of studies are dedicated to city planning in the context of counteracting the threat of epidemics.<sup>7</sup> Hence the impact of the COVID-19 pandemics on intensifying research on urban resilience.

<sup>1</sup> United Nations, *World Urbanization Prospects: The 2018 Revision* (ST/ESA/SER.A/420), New York, NY 2019.

<sup>2</sup> G. Duranton, "Are Cities Engines of Growth and Prosperity for Developing Countries?", in M. Spence, P.C. Annez, R.M. Buckley, *Urbanization and Growth: Commission on Growth and Development*, Washington, DC 2009; P.C. Annez, R.M. Buckley, "Urbanization and Growth: Setting the Context", in M. Spence, P.C. Annez, R.M. Buckley, *Urbanization and Growth...*, pp. 1-46.

<sup>3</sup> R. Dobbs et al., "Urban World: Mapping the Economic Power of Cities", McKinsey & Company, 1 March 2011, at <http://www.mckinsey.com/global-themes/urbanization/urban-world-mapping-the-economic-power-of-cities>, 16 February 2022.

<sup>4</sup> N. Bennett, G.J. Lemoine, "What VUCA Really Means for You", *Harvard Business Review* 2014, January-February 2014, p. 27.

<sup>5</sup> R. Martin, P. Sunley, "On the Notion of Regional Economic Resilience: Conceptualization and Explanation", *Journal of Economic Geography* 2015, vol. 15, no. 1, p. 4.

<sup>6</sup> A. Sharifi, "Urban Resilience Assessment: Mapping Knowledge Structure and Trends", *Sustainability* 2020, vol. 12, no. 15, p. 5918.

<sup>7</sup> R.A. Matthew, B. McDonald, "Cities under Siege: Urban Planning and the Threat of Infectious Disease", *Journal of the American Planning Association* 2006, vol. 72, no. 1, pp. 109-117.

The COVID-19 pandemic has been the most severe social and economic crisis in the recent years. Its unpredictable and demand-supply character<sup>8</sup> as well as its global impact have affected all social and economic actors. During the first months of the pandemic, the research on the impact of COVID-19 on cities focused on four areas: the quality of the natural environment (e.g. the impact of lockdown on air quality), the impact on society and economy, management and transport as well as urban design.<sup>9</sup> From a social perspective, attention was given to the widening in inequalities due to COVID-19.<sup>10</sup> Higher mortality rates among US minorities were attributed to socioeconomic factors.<sup>11</sup> Literatures dealing with the impact of COVID-19 on cities also cited the positive cases of social innovation and cooperation, which allowed for strengthening social ties under lockdown and counteracting inequalities in access to public services.<sup>12</sup>

Much of research on the impact of COVID-19 on the economy focused on those sectors that represented a major source of budgetary revenue, e.g. tourism.<sup>13</sup> It was stressed, however, that the impact of the pandemic on cities' tax base could be investigated on the basis of longer periods of time.<sup>14</sup> The analyses of the implications of lockdown for cities also considered spatial factors which enhanced a negative financial and economic impact on the populations of post-industrial cities with undiversified economic structures.<sup>15</sup>

Despite the fact that the crisis is not over yet, a number of researchers are undertaking efforts to understand the effects of the crisis on spatial economics and urban development. Municipal institutions and systems respond to the current consequences of the pandemic and its evolutionary character. It necessitates conducting exploratory

<sup>8</sup> R. Baldwin, B. Weder di Mauro, *Economics in the Time of COVID-19*, London 2020, at [https://cepr.org/sites/default/files/publication-files/60120-economics\\_in\\_the\\_time\\_of\\_covid\\_19.pdf](https://cepr.org/sites/default/files/publication-files/60120-economics_in_the_time_of_covid_19.pdf), 24 September 2022.

<sup>9</sup> A. Sharifi, A.R. Khavarian-Garmsir, "The COVID-19 Pandemic: Impacts on Cities and Major Lessons for Urban Planning, Design, and Management", *Science of The Total Environment*, vol. 749, 20 December 2020.

<sup>10</sup> C.W. Kihato, L.B. Landau, "Coercion or the Social Contract? COVID 19 and Spatial (In)Justice in African Cities", *City and Society* 2020, vol. 32, no. 1, pp. 1-11.

<sup>11</sup> D.S. Grigsby-Toussaint, J.Ch. Shin, A. Jones, "Disparities in the Distribution of COVID-19 Testing Sites in Black and Latino Areas in New York City", *Preventive Medicine*, vol. 147, June 2021.

<sup>12</sup> V. Cattivelli, V. Rusciano, "Social Innovation and Food Provisioning During Covid-19: The Case of Urban-Rural Initiatives in the Province of Naples", *Sustainability* 2020, vol. 12, no. 11, p. 4444; L. Mendes, "How Can We Quarantine without a Home? Responses of Activism and Urban Social Movements in Times of COVID-19 Pandemic Crisis in Lisbon", *Tijdschrift voor economische en sociale geografie / Journal of Economic and Human Geography* 2020, vol. 111, no. 3, pp. 318-332.

<sup>13</sup> T. Napierała, K. Leśniewska-Napierała, R. Burski, "Impact of Geographic Distribution of COVID-19 Cases on Hotels' Performances: Case of Polish Cities", *Sustainability* 2020, vol. 12, no. 11, p. 4697; G. McCartney, J. Pinto, M. Liu, "City Resilience and Recovery from COVID-19: The Case of Macao", *Cities*, vol. 112, May 2021.

<sup>14</sup> A. Sharifi, A.R. Khavarian-Garmsir, *The COVID-19 Pandemic...*

<sup>15</sup> R. Krzysztofik, I. Kantor-Pietraga, T. Spórna, "Spatial and Functional Dimensions of the COVID-19 Epidemic in Poland", *Eurasian Geography and Economics* 2020, vol. 61, no. 4-5, pp. 573-586.

research on the selected aspects of the functioning of urban areas, which have not been analysed so far.

