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The Role of Smart Cities during the COVID-19 Pandemic – the Example of New York City

Rola miast inteligentnych w czasie pandemii COVID-19 na przykładzie Nowego Jorku

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Abstract: This paper investigates how smart cities responded to the COVID-19 pandemic-related issues based on the example of New York City (the case study formula). The first part of the research constitutes a background to the study. The specific challenges and city responses that the pandemic introduced to urban centres are indicated. The second part contains research on various definitions of the smart city concept. Since there is no official characteristic of such an urban centre, the commonly accepted attributes were indicated in the study. The first and second parts are based on desk research. Finally, in the last phase of the research, a case study analysis of New York City was conducted to present manifestations of previously indicated attributes of a smart city concept. The actions taken by the city authorities and other city actors to address the challenges that were both common for cities and specific ones (that applied to New York City) were investigated.

Keywords: COVID-19, the pandemic, smart city, New York.

Streszczenie: W niniejszym opracowaniu na przykładzie Nowego Jorku zbadano, jak inteligentne miasta zareagowały na problemy związane z pandemią COVID-19 (formuła studium przypadku). Pierwsza

część badań stanowi tło opracowania. Wskazano konkretne wyzwania i odpowiedzi miast na zagadnie-nia związane z pandemią. Druga część zawiera badania nad różnymi definicjami koncepcji *smart city*. Ponieważ nie ma oficjalnej charakterystyki takiego ośrodka miejskiego, dokonano wskazania po-wszechnie akceptowanych jego atrybutów. Części pierwsza i druga zostały oparte na badaniu danych zastanych (*desk research*). Ostatecznie w ostatniej fazie badawczej przeprowadzono analizę studium przypadku Nowego Jorku, aby przedstawić przejawy wskazanych wcześniej atrybutów koncepcji *smart city*. Zbadano działania podejmowane przez władze miejskie i innych aktorów miasta w celu sprostania wyzwaniom stojącym przed ośrodkami miejskimi, jak i specyficznymi (dotyczącymi Nowe-go Jorku).

Słowa kluczowe: COVID-19, pandemia, miasto inteligentne, Nowy Jork.

1. Introduction

COVID-19, a declared pandemic in 2021 by the World Health Organization, has caused unprecedented disruptions in every sphere of human life all around the globe. Due to their high population density, big urban centres became coronavirus epicentres. Thus the pandemic served as an accelerator of rapid adaptive changes in an urban context.

This paper investigates how smart cities responded to pandemic-related issues based on the example of New York City (the case study formula). The choice of the city was made due to its high position in the smart city rankings and the fact that it was the epicentre of the pandemic in the United States.

The first part of the research constitutes a background to the study. The specific challenges and city responses that the pandemic prompted in urban centres are indicated. The challenges included rapid digitalisation (both in terms of public services and the business sector), different usage and functions of public spaces and new activity patterns of citizens.

The second part contains research on various definitions of the smart city concept. Since there is no official characteristic of such an urban centre, the study indicated the commonly accepted attributes.

Finally, in the last research phase, a case study analysis of New York City was conducted to present manifestations of the previously indicated attributes of the smart city concept. The actions taken by the city authorities to address the challenges that were both common for cities and specific ones (that applied to New York City) were investigated.

2. Specific conditions of the COVID-19 pandemic in cities

The COVID-19 pandemic has been a time of unprecedented disruptions in the global economy. The high population density of urban centres had a significant impact on them, especially during lockdowns. The urgent need for adaptation to the new

