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# New York City's response to COVID-19 in the context of the smart city concept

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## Abstract

**Aim:** This study aims to critically assess how New York City's response to the COVID-19 pandemic aligns with the principles of the smart city concept. Expanding upon an earlier study focused on the initial, *ad hoc* urban responses, this research examines the entire duration of the pandemic, highlighting strategic shifts and long-term adaptations in crisis management and urban resilience.

**Methodology:** The study employs a case study approach, analysing policy documents, statistical data, and secondary sources to assess New York City's transition from immediate crisis response to structured recovery efforts. A qualitative assessment of governance strategies, social equity measures, and sustainability policies forms the basis of the evaluation.

**Results:** The study reveals that while New York City made strides in job recovery and economic revitalization, its response to the COVID-19 pandemic exposed persistent disparities in digital access, environmental justice, and social equity. The city implemented smart city-aligned initiatives, such as digital transformation efforts and sustainability programs, but challenges in governance, public trust, and equitable resource distribution hindered comprehensive resilience. The uneven recovery process highlighted gaps in long-term crisis management, emphasizing the need for a more inclusive and adaptive approach to urban resilience.

**Implications and recommendations:** The study underscores the necessity for a more integrated and inclusive approach to urban crisis management. It highlights the importance of addressing systemic inequalities and ensuring equitable access to technology and resources to fully realize the smart city vision.

**Originality/value:** This research contributes to the discourse on smart city resilience by offering a longitudinal perspective on New York City's pandemic response. It provides valuable insights into the complexities of urban governance in times of crisis and the role of smart city strategies in fostering sustainable recovery.

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

## 1. Introduction

Urban areas across the globe, including New York City, encountered unparalleled challenges due to the COVID-19 pandemic, which disrupted how they function profoundly. The pandemic's influence extended far beyond immediate health concerns, affecting the city's economy, social dynamics, and governance structures, with impacts that continue to reverberate today.

This work serves as a continuation of a previous study that analysed New York City's response during the initial phase of the COVID-19 pandemic (covering the years 2020 and 2021) in relation to smart city principles (Kozak, 2022). While the earlier work concentrated on the immediate impacts and short--term responses during the first two years of the pandemic, this study expands the scope to encompass the entire pandemic period, with particular emphasis on the subsequent second phase from 2022 to 2023 (which is considered to conclude with the World Health Organization's declaration that the pandemic was officially over on May 5th, 2023).

This study aims to critically evaluate the extent to which New York City's strategies and initiatives during the COVID-19 pandemic align with the fundamental principles of a smart city. It is conducted using a case study formula with critical assessment. Employing a case study methodology, the research undertakes a thorough critical evaluation of the city's pandemic response, focusing on its adherence to core smart city components.

The structure of this study is organised as follows. Section 2 serves as the background to the study and provides context on how the pandemic influenced cities globally, with a specific focus on urban areas. It explores the unique conditions brought about by the COVID-19 pandemic, such as the disruptions in economic activities, social dynamics, and governance in urban settings. This section lays the foundation for understanding the challenges which cities, particularly New York City, faced during this period. Section 3 focuses on New York City's recovery between 2022 and 2023, analysing the city's transition from emergency responses to long-term recovery strategies. This part evaluates various socio-economic indicators, including governance, public health policies, economic recovery, and the broader societal impacts of the pandemic. Section 4 critically examines specific initiatives and strategies implemented by New York City during the pandemic. These initiatives are assessed through the lens of smart city principles, providing a detailed evaluation of how effectively they align with key tenets of a smart city – such as resilience, digital transformation, and sustainable urban management. This study serves as a retrospective analysis of New York City's pandemic response and a forward-looking examination of how cities can evolve to meet the upcoming unexpected challenges.

## 2. The unique conditions of the COVID-19 pandemic in urban areas

As established in the prior work, The COVID-19 pandemic represented a period of exceptional disruptions across the global economy, including urban centres. Now that the pandemic has been officially declared over, it is possible to analyse its precise effect on cities and indicate which have persisted, with the potential to become permanent. A retrospective examination of its progression in the first two years has been analysed in the prior work; therefore, this study pays more attention to the following period of 2022-2023.[1]

[1] In this work, the years 2020-2021 are referred to as the *first period* (of the COVID-19 pandemic), while the years 2022-2023 as the *second period* (of the COVID-19 pandemic).

In overview, the first period was marked by lockdowns which, although effective in decreasing death tools, negatively influenced a lot of society's living spheres, such as well-being (Li et al., 2023). The COVID-19 pandemic in the second period was significantly less severe (accordingly less deadly[2]). Many trends disrupted by the pandemic started to move towards their pre-pandemic levels.