Our study undertakes to meet the demand for research in this area. This article aims to investigate the institutional and economical ability of Polish cities to respond to the effects of COVID-19, so it supplements the hitherto studies in three ways. Firstly, the study covers a large population of cities. We have analysed 66 cities with powiat (district) rights – all the Polish cities enjoying this special status. Cities with powiat rights are inhabited by 33% of Poles and they perform functions of trans-local or trans-regional character. Because of these characteristics, cities with powiat rights during COVID-19 pandemic have played a distinct role among other territorial self-government entities in Poland in ensuring security for citizens and protecting local economies.

To this day, research on the impact of COVID-19 on urban development in Poland has been confined to the largest metropolitan areas (e.g. Napierała et al. analyse only 9 biggest cities in Poland).<sup>16</sup> Secondly, the article identifies the functions of cities that – in the face of the pandemic – show high or low resilience to pandemic-related disturbances. Thirdly (in connection with the above), the article verifies the extent to which a systemic position of Polish cities, as set out in the mechanisms on crisis management and public finance management, is effective in dealing with such threats as those posed by COVID-19.

The article consists of five parts. In the first part we present a theoretical framework of our research study. We describe the characteristics of institutional and economic resilience in the context of cities' response to COVID-19. In this part of the article we also present the processual aspects of the concept of resilience, which allows for a clear identification of the stage of the pandemic crisis referred to in our study. The next part of the article presents the legal and formal aspects of the system of crisis and financial management in Polish cities. This context facilitates the interpretation of the obtained results, which are discussed in the fourth part of the article. This part of the work also presents the methodology of qualitative research on the institutional resilience of cities to COVID-19, and quantitative research on cities' economic resilience. In the last part, Discussion, we argue that in some aspects of managing the COVID-19 crisis cities were more effective than the central authorities.

## THE USE OF THE CONCEPT OF INSTITUTIONAL AND ECONOMIC RESILIENCE IN ANALYSING CITIES' RESPONSE TO COVID-19

The concept of resilience emerged from research studies on the stability and sustainability of ecological systems.<sup>17</sup> Resilience turned out to be a universal way of thinking, arousing interest of other disciplines including social sciences, environmental science,

<sup>16</sup> T. Napierała, K. Leśniewska-Napierała, R. Burski, "Impact of Geographic Distribution...".

<sup>17</sup> C.S. Holling, "Resilience and Stability of Ecological Systems", *Annual Review of Ecology and Systematics* 1973, vol. 4, pp. 1-23.

engineering, medicine, psychology, computer science, management studies, development studies and political science. The concept has also been applied by researchers in the fields of economic geography, urban development and regional studies, who used it to explore the ways in which regions and cities respond to and recover from disturbances and disruptions.<sup>18</sup>

According to a definition proposed by Martin and Sunley, economic resilience is *the capacity of a regional or local economy to withstand or recover from market, competitive and environmental shocks to its developmental growth path, if necessary by undergoing adaptive changes to its economic structures and its social and institutional arrangements, so as to maintain or restore its previous developmental path, or transit to a new sustainable path characterized by a fuller and more productive use of its physical, human and environmental resources.*<sup>19</sup>

Institutional resilience, on the other hand, is a broad term that usually refers to changes in social institutions, spread over time, resulting from adapting to external factors.<sup>20</sup> However, considering the phenomena of sudden shocks and the necessity of response on the part of social systems, institutional resilience should stress institutions' operating capacities to absorb disturbance and reorganise into a functioning system.<sup>21</sup> In this context it is assumed that an institutional system is resilient if, firstly, it can withstand distortions, ensuring the performance of its major function, i.e. mitigating

<sup>18</sup> L. Brüguglio et al., "Economic Vulnerability and Resilience: Concepts and Measurements", *WIDER Working Paper Series*, Research Paper No. 2008/55, at <https://www.wider.unu.edu/sites/default/files/rp2008-55.pdf>, 24 September 2022; R. Martin, B. Gardiner, "The Resilience of Cities to Economic Shocks: A Tale of Four Recessions (and the Challenge of Brexit)", *Papers in Regional Science* 2019, vol. 98, no. 4, pp. 1801-1832; P. Breathnach, Ch. van Egeraat, D. Curran, "Regional Economic Resilience in Ireland: The Roles of Industrial Structure and Foreign Inward Investment", *Regional Studies, Regional Science* 2015, vol. 2, no. 1, pp. 497-517; J. Doran, B. Fingleton, "Resilience from the Micro Perspective", *Cambridge Journal of Regions, Economy and Society* 2015, vol. 8, no. 2, pp. 205-223; F. Oprea et al., "The Determinants of Economic Resilience. The Case of Eastern European Regions", *Sustainability* 2020, vol. 12, no. 10, p. 4228; R. Capello, A. Caragliu, U. Fratesi, "Spatial Heterogeneity in the Costs of the Economic Crisis in Europe: Are Cities Sources of Regional Resilience?", *Journal of Economic Geography* 2015, vol. 15, no. 5, pp. 951-972.

<sup>19</sup> R. Martin, P. Sunley, "On the Notion...", p. 3.

<sup>20</sup> J.W. Handmer, S.R. Dovers, "A Typology of Resilience: Rethinking Institutions for Sustainable Development", *Industrial & Environmental Crisis Quarterly* 1996, vol. 9, no. 4, pp. 482-511; R.E. Goodin, "Institutions and Their Design", in R.E. Goodin (ed.), *The Theory of Institutional Design*, Cambridge 1996, pp. 1-53; K.A. Shepsle, "Rational Choice Institutionalism", R.A.W. Rhodes, S.A. Binder, B.A. Rockman (eds), *The Oxford Handbook of Political Institutions*, Oxford 2006, pp. 23-38; J.G. March, J.P. Olsen, *Rediscovering Institutions: The Organizational Basis of Politics*, New York, NY 1989; I. Greener, "The Potential of Path Dependence in Political Studies", *Politics* 2005, vol. 25, no. 1, pp. 62-72; M.D. Cohen, J.G. March, J.P. Olsen, "A Garbage Can Model of Organizational Choice", *Administrative Science Quarterly* 1972, vol. 17, no. 1, pp. 1-25.