challenging situation caused the intensification of a transition into a more adaptive way of functioning. Some common patterns of behaviour of inhabitants and city authorities have suddenly become unacceptable and even forbidden by law. A need for re-defining the city's priorities (the main being public health) and formulate methods to achieve them has emerged. The methods differed between countries (regulations applied at national level), cities (city-authority regulations), and sometimes regions. One city sphere that needed to be re-regulated was the use of public space (to limit the spread of the virus). For example, in Serbia, people over 65 were tightly restricted from using public city space, as they were allowed to enter it only once a week to buy groceries from 4 to 7 am (The Government of the Republic of Serbia). In Australia, one person from the household was allowed to enter the public city space once a day, within a radius of 5 km (CTV News). Modifications in the functions of public spaces were commonly observed, with a particular aim at redesigning streets – for instance, expanding bike lanes at the expense of car infrastructure. As stated by O. Romano regarding such changes, city officials "implemented policies that existed before the pandemic, but which had previously been unacceptable politically and socially" (Romano, 2021). Some of the changes were temporary, however some have been applied permanently[1]. In Berlin, Paris and Bogota, the usage of pop-up bicycle lanes[2] was high, and thus, later on they were made permanent. As pointed out by numerous studies, apart from the physical changes in the city's infrastructure, a psychological change in society has been made regarding a more accepting attitude towards cycling and walking in the city space (Barker, 2022; Galloway, 2022; World Health Organization, 2022).

The pandemic served as an accelerator of the digitalization of services, including public ones. This trend raises the issue of digital exclusion, an "unequal access and capacity to use ICT that are essential to participating in society fully" (Sanders, 2020). Intuitively, this is a significant threat to developing economies, however, as the evidence shows, even in the most developed countries the problem is being observed – for example, in New York, almost 18% of inhabitants do not have a mobile connection or Wi-Fi. Nevertheless, providing this connection is not enough – apart from access to the appropriate device, inhabitants need to have digital literacy, thus the ability to use ICT (New York State Comptroller, 2021). When investigating the issue deeper, technology anxiety[3] comes into play – this is a complex combination of emotions (for instance, nervousness and fears) related to using and learning to use technology. In the research conducted by Troisi, Orlando et al., which examined the technology anxiety of citizens from four European cities expressed via tweets, the outcome is unambiguous – during the pandemic, the negative sentiment and anger toward technology expressed turned into fear (Troisi et al., 2022); this significant challenge needs to be addressed by city and country officials.

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[1] Open Restaurants programme in New York City discussed later is an example.
[2] Temporary bike lanes.
[3] Also known as Technology Induced State Anxiety.

A digital transformation has also been observed in the business sector in the form of work-from-home (telework) and even reshaping models of businesses, introducing e-commerce. Research shows that ten years of e-commerce adoption was compressed into three months (McKinsey, 2021). This change affected the city environment since the frequency of shopping-related trips has been reduced, especially during lockdowns. Consumers' activity patterns have changed, and they are no longer solely polarised by specific locations; conversely, they are now fragmented in space and time (Sugaris, Universite Gustave Eiffel, Poste Immo, 2021). Many offices were closed down permanently[4]. Although most restrictions have been loosened or removed and retail stores have re-opened, projections indicate that online retail sales will continue to rise (International Trade Administration, 2022). This trend poses a challenge to cities in various spheres. For instance, in logistics – the growing frequency of home deliveries has led to increased freight traffic in residential areas and a greater demand for parking spaces for delivery trucks (SWECO, 2018). The growing last-mile delivery market forced the formulation of new delivery strategies for businesses and cities. In particular, in developed markets both groups of actors collaborated for the sake of introducing innovative mobility solutions. In London, such action led to the establishment of the storage and distribution centre CEVA Logistics, which centralises and manages supplies for two hospitals, minimises the 160 daily deliveries to the hospitals into one, and also reduces pollution, traffic congestion, and the amount of packaging waste produced by the hospital (Royo & De La Cruz, 2022). New delivery systems, such as cargo bikes, were adopted worldwide to guarantee sustainable last-mile operations in specific zones (Castillo et al., 2022).

3. Smart city concept foundation

The smart city concept emerged based on the fourth industrial revolution. Its definition varies depending on the type of entity that makes this definition – and such a different perception is shown, for example, by urban centres, business environment actors, and scientific entities (there is also diversification between the adopted scientific discourse). A study conducted in 2021 showed that the most frequently indicated components of this concept by cities were high quality of life, sustainable development[5], high-quality human and social capital, and high innovation (Kozak, 2021). Business environment entities, in turn, indicate that a smart city is characterised by the implementation of the latest information and communication technology (ICT) solutions. For example, Huawei describes

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[4] Interestingly, some cities observe rising demand for working office spaces, but specifically in a type of co-working spaces (Anarock, 2022).