<sup>21</sup> S.L. Cutter et al., "A Place-Based Model for Understanding Community Resilience to Natural Disasters", *Global Environmental Change* 2008, vol. 18, no. 4, pp. 598-606; C. Folke, "Resilience: The Emergence of a Perspective for Social-Ecological Systems Analyses", *Global Environmental Change* 2006, vol. 16, no. 3, pp. 253-267; L.B. Grefalda et al., "Building Institutional Resilience in the Context of Climate Change in Aurora, Philippines", *Environmental Research*, vol. 186, July 2020.

uncertainty and maintaining the system's stability, and, secondly, it has the ability to change in order to effectively respond to external factors.<sup>22</sup>

The common characteristic of the two presented concepts is the processual nature of resilience. Considering distortions from the perspective of an affected entity, resilience assumes the sequential character of activities carried out by individuals and systems in response to shocks.<sup>23</sup> It comprises five elements: vulnerability, i.e. sensitivity of socioeconomic structures to shocks; disturbance, which describes the type, scope, ways and time of the impact of shocks; resistance, which describes the response to shocks and their initial impact on the economy and society; robustness, which relates to social actors' adaptation mechanisms aimed to mitigate the effects of shocks; recovery, i.e. a period of time related to the degree and nature of the revival of the economy and social structures.<sup>24</sup>

An analysis of the response of social entities at each stage allows for describing their resilience during the entire period of disturbances, i.e. long-term resilience. However, the impact of the shock which has not ended yet, like COVID-19 pandemic, cannot be considered from the perspective of all five stages of the systemic response to the disturbances. The nature and impact of COVID-19 has been already analysed by a number of economists<sup>25</sup> or self-government economy experts.<sup>26</sup> An analysis of the vulnerability of individuals and economic systems as well as the time of the restructuring, reorientation or transformation of structures (adaptive development), can only be carried out when the impact of disruptions decreases.<sup>27</sup> Therefore in the context of the present stage of the COVID-19 pandemic (after the second and in the course of the third wave), an analysis of the institutional and financial abilities of Polish cities to react to COVID-19 can only be based on the stages of resistance and robustness.

At the moment of the occurrence of a shock<sup>28</sup> an entity's or system's response comes down to withstanding a 'hit' and maintaining the ability to perform core functions and

<sup>22</sup> E. Herrfahrdt-Pähle, C. Pahl-Wostl, "Continuity and Change in Social-Ecological Systems: The Role of Institutional Resilience", *Ecology and Society* 2012, vol. 17, no. 2, art. 8, pp. 1-14.

<sup>23</sup> R. Martin, P. Sunley, "On the Notion..."; R. Martin, "Shocking Aspects of Regional Development: Towards an Economic Geography of Resilience", in G.L. Clark et al. (eds), *The New Oxford Handbook of Economic Geography*, Oxford 2018, pp. 839-862.

<sup>24</sup> R. Martin, P. Sunley, "On the Notion...".

<sup>25</sup> R. Baldwin, B. Weder di Mauro, *Economics in the Time...*; J. Gans, *Economics in the Age of COVID-19*, Cambridge, MA 2020.

<sup>26</sup> OECD, "Territorial Impact of COVID-19: Managing the Crisis Across Levels of Government", 10 November 2020, at <https://www.oecd.org/coronavirus/policy-responses/the-territorial-impact-of-covid-19-managing-the-crisis-across-levels-of-government-d3e314e1/>, 16 February 2022; J. Kudelko, K. Wałachowski, D. Żmija, *Gospodarka regionalna w obliczu kryzysu wywołanego pandemią COVID-19*, Warszawa 2020; J. Kudelko, D. Rynio, "Level of Regional Development and The Dynamics of Unemployment During The COVID-19 Crisis, Based on Observations of German And Polish Regions", in K.S. Soliman (ed.), *Sustainable Economic Development and Advancing Education Excellence in the era of Global Pandemic. Proceedings of the 36<sup>th</sup> International Business Information Management Association Conference (IBIMA)*, Granada 2020, pp. 1890-1904.

<sup>27</sup> R. Martin, "Shocking Aspects...".

<sup>28</sup> We do not consider positive shocks, e.g. a rapid economic growth, or disruptions spread over time which are incremental in character (slow burn).

tasks. At this stage administrative units make efforts to avoid institutional lock-in or even institutional implosion, resorting to redundant time and HR resources, or relocating available resources.<sup>29</sup> Effective cooperation with third parties also eases the original pressure on administrative entities. Maintaining internal controllability in institutional systems and local economies is key to ensuring stability and reducing uncertainty.<sup>30</sup> The boundary of internal controllability is determined by an entity's so called absorptive capacity, which describes the moment at which a disruption in the analysed system is so severe that it starts changing its structure and internal processes.

At the next stage of a shock we analyse an entity's *self-restorative bounce back*, i.e. its ability to adapt to the current conditions resulting from a shock.<sup>31</sup> We do not focus on a sudden event itself but rather on the flexibility of organizational structures and public administration procedures which allow for maintaining equilibrium. Martin and Sunley supplement this requirement with a characteristic referred to as robustness – the ability to positively react to a disruption, which is indispensable to improving the functioning of a system without changing its core functionalities.<sup>32</sup> Folke refers to this ability as 'learning from shocks'.<sup>33</sup> This moment can also initiate a structural reorganization of a system, which is later transformed into the process of adaptive development. Therefore, the robustness of public administration can be measured by its ability to improve functioning in selected areas, allowing for ensuring public safety and order or maintaining the stability of public finance for the purpose of providing basic services (e.g. water supply, waste disposal, public transport). The so-called robust adaptation enhances the ability to experiment and reduces the fear of organizational innovation.<sup>34</sup>

## INSTITUTIONAL AND ECONOMIC RESILIENCE OF POLISH CITIES TO COVID-19 – METHODS OF THE RESEARCH

The analysis of Polish cities' institutional and financial ability to respond to the effects of COVID-19 is based on methodological triangulation. It consists of a qualitative and quantitative part. With regard to the first part, a research survey was conducted from 23 November to 31 December 2020 among all 66 Polish cities with poviats rights. The survey included closed and open questions. Closed questions referred to the functioning of municipal institutions during the pandemic in the context of their powers

<sup>29</sup> J.W. Handmer, S.R. Dovers, "A Typology of Resilience...".

<sup>30</sup> E. Herrfahrdt-Pähle, C. Pahl-Wostl, "Continuity and Change..."; C.S. Holling, "Understanding the Complexity of Economic, Ecological, and Social Systems", *Ecosystems* 2001, vol. 4, pp. 390-405.

<sup>31</sup> R. Martin, "Shocking Aspects...".

<sup>32</sup> R. Martin, P. Sunley, "On the Notion...".

<sup>33</sup> C. Folke, "Resilience: The Emergence...".

<sup>34</sup> T. Lang, "Urban Resilience and New Institutional Theory – A Happy Couple for Urban and Regional Studies?", in B. Müller (ed.), *German Annual of Spatial Research and Policy 2010*, Berlin 2011, pp. 15-24.

set forth in the Act on crisis management in Poland. Closed questions, based on Likert scale questions, related to the problem of access to resources (personal protection equipment, medical staff, police force, city guards and sanitation employees) and the degree to which management crisis measures were adapted to the conditions between the first wave of the pandemic in the spring of 2020 and the second wave in the autumn of 2020. The reliability of scales in the questions, measured by  $\alpha$ -Cronbach, was at the level of 0.876 – a high value allowing for a further analysis of data.<sup>35</sup>

The survey targeted the internal units of institutions responsible for safety and security and crisis management in the cities with powiat rights. The research sample covered the entire population of the analysed entities – 66 cities – in terms of the characteristics which were relevant to research objectives. Feedback information was obtained from 20 cities, accounting for 30.3% of the analysed entities. For this reason, the results are not representative and do not refer to the entire population. However, considering the subject of research and its exploratory character, conclusions based on  $\frac{1}{3}$  of the entire population present an interesting picture from the cognitive point of view.

The economic resilience of cities is analysed on the basis of two methods. Cities are classified by the effects of the crisis in the major areas of functioning: labour market (unemployment rates), public finance (budgetary revenue), and in private companies (number of business entities). This stage is followed by an analysis of city vulnerability.

The Polish economy started to feel the effects of the crisis in Q2 2020. April was the first month to record higher unemployment rates, accompanied by a decrease in GDP and budgetary revenue. When this article was taking shape (April 2021), any predictions with regard to the end of the crisis were not possible, while macroeconomic factors indicated the on-going negative effects of the crisis. In this context, an analysis was conducted of the resilience of cities with powiat rights to the crisis until the end of 2020. An analysis within a short period of time after the crisis faced a major challenge: access to current statistical data and the identification of the subject of research. It was not possible to analyse macroeconomic data commonly applied in vulnerability analyses, such as GDP, investment rates or compensation levels. The analysis was based on unemployment dynamics between March and December 2020, which represents the condition of local labour markets and, indirectly, economic trends and cities' current budgetary revenue reduced by one-time subsidies from the Government Local Investment Fund for quarters 2, 3 and 4 of 2020, and the dynamics of the number of SMEs and large companies in 2020 as compared with 2019.

The identification of potential groups of cities based on their vulnerability to crisis made use of the most widely employed K-means Cluster Analysis, conducted in IBM SPSS software. Data used for the analysis was standardised. The first stage aimed to identify the number of clusters and initial centroids. The analysed objects were then assigned to a group whose distance from the sample centroid was the smallest. The

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<sup>35</sup> D. George, P. Mallery, *SPSS for Windows Step by Step: A Simple Guide and Reference. 11.0 Update* (4<sup>th</sup> ed.), Boston, MA 2003.



calculation of the distance was based on the Euclidean distance. Then, on the basis of iterative methods, objects were relocated between groups to minimise errors. The procedure was repeated for the purpose of achieving the convergence criterion.<sup>36</sup>

## RESILIENCE OF POLISH CITIES TO COVID-19 – RESULTS OF THE RESEARCH

### Institutional resilience

Upon the outbreak of the pandemic, a key role was played by cities' cooperation with other services and central public administration bodies as well as by the management of cities' own resources. The most frequently mentioned strength of city monitoring and alert systems during the first wave of the pandemic was the cooperation between city units and police forces and sanitation services (43% of responses). With regard to the areas in which cooperation problems were recorded, respondents expressed appreciation for *informal readiness of system participants to analyse problems and find prompt solutions*. The second indicated strength was an effective flow of information between city units, services and inhabitants (33% of responses), and the third strength – the effectiveness of activities carried out by city units, especially crisis management teams and crisis management centres (19% of responses). One of respondents noted that an interesting case of city units' activism was the fact that the city crisis management team had engaged in fighting COVID-19 effects as early as at the turn of January and February 2020: *We started intense cooperation with city services and we initiated the supply of individual protection equipment for city services and inhabitants*.

The Polish crisis management system is highly hierarchised. It is reflected in the fact that activities and tasks performed by territorial self-government bodies must be consistent with those carried out by the government administration at voivodeship and central levels. Therefore, cooperation between entities at particular levels is of key significance. A positive assessment of cooperation with voivodeship crisis management centres was given by 75% of cities (45% – 'rather good'; 30% – 'very good'). Appreciation was mainly expressed for effective and prompt exchange of information including alarm signalling (54% of responses), the availability of voivodeship centre of crisis management staff, and emergency aid (31%), as well as assistance in replenishing the supply of individual protection equipment (15%). Only one city (5% of respondents) indicated that cooperation was unsatisfactory with regard to communicating information about persons crossing the Polish borders and those who should be put on quarantine.<sup>37</sup>

Cooperation with city services, institutions and other entities reporting to central administration, i.e. the police, sanitary inspectors, armed forces, firefighting units,

<sup>36</sup> Ch.C. Aggarwal, Ch.K. Reddy, *Data Clustering: Algorithms and Applications*, London 2014.