[5] Sustainable development occurred in half of the analysed studies of the smart city concept from the perspective of urban centers.

a smart city as "integrated information management that creates value by applying advanced technologies to search, access, send and process information" (Huawei) and Deloitte as "a vibrant city that provides its residents with a high quality of life through solutions for communication and information technologies" (Deloitte)[6]. Some of them also indicate that the functioning of a smart city fits in with the idea of sustainable development, e.g. Iotofall states that smart cities are urban projects that meet the needs of the present without compromising the ability of future generations satisfy their own needs (Iotofall). Conceptual differentiation is also visible in the scientific discourse. Hartley suggested that a smart city is a city combining physical infrastructure (including IT, social and business infrastructure) to use its collective intelligence (Hartley, 2005), while Stawasz and Sikora-Fernandez extended this reasoning with the element of creativity of its inhabitants – "(...) a city that uses advanced technologies, (...) a city of thinking and creative people who can absorb technical and technological innovations in their activities and who use modern information and communication technologies commonly" (Stawasz & Sikora--Fernandez, 2016). In some interpretations, the notion of effective management is also present – Kulisiewicz stated that it is a "habitat friendly to its inhabitants, well planned and effectively managed" (Kulisiewicz). Moreover, many characteristics derived from various urban stakeholders indicate (directly or indirectly) that a smart city develops sustainably.

To sum up the above considerations, the following features apply to the concept of a smart city:
1. High quality of life.
2. Intelligence in the meaning of ability to adapt to changing (exogenous and endogenous) conditions, primarily by implementing ICT.
3. Sustainable development.
4. Creative, innovative society and city actors.
5. Effective management.

4. The case of New York City

New York City follows the path of smart city development. In 2022 it was ranked second among IESE Cities in Motion, which assesses cities in terms of sustainability and quality of life (IESE Cities in Motion, 2022). The pandemic profoundly affected the city and its inhabitants: it increased retail thefts, aggravated of the unemployment

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[6] Examples of other understandings are as follows: (1) "a smart city is a framework, predominantly composed of Information and Communication Technologies (ICT), to develop, deploy, and promote sustainable development practices to address growing urbanization challenges" Thales); (2) "'smartness' is not just about installing digital interfaces in traditional infrastructure or streamlining city operations. It is also about using technology and data purposefully to make better decisions and deliver a better quality of life" (McKinsey, 2021).

problem, decreased revenue from tourism and reshaped the cultural landscape (The New York Times). Moreover, it has dealt with the racial and ethnic disparities in the mortality rate (University of Albany, 2021). At the end of March 2020, the city had become the worst-affected area in the country (City of New York).

The first executive orders of the city's authorities included closing "non--essential" businesses (New York State, 2020). Special regulations were addressed towards areas with the highest numbers of infections[7] (OECD, 2020). Additionally, an order with detailed information about behaviour in public places was issued. Gatherings (as well as in private and in public spaces) were forbidden (New York State, *Governor Cuomo…*, 2020).

Despite the status of a smart city, New York has not managed to eliminate the negative influence of the pandemic, however, possessing smart attributes has helped in the process. The negative influence demonstrated itself in, for example, spiking unemployment rates and the mass closure of businesses (Office of the New York, State Comptroller, 2020), especially of small, local ones – the number of which decreased by 44.7% (Glesby, 2021).

ICT served as the main tool in two-way contact: city authorities with inhabitants. To ensure equal access, the "Affordable Connectivity Program", which granted discounts for online services, was implemented (City of New York, *Mayor's Public Engagement Unit*). Apart from mitigating the negative impact of the pandemic, the main aim was the city's highest possible quality of life. A special Internet platform was introduced, where various forms of assistance in problematic situations were available for inhabitants and businesses, such as tax benefits for childcare, mortgage relief, services for owners of sick pets and long-COVID support. The law of a 7-day waiting period for unemployment insurance benefits for people out of work due to coronavirus closures or quarantine was waived (City of New York, *COVID-19: Data*)[8]. A special telephone number was set up to provide crucial information sent via text messages in English and Spanish (Citizens' Committee for Children).