<sup>37</sup> According to 20% of cities, cooperation with voivodeship crisis management centres was neither good nor bad.

voivodes, as well as ministries, for example the ministry of economy, is given a positive assessment by the majority of the analysed cities (79%).<sup>38</sup> Positive evaluations are given, in the first place, to their availability and readiness to offer assistance to city units (57% of responses), as well as to the exchange of information which is in not easily accessible at the local level (43%). Similarly to the question related to voivodeship crisis management centre, a negative assessment of cooperation with other entities reporting to central administration was given by one city which reported inadequate contacts with a powiat sanitation and epidemiology centre.<sup>39</sup>

In their fight against the 2020 pandemic, cities frequently resorted to the assistance of the Armed Forces of the Republic of Poland, which is allowed by the Act on crisis management.<sup>40</sup> 19 out of 20 analysed cities confirmed the engagement of military units in their territory. This was mainly Territorial Defence Force, which provided medical assistance and performed epidemiology-related tasks, e.g. collections of swabs (50% of responses), and participated in the monitoring of threats (29% of responses).<sup>41</sup>

During the first weeks of the epidemic, the performance of some components of city risk monitoring systems and alarm signalling was not satisfactory. According to respondents, the deficiencies of these systems were mainly related to the accessibility of individual protection equipment (22% of responses) and the exchange of information between city units and powiat sanitation and epidemiology centres (22% of responses). The latter problem was also indicated in responses to other questions in the survey. Another reported deficiency of the crisis management system was a state of confusion resulting from regulations imposed at different levels. On the one hand, city representatives pointed to inconsistent government regulations related to restrictions, imposed without consultations with self-government authorities (17% of responses). On the other hand, unsatisfactory coordination was reported between regulations imposed by cities and voivodes in connection with the Act on crisis management (13% of responses).

Cities referred to the following difficulties in the functioning of city crisis management centres: staff shortages (29%), equipment shortages (23%), ineffective communication with services, e.g. the police and sanitation services (19%). Some minor issues identified by respondents included ineffective procedures (13%) and the

<sup>38</sup> With regard to this question, N = 19; 58% of respondents evaluated cooperation as 'rather good', and 21% as 'very good'.

<sup>39</sup> 16% respondents evaluated cooperation with services, institutions and entities reporting to central administration as 'neither good nor bad'.

<sup>40</sup> Formally, military units can be put at the disposal of the voivode pursuant to the decision of the minister of national defence. According to article 25, paragraph 6 of the Act on Crisis Management, the city mayor coordinates the activities of the Armed Forces as set forth in the Act on Crisis Management. Tasks are directly assigned by the president to unit commanders; see Ustawa z dnia 26 kwietnia 2007 r. o zarządzaniu kryzysowym [The Act on Crisis Management], Dz.U. 2007, no. 89, poz. 590.

<sup>41</sup> To a lesser extent, the armed forces were engaged in evacuating people and property (7% of responses); isolating high-risk areas or areas of rescue activities (7% of responses); performing tasks aimed to prepare temporary shelter for evacuated inhabitants (4% of responses) or tasks aimed to assess the effects of events in high-risk areas (4% of responses).

inadequately specified scope of crisis management centres' responsibilities (6%). Also, cities pointed to other non-system related problems resulting from specific local conditions. They included such issues as the lack of clear regulations regarding the use of budgetary reserves for the purpose of crisis management, competence-related and formal problems in cooperation with Voivodeship Offices, and the necessity to reorganize and relocate crisis management centres to replacement premises when a centre's employees were infected.

The other element explored in the survey was cities' absorptive capacity, showing cities' ability to reorganize its resources and structures, following a disruption, for the purpose of regaining the state of equilibrium within a possibly short period of time, enabling municipal bodies and institutions to perform their statutory functions.

Chart 1 presents resource shortages in Polish cities between the first wave of the pandemic in the spring of 2020 and the second wave in the autumn of 2020.<sup>42</sup> It should be noted that from the perspective of formalities and legal regulations, cities are not authorised to make decisions regarding specific resources. However, the intention of the Act on crisis management is to enable municipal teams and crisis management centres – within the framework of assigned tasks – to monitor all problems related to the functioning of services and systems in the territory of cities. The implementation of the Act enabled us to identify the major problem faced by cities in the spring of 2020 – access to individual protection equipment and staff shortages in sanitation and epidemiology centres which were assigned a challenging task to collect information about infections and coordinate quarantine procedures for particular individuals. Interestingly, in the autumn the problem of the short supply of individual protection equipment was solved by cities themselves, which was accompanied, however, by deterioration in the staffing of poviat sanitation centres. Apart from that, ambulance services faced more severe staff shortages than in the spring of 2020; however, the percentage of respondents who regarded it as a big or very big problem was twice as low (23.5%) as the number of respondents regarding it as a small or a very small problem (47.1%). It indicates that this particular area of the health care system did not pose major threats to its functioning.

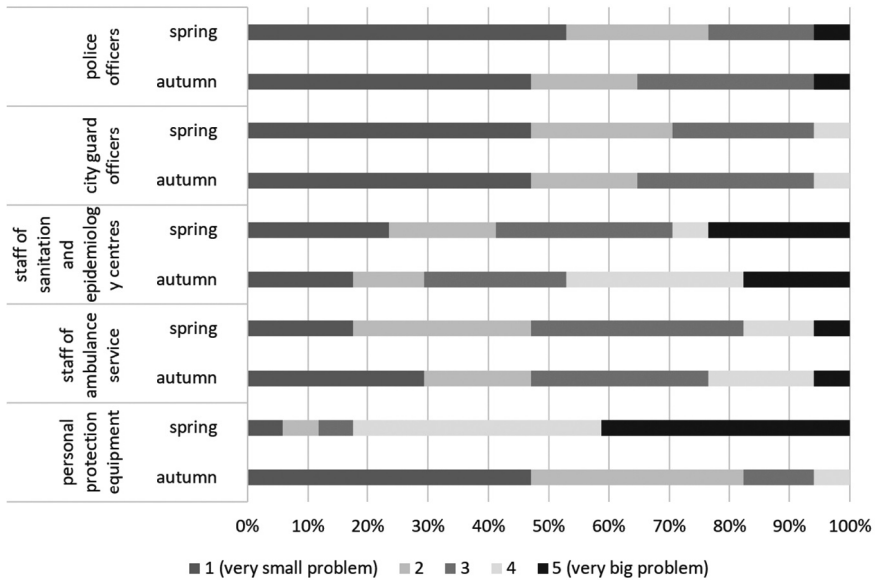
These conclusions are confirmed by data presented in Chart 2.<sup>43</sup> The areas of the health care system characterised by slight or very slight improvements between the spring and autumn of 2020 include access to respirators and hospital beds for COVID-19 patients in hospitals managed by cities with poviat rights. Chart 2 also shows that alarm signalling and monitoring systems in sanitation and epidemiology centres were not much improved in the analysed period (58.8% and 70.6% of respective middle answers).

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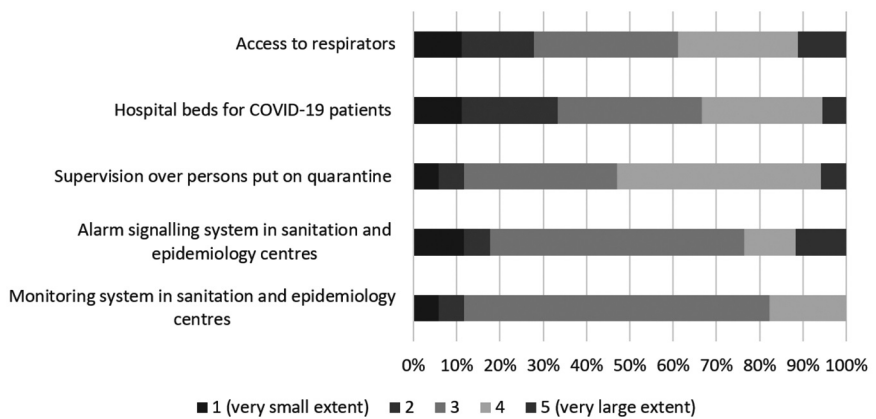
<sup>42</sup> N = 17.

<sup>43</sup> The number of respondents referring to a given element of the crisis management system: monitoring systems in sanitation and epidemiology centres (N = 17), alarm signalling systems in sanitation and epidemiology systems (N = 17), supervision systems for persons put on quarantine (N = 17), hospital beds for COVID-19 patients (N = 18), access to respirators (N = 18).

**Chart 1.** What resource shortages caused major problems in your city during the first wave of the COVID-19 pandemic (the spring of 2020) and the second wave (the autumn of 2020)?



**Chart 2.** To what extent was it possible to improve the functioning of selected elements of the crisis management system in your city during the pandemic between the spring and autumn of 2020?



**Economic resilience**

A cluster analysis was conducted twice for current revenue and unemployment, and the number of economic entities and unemployment rates. The points in the graph represent the analysed objects, and the lines – the distance between a given cluster and the centroid.

Figure 1. K-means classification between budget income and unemployment rate

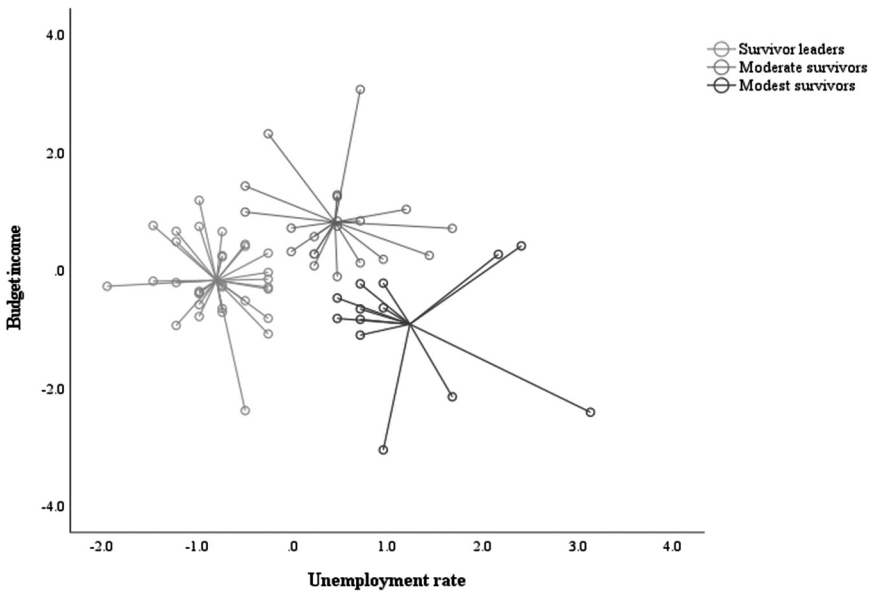


Table 1. ANOVA test for k-means classification between unemployment rate and budget income

	Cluster		Error		F	Sig.
	Mean Square	df	Mean Square	df		
Unemployment rate	22.216	2	.326	63	68.051	<.001
Budget income	12.911	2	.622	63	20.760	<.001

Variables in the first classification were checked using ANOVA. Both of them are characterised by high values of F ( $p$  value < 0.01), which points to a very high level of statistical significance, i.e. the occurrence of significant differences between clusters. The two features of the classification differentiate particular groups. The best results are recorded for 3 groups of cities: survivor leaders (low increase in unemployment, average income dynamics), moderate survivors (high increase in unemployment, high increase in income), and modest survivors (high increase in unemployment, low income dynamics).

The second classification was also checked using ANOVA. The results are very similar to those in the first classification. Both variables are characterised by high values of F ( $p$  value < 0.01), which points to a very high level of statistical significance, i.e. the occurrence of significant differences between clusters. Similarly to the first classification, the best results have been recorded for 3 groups: survivor leaders (low increase in unemployment, a large increase in the number of companies), moderate survivors

(high increase in unemployment, high increase in income), and modest survivors (with a high increase in unemployment, a large increase in the number of companies), and modest survivors (with a low increase in the number of companies).