Thanks to the advanced city system of collecting and processing data, a newly arisen problem have been noticed, namely disproportions in the impact of the virus among inhabitants. Latino, Black and low-income neighbourhoods were harder hit (Chokshi & Katz, 2020). Moreover, they were more vulnerable to anxiety caused by the pandemic. A new action plan (COVID-19 Equity Action Plan) for addressing the issue was implemented. The city's intelligence showed itself in drawing conclusions from unusual events – in this case, the post-pandemic plan (New York Health Equity Reform, 2022) for redesigning health services to ensure health equity. Another valuable piece of information from processing pandemic-related data was the high

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[7] Two-week lockdowns were imposed on schools and non-essential businesses in Brooklyn and Queens.

[8] National and state level actions were not included in the considerations.

diversification of attributes of inhabitants in boroughs[9], which indicates a need for diverse management strategies for different parts of the city.

The use of public spaces has been re-defined. To help restaurants survive the hard times and ensure the well-being of the inhabitants, the city authorities introduced the "Open Restaurants Program", which temporarily expanded the use of sidewalks and public right of way for outdoor dining, which proved a great success. Currently, the city aims to transition to its permanent version (The City of New York, 2021), which is said to be a massive step towards the city's sustainable development (Yaks, 2021). New trends in New Yorkers' behaviour have been observed – they went to parks and other green public spaces more often. A study conducted in the United States discovered that tree-rich spaces protected mental health during the pandemic, indicating that green space-related strategies can help mitigate the mental health burden (Wortzel et al., 2021). Even though the city already had relatively many green spaces – per capita 658.36 m^2 (Humanitarian Data Exchange, 2018) – the city authorities decided to construct new green spaces (Lorincz, 2021).

The above considerations can be summed with the notion of adaptive management. However, adaptation is not limited to city authorities' actions only. Other actors, such as inhabitants, businesses, and the academic sector, are responsible for the city's functioning and adaptation. During the pandemic, many actions and initiatives were undertaken that helped mitigate the negative effects.

By knowing its advantage in having an advanced technological environment (high-tech businesses, creative society), the city invited contributions from individuals and organizations to help form its "COVID-19 Technology Swat Team (Etherington, 2020). The team focused on following web and mobile development, data science and analytics, end-user support and digital content strategy areas. This resulted in 19 pro-bono partnership projects and savings to taxpayers of about $14 million (Kanowitz, 2020). New York's business sector has undertaken many initiatives. For example, Airbnb provided hotel rooms for medical first responders (Airbnb, 2020), while Bloomberg Philanthropies partnered with World Central Kitchen and provided daily meals for 30,000 frontline healthcare workers (Bloomberg, 2020).

Before the pandemic, the city centralised and coordinated volunteer efforts in critical services (NYC Volunteer Coordination Taskforce), which was commonly used during lockdown (for example, for food delivery) (The City of New York, 2017).

New York has a robust academic sector contributing to mitigating the disease's outcomes. Columbia University, New York University and Cornell University (all located in New York City) are listed among the top 31 institutions worldwide that contribute to the research topic (SciVal). The Pandemic Response Institute

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[9] For example, inhabitants show different attitudes towards safety of vaccination (including children vaccination), trusting the science and supporting restrictions (CUNY Graduate School of Public Health and Health Policy, 2022).

at Columbia University was established to support city agencies, organizations, and communities to prepare and respond to acute public health crises (Pandemic Response Institute).

The city took advantage of the synergic effect of various collaborations across the city actors. One institutional example is WNY COVID-19 Research Collaborative which served as a bridge between community, business and schools with primary care sites, hospitals, academic institutions, and health department programmes (University at Buffalo, 2022). Another example is the NYC COVID-19 Rapid Response Coalition, formed by cross-sector healthcare and technology leaders, which brought together more than 75 organizations operating pro bono "to achieve a record of the impact that made a measurable difference in the life of the city and its most at-risk and underserved populations" (Public Health Solutions). Another collaboration was effectively formed between four NYC hospitals, despite having different modes of functioning. An effective communication strategy, especially regarding the short time of its creation, has influenced the positive outcome of this coordination, hence the conclusion that fast response time during an emergency is vital.

Many city services depend on country-level officials, and the healthcare system is such a case in the United States. During the pandemic, the country had no large--scale system suitable for screening samples for mutations and tracking variants of the virus. As for innovative urban centres, the city prepared its programme, which offered insights into the spread of variants around the city (Goldstein & Otterman, 2022). Another example of dissimilarity with the country-level policy was the early re-opening of schools. The city's health commissioner later summarised it as a positive move, as "schools were not a major driver of transmission, particularly when we did have preventive measures in place" (Goldstein & Otterman, 2022).

5. Conclusion

In cities, due to the social distancing policy implemented to prevent the spreading of the virus, new problems and trends have emerged. The digital transformation speeded up in an unprecedented way the delivery of public services and also activity in the business sector (in the form of e-commerce). This trend is a challenge for city authorities as it raises the issue of digital exclusion, digital literacy, and the technology anxiety of inhabitants. Moreover, other spheres need to be reshaped (for example, logistics, thus the growing frequency of home delivery services). Additionally, new regulations in the usage and functions of public spaces have been implemented, and the activity patterns of inhabitants have changed.

One of the vital characteristics of a smart city is its adaptation to changing (both exogenous and endogenous) conditions (especially by implementing ICT). This notion of adaptation was especially crucial during the pandemic, as the pandemic was the exogenous factor influencing city life; other attributes are: high quality

of life, sustainable development, creative, innovative society and city actors, and effective management.

New York City, one of the highest-ranked smart cities, was hard hit by the pandemic, as it became the epicentre of the pandemic in the United States. In order to establish an effective two-way communication channel with inhabitants and other city actors, the city authorities used ICT. They applied adaptive management in the form of the implementation of temporary law packages to mitigate the negative effects of the crisis – changes facilitated maintaining the highest possible quality of life and simplified running a business. One of the profound modifications, which later became permanent (due to, among others, its sustainable nature), was the expanded use of sidewalks and public right of way for outdoor dining. The city constantly monitored the development of the pandemic and its effects on the city through an advanced city system of collecting and processing data. Newly arisen problems were, which then met with a quick response from the city authorities. What is more, society and other city actors served as innovation creators in the form of various synergic collaborations (even in the fields that were problematic at national level).

References

Airbnb. (2020). *Working with 1199SEIU & the State of New York to House First Responders.* https://news.airbnb.com/working-with-1199seiu-the-state-of-new-york-to-house-first-responders/

Anarock. (2022). https://anarock.com/research-insights

Barkerm, N. (2022). *Global cities becoming cycle friendly after "seismic shift" during pandemic.* https://www.dezeen.com/2022/06/03/cycling-cities-seismic-shift-coronavirus-pandemic

Bloomberg. (2020). *Mike Bloomberg supports world central kitchen to provide as many as 1 million meals for healthcare workers at 16 NYC health + hospitals facilities on the frontlines of the COVID-19 pandemic.* https://www.bloomberg.org/press/mike-bloomberg-supports-world-central-kitchen-to-provide-as-many-as-1-million-meals-for-healthcare-workers-at-16-nyc-health-hospitals-facilities-on-the-frontlines-of-the-covid-19-pandemic

Castillo, C., Viu-Roig, M., & Alvarez-Palau, E. J. (2022). COVID-19 lockdown as an opportunity to rethink urban freight distribution: lessons from the Barcelona metropolitan area. *Transportation Research Interdisciplinary Perspectives*, *14*.

Chokshi, D. A., & Katz, M. H. (2020). Emerging lessons from COVID-19 response in New York City. *American Medical Association*, *323*(20).