Figure 2. K-means classification between number of business entities and unemployment rate

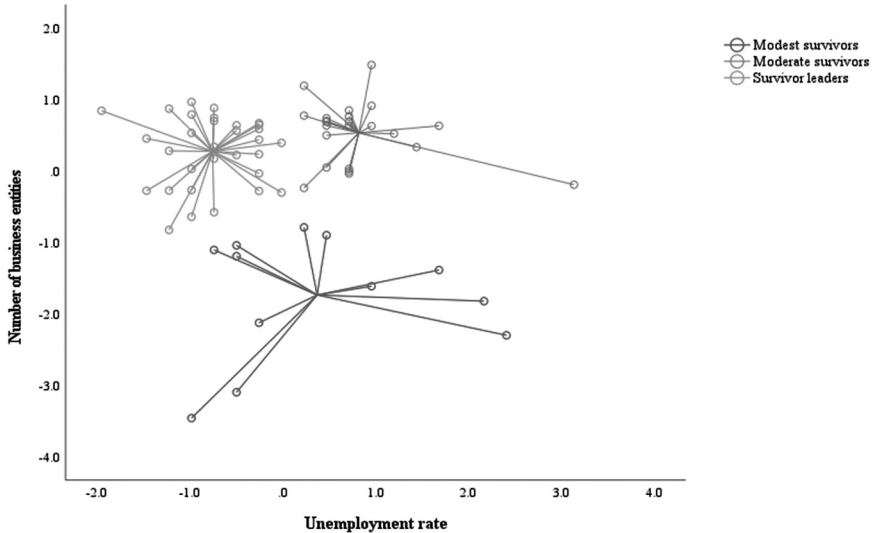


Table 2. ANOVA test for k-means classification between number of entities and unemployment rate

	Cluster		Error		F	Sig.
	Mean Square	df	Mean Square	df		
Number of business entities	22.596	2	.314	63	71.866	<.001
Unemployment rate	17.332	2	.482	63	35.995	<.001

Table 3. Contingency table between classification 1 and classification 2

		Classification 2 (NoE and UR).		
		Leader	Moderate	Modest
Classification 1 (BI and UR).	Leader	28	0	4
	Moderate	3	14	4
	Modest	0	9	4

The distribution of positions in classifications is presented in the contingency table (Table 3). 69% of cities are classified in the same way in both classifications, 25% of cities are assigned different classifications, and 6% of them are inversely classified (simultaneously as leader and modest survivor). Similarities between the two classifications were tested using Chi-square test for independence. At the level of statistical significance 0.05, no differences are recorded for the classifications, which implies that they lead to similar conclusions.

An analysis of causality was based on linear regression which, for set  $\{y_i, x_{i1}, \dots, x_{ip}\}_{i=1}^n$  assumes the following form:

$$Y_i = \beta_0 + \beta_1 x_{i1} + \dots + \beta_p x_{ip} + \varepsilon_i$$

where  $Y_i$  is a dependent variable, and  $x_i$  independent variables.

Literature describes a number of characteristics which have a potential impact on city resilience. A synthesis of such determinants was proposed by Martin and Gardiner (2019), who identified the following factors: economic structure and market orientation, the size of public sector, scale and nature of export base, competitiveness of local firms, skill base and labour market flexibility, size of city economy, firms access to finance and credit, or governance.

For a number of hypothetical reasons, the stepwise regression was employed for IBM SPSS – a method of matching statistically significant independent variables with a dependent variable. Independent variables include the following: dynamics of the number of economic entities in 2020 and 2019, current income dynamics between Q2, Q3 and Q4 of 2020 and 2019, differences between unemployment rates between December and March 2020.

**Table 4.** Predictors included in the step-wise regression

Variable	Description	Source
NoCitizens	Number of population	GUS
AdStatus	City administrative status (voivode or powiat)	GUS
SmEnt	Number of small businesses (10-49 employees) per 1000 inhabitants	GUS
waMeEnt	Number of medium firms (50-249 employees) per 10k inhabitants	GUS
LaEnt	Number of large companies (250+ employees) per 100k inhabitants	GUS
InvO	Private investment outlays per 1 inhabitant	GUS
VoFA	Gross value of fixed assets in companies per 1 inhabitant	GUS
MigRate	Migration balance per 1000 inhabitants	GUS
NoPatents	Number of patents per 100k inhabitants	GUS
ForCap	Value of foreign capital per 1 inhabitant	GUS
NoStud	Number of students per 100 inhabitants	GUS

Variable	Description	Source
NoTourists	Number of overnight stays per 1000 inhabitants	GUS
AvIncome	Average gross compensation	GUS
CapDstnc	Distance from the capital city	Google maps

GUS – Statistics Poland

Tables 5 to 7 present only the data that the stepwise regression identifies as statistically significant.

**Table 5.** Regression results for unemployment rate as a dependent variable

	Coefficient	Std. Error	t-ratio	p-value
const	0.982864	0.0622399	15.79	<0.0001
NoCitizens	-4.11008e-07	1.97140e-07	-2.085	0.0411
	Mean dependent var	0.904545	S.D. dependent var	0.413403
	Sum squared resid	10.40216	S.E. of regression	0.403155
	R-squared	0.063597	Adjusted R-squared	0.048965
	F(1, 64)	4.346622	P-value(F)	0.041077
	Log-likelihood	-32.67779	Akaike criterion	69.35558
	Schwarz criterion	73.73489	Hannan-Quinn	71.08606

**Table 6.** Regression results for budget income as a dependent variable

	Coefficient	Std. Error	t-ratio	p-value
const	0.00927483	0.0227816	0.4071	0.6854
MeEnt	0.00524636	0.00246960	2.124	0.0380
	Mean dependent var	0.004804	S.D. dependent var	0.039577
	Sum squared resid	0.075361	S.E. of regression	0.036361
	R-squared	0.198132	Adjusted R-squared	0.155928
	F(3, 57)	4.694665	P-value(F)	0.005348
	Log-likelihood	117.6831	Akaike criterion	-227.3661
	Schwarz criterion	-218.9226	Hannan-Quinn	-224.0570