Citizens' Committee for Children. (n.d.). https://cccnewyork.org/covid-19-resources

City of New York, Mayor's Public Engagement Unit. (n.d.). https://www.nyc.gov/site/mayorspeu/resources/affordable-connectivity-program.page

City of New York. (n.d.). https://portal.311.nyc.gov

City of New York. (n.d.). COVID-19: Data. https://www.nyc.gov/site/doh/covid/covid-19-data.page

CTV News. (2020). *Australia imposes strict new virus measures in Victoria as early successes unravel.* https://www.ctvnews.ca/health/coronavirus/australia-imposes-strict-new-virus-measures-in-victoria-as-early-successes-unravel-1.5050172

CUNY Graduate School of Public Health and Health Policy. (2022). *COVID behaviors and attitudes vary among NYC boroughs, CUNY SPH survey finds.* https://sph.cuny.edu/life-at-sph/news/2022/08/23/survey-covid-behaviors-attitudes

De La Cruz, R. (2022). *Future of last-mile delivery: autonomous, electric, connected and shared transport.* https://www.mecalux.com/logistics-articles/beatriz-royo-teresa-de-la-cruz-future-last-mile-delivery

Etherington, D. (2022). *New York State seeks tech talent for its COVID-19 technology SWAT team.* https://techcrunch.com/2020/03/25/new-york-state-seeks-tech-talent-for-its-covid-19-technology-swat-team/?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAACdWigKAcxR4K3m2PTq-qr0Umr39ceWHEpIcM6vMZSRBF3ml-RcWGtj5SeBFMoj6JadhN6LZRpt1sxlxwmI-DSm-3Fr_3hzVDgzkCvmIcpq0B-EBc0xtuDx8GWlV9xBFnPgOwbl8bG6uNo-7O-yaGOF1G58lY6FzJTUq700UT0sM

Galloway, L. (2022). *Inspired by Covid-19's long lockdowns and safety concerns, cities are implementing pedestrian-friendly initiatives and pushing for more car-free spaces.* https://www.bbc.com/travel/article/20220912-four-health-conscious-cities-putting-pedestrians-first

Glesby, L. (2021). Report shows extensive small business struggles, ways city government can help. https://www.gothamgazette.com/city/10557-report-small-business-struggles-city-government-help

Goldstein, J., & Otterman, S. (2022). *What New York got wrong about the pandemic, and what it got right.* https://www.nytimes.com/2022/03/17/nyregion/new-york-pandemic-lessons.html

Gray, R., Owen, D., & Sopher, M. J. (1998). Setting up a control system for your organization. *Nonprofit World*, *16*(3).

Humanitarian Data Exchange. (2018). https://data.humdata.org/dataset/green-area-per-capita-square-meters-per-capita

IESE Cities in Motion. (2022). https://media.iese.edu/research/pdfs/0189-IESE-CitiesInMotion2022_ENG.pdf

International Trade Administration. (2022). *Impact of COVID pandemic on ecommerce.* https://www.trade.gov/impact-covid-pandemic-ecommerce

Kanowitz, S. (2020). *How NY's Tech SWAT Team ramped up COVID response.* https://gcn.com/state-local/2020/09/how-nys-tech-swat-team-ramped-up-covid-response/314992

Kołodko, G. (2010). Neoliberalizm i światowy kryzys gospodarczy. *Ekonomista*, (1).

Kowalski, J. (Ed.). (2013). *Rola polityki logistycznej.* Wydawnictwo Uniwersytetu Ekonomicznego we Wrocławiu.

Kowalski, J., Nowak, T., & Pisarek, W. (Eds.). (2018). *Aspekty zarządzania.* Wydawnictwo Naukowe PWN.