**Table 7.** Regression results for number of entities as dependent variable

	<b>Coefficient</b>	<b>Std. Error</b>	<b>t-ratio</b>	<b>p-value</b>
const	-0.0235522	0.00334821	-7.034	<0.0001
AdStatus	0.0129693	0.00639349	2.029	0.0473
NoTourists	-3.42175e-06	1.14607e-06	-2.986	0.0042
NoCitizens	1.90164e-08	1.12674e-08	1.688	0.0970
	Mean dependent var	-0.020830	S.D. dependent var	0.022660
	Sum squared resid	0.019532	S.E. of regression	0.018676
	R-squared	0.366054	Adjusted R-squared	0.320772
	F(3, 57)	8.083886	P-value(F)	0.000032
	Log-likelihood	158.8660	Akaike criterion	-307.7321
	Schwarz criterion	-297.1777	Hannan-Quinn	-303.5957

Among dependent variables it was possible, to the highest degree, to find satisfactory factors explaining differences in the number of business entities (the highest R-squared = 0.36). Surprisingly, with regard to unemployment rates, various factors do not explain the observed changeability (R-squared = 0.06). It could seem that this factor will be diversified by city economic dynamics (investment outlays, volume of fixed assets, settlement attractiveness (migration balance), innovativeness (number of patents), or touristification (number of overnight stays). The only statically significant factor was the size of population. It points to greater vulnerability to crisis in smaller urban areas and a potentially higher level of adaptability of larger economies. Budget income dynamics was positively affected by medium enterprises. Cities with a larger number of such entities performed better in a crisis situation. Probably, this phenomenon can be attributed to a smaller scale of activity in such entities (fewer firms have global operations) as well as greater organizational flexibility, allowing for adapting to new conditions. With regard to the dynamics of the number of firms, city resilience was positively affected by the voivodeship status and the number of population, and negatively affected by the number of overnight stays. The voivodeship status in the system of Polish self-governments is assigned to the cities which are the capitals of the regions, and implies the performance of regional functions. It can be explained by the fact that capitals of the voivodeships, compared with poviat cities, have more administration-related jobs which are more vulnerable to crisis. The obvious reason for the greater vulnerability of cities with a well-developed tourist sector was the imposing of lockdown during the pandemic, which was a barrier to tourist traffic.

## DISCUSSION

An attempt to assess the institutional resilience of cities with poviats rights to the COVID-19 pandemic within a short period of time (spring-autumn 2020) should give consideration to two elements of resilience. Firstly, the ability to withstand the first shock, accompanied by ensuring the performance of basic functions and tasks. Secondly, the ability to recover after a disruption and to regain the original state of equilibrium. Both elements of institutional resilience, within the adopted time framework, have been analysed on the basis of regulations which determine the availability of resources and set out the principles of activities carried out by particular units and crisis management systems in cities with poviats rights. Attention has also been paid to institutional elements directly supervised by city authorities and those controlled by government and central administrative bodies.

An important task performed by cities within the framework of crisis management was cooperation between their crisis management teams and centres and voivodeship crisis management centres, the police, armed forces and other central administration bodies. Respondents assessed this area as the least problematic one. Similar assessments were given to the activities of the cities' crisis management teams and centres – i.e. the flow of information between other city units, services and inhabitants.

Cities demonstrated a large recovery potential in the areas which they supervised in a direct way. It is reflected in the accessibility of individual protection equipment – it posed the biggest challenge in the spring of 2020, while in the autumn of 2020 such equipment was widely available. Also, city guard officers represented a satisfactory force in the fight against the pandemic. On the other hand, problems arose in the areas of crisis management which do not directly report to self-government authorities. Access to respirators as well as hospital beds for infected patients were coordinated by central government bodies or other central entities (the ministry of health). From the perspective of cities, acts and directives related to restrictions imposed on businesses and inhabitants were not clear and led to regulatory chaos. This proves that in a highly centralized system of crisis management during the COVID-19 pandemic in Poland, the cities were more responsive to the local needs and acted quicker than the central government. Findings in the article support also an argument that more flexible role of the cities in the national system of crisis management can contribute to its higher efficiency.

From the perspective of cities, sanitation and epidemiology centres were a major bottleneck of the crisis management system. During the pandemic, the scope of their responsibilities did not match the available human and financial resources. It was reflected in the frequently indicated problem of ineffective communication between city crisis management centres and sanitation authorities, having a negative impact on the functioning of city monitoring and alarm signalling systems. Among other elements of crisis management systems, it was sanitation and epidemiology centres that did not adapt effectively to new conditions between the first and second wave of the epidemic in Poland. There was a common conviction in cities that the functioning of monitoring

and alarm signalling systems used by sanitation centres was not much improved. However, it should be noted that activities carried out by sanitation and epidemiology centres under the emergency conditions of the crisis were not supported by relevant laws and regulations. The respective regulations were frequently amended. The last amendment was made in February 2020, just before the pandemic outbreak, which certainly escalated the problems faced by these significant services.

From an economic perspective, the COVID-19 pandemic seems to have accelerated divergence processes in the development of Polish cities. Smaller cities, which are not voivodeship capitals, turned out to be more vulnerable to crisis. The current crisis confirms the necessity to diversify economic structures of urban areas. Tourist cities turned out to be less resilient. A large number of medium companies was an advantage. However, no correlation was found between resilience and small (large) business entities.

According to the theory of resilience, the most significant time of the development of Polish cities coincides with the time of writing this paper. Crises provide opportunities for reorganizing the position of urban centres in the global economy. It is the robustness and adaptability of cities that will determine new path dependence, which can weaken or strengthen cities' competitive position. Further analyses are required to explore new paths and success factors. Their identification will facilitate the implementation of effective public policies.

#### **Data availability statement**

The qualitative data that support the findings of this study are available from the corresponding author, Karol Wałachowski, upon reasonable request.

The quantitative data that support the findings of this study are available in Główny Urząd Statystyczny – Bank Danych Lokalnych (Main Statistical Office, Poland – Local Data Bank) at <https://bdl.stat.gov.pl/BDL/start>. These data were derived from the following resources available in the public domain: <https://bdl.stat.gov.pl/BDL/start>.

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