Lorincz, B. (2021). *Has the pandemic changed NYC's public realm forever*? https://www.commercialsearch.com/news/has-the-pandemic-changed-nycs-public-realm-forever

McKinsey. (2021). *US consumer sentiment and behaviors during the coronavirus crisis*. https://www.mckinsey.com/capabilities/growth-marketing-and-sales/our-insights/survey-us-consumer-sentiment-during-the-coronavirus-crisis

New York Health Equity Reform. (2022). https://www.health.ny.gov/health_care/medicaid/redesign/med_waiver_1115/docs/2022-09-02_final_amend_request.pdf

New York State Comptroller. (2021). *Availability, access and affordability: understanding broadband challenges in New York State*. https://www.osc.state.ny.us/reports/availability-access-and-affordability-understanding-broadband-challenges-new-york-state

New York State. (2020). *Governor Cuomo issues guidance on essential services under The 'New York State on PAUSE' executive order*. https://www.governor.ny.gov/news/governor-cuomo-issues-guidance-essential-services-under-new-york-state-pause-executive-order

OECD. (2010). *Sprawozdanie dotyczące przygotowania Strategii Zielonego Wzrostu*. http://www.oecd-ilibrary.org

OECD. (2020). *The territorial impact of COVID-19: Managing the crisis across levels of government.*

Office of the New York State Comptroller. (2020). *New York's economy and finances in the COVID-19 era.* Retrieved from https://www.osc.state.ny.us/reports/covid-19-september-2-2020

Pandemic Response Institute. (n.d.). https://pandemicresponse.columbia.edu

Public health solutions, NYC Covid-19 rapid response coalition. (n.d.). https://www.healthsolutions.org/partnerships/nyc-covid-19-rapid-response-coalition

Romano, O. (2021). *Can the circular economy become the new normal in cities*? https://www.oecd-forum.org/posts/can-the-circular-economy-become-the-new-normal-in-cities

Sanders, R. (2020). *Digital inclusion, exclusion and participation.* ESSS Outline.

Scival. (n.d.). https://scival.com/overview/topics?uri=InstituteGroup/305.

Sugaris, Universite Gustave Eiffel & Poste Immo. (2021). *E-commerce mobilities the impacts on cities*. https://www.lvmt.fr/wp-content/uploads/2021/07/LC2021-UK.pdf

SWECO. (2018). *Urban move report. Signed, sealed, delivered – analyzing the impact of e-commerce on urban areas*. https://www.swecourbaninsight.com/wp-content/uploads/2020/10/urban-insight-report_e-commerce_a4.pdf

The City of New York. (2017). *Volunteering after a disaster in New York City*. https://www1.nyc.gov/assets/helpnownyc/pdf/disaster_volunteer_guide.pdf

The City of New York. (2021). *Open restaurants*. https://www.nyc.gov/html/dot/html/pedestrians/openrestaurants.shtml

The Government of the Republic of Serbia. (n.d.). https://www.srbija.gov.rs/

The New York Times. (n.d.). https://www.nytimes.com/series/nyc-reopening

The World Bank. (2012). *Inclusive green growth: The pathway to sustainable development*. Washington, DC: The World Bank.

Troisi, O., Fenza, G., Grimaldi, M., & Loia, F. (2022). Covid-19 sentiments in smart cities: The role of technology anxiety before and during the pandemic. *Computers in Human Behavior*, (126).

University at Albany. (2021). SUNY, NYS COVID-19 & minority health disparities in New York project team. Minority health disparities in the 21st-century pandemic: A comprehensive report of project research focused on New York. University at Albany. SUNY: Scholars Archive.

University at Buffalo. (2022). *Western New York COVID-19 research collaborative to promote vaccine acceptance*. https://www.buffalo.edu/eln/students/project-portal/host-page.host.html/content/shared/www/eln/project-portal/project-profiles/active-projects/western-new-york-covid-research-collaborative.detail.html

Ustawa z dnia 17 grudnia 2004 r. o odpowiedzialności za naruszenie dyscypliny finansów publicznych (Dz. U. 2004, nr 14, poz. 114 ze zm.)

World Health Organization. (2022). *Walking and cycling: latest evidence to support policy-making and practice.* WHO Regional Office for Europe.

Wortzel, D., Wiebe D., et. al. (2021). Association between urban greenspace and mental wellbeing during the COVID-19 pandemic in a U.S. Cohort, *Frontiers in Sustainable Cities*. 3.

Yaks, B. (2021). NYC Takes Major Step Toward Making Outdoor Dining Permanent. https://gothamist.com/food/nyc-outdoor-dining-permanent