Summing up both periods together (2020-2023), the pandemic had a significant influence on different spheres of functioning of the cities, some of them with permanent character, others temporary, namely:

- urban governance,
- urban planning and design,
- urban society,
- urban environment,
- urban mobility.

The new, disruptive and uncertain conditions challenged urban governance. Plans and strategies grounded in pre-pandemic data, forecasts, and well-established professional methodologies were supplanted by the necessity for swift responses, often driven by uncertainty and incomplete information (Zhu & Xu, 2023). Communication between local governments and citizens was mainly based on Information and Communication Technologies.[3] Governance responses were guided by overarching directives provided by the World Health Organization to avoid close human contact in confined and crowded places (World Health Organization, 2021). Yet, there is no doubt these responses were experimental. The pandemic made the call for successfully addressing future disruptions (not only in public health) apparent. This new layer of resilience,[4] as noted by Zhu and Xu (2023), adds to the existing urban priorities – such as addressing inequity and mitigating climate change – thereby making the governance of modern cities even more challenging.

Resilience has also become increasingly important in the closely related fields of urban planning and design. As Moreno et al. (2021) point out, the pandemic revealed significant weaknesses in the existing structure of cities, emphasising the urgent need for a fundamental reassessment. This reassessment should focus on devising innovative strategies that enable urban residents to maintain their essential activities and adapt to future challenges. The concept of '15-minute city' has gained considerable attention in this vein. In a nutshell, it is an urban planning concept that emphasises sustainable, human--focused development. It aims to enable residents to reach essential services within a 15-minute walk or bike ride. This approach advocates for a decentralised urban framework, intending to decrease reliance on private vehicles, minimise fossil fuel usage, and enhance the overall well-being of inhabitants (Moreno, 2021). The pandemic also highlighted the importance of the urban environment, namely green spaces – especially for mental and physical health (Noszczyk et al., 2022). The stress has been put on mixed-use development in the spirit of the 15-minute city concept. The examples of the implementation of the concept are Paris or Portland.

The COVID-19 pandemic significantly influenced urban society in multiple ways, affecting social interactions, mental health, work-life balance and community cohesion – how people live and work. Regarding not temporal transformations, the pandemic has underscored the society's longstanding mental health concerns. Also, the transition to remote work during the pandemic prompted many companies to implement permanent remote or hybrid work arrangements. This shift has significantly impacted urban mobility, decreasing daily commuting and diminishing demand for office space in city centres.

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2 Based on data provided by the World Health Organization about weekly confirmed COVID-19 deaths per million people (World Health Organization, 2024).

3 This aspect is described in prior work.

4 UN-Habitat (2018) describes resilience as "the ability of any urban system, with its inhabitants, to maintain continuity through all shocks and stresses, while positively adapting and transforming toward sustainability."

## 3. New York City recovery

In 2022 and 2023, New York City, in alignment with global trends, transitioned into a new phase of managing the COVID-19 pandemic. This period was marked by a gradual shift from immediate emergency responses to more sustainable, long-term strategies as the virus evolved into an endemic presence (New York City Economic Development Corporation, 2022b). NYC started entering a recovery phase around mid-2022, and accelerated it in 2023 (NYC, 2024), which was reflected in various indicators of city spheres, e.g. demographics, economy, and entertainment (several are compiled in Table 1).

The number of migrants, after plummeting in 2020 and 2021, started to spike in 2022, although it has not reached its pre-pandemic value by the end of 2023 (Whitaker, 2023). The population's statistics report states that from 2019 to 2021, there has been a significant decrease (by 35.2%) in the number of households with incomes of 100,000 USD or more, however in the following 2022 year, the share increased to a high of 39% (Office of the State Deputy Comptroller for the City of New York, 2023b). 972,000 jobs were lost by April 2020 in the city – the deficit gradually started to shrink from 2021 but ended scarcely in January 2024 (New York State, Department of Labor, 2024).

Another critical aspect of the city's labour market is the unemployment rate, which has not fully recovered since the pandemic.[5] However, private sector jobs that the city lost during the pandemic have been regained more than a year ahead of schedule (The City of New York, 2023). The attention-grabbing issue is the uneven recovery of employment. Namely, some sectors grew (i.e. health care and social assistance, finance and insurance and educational services). In contrast, others experienced a sharp decrease (construction, manufacturing or retail trade) (Mayor's Office of Management and Budget, 2024).

For New York City, the tourism sector plays a vital economic role, which was devastated during the first phase and still (August 2024) has not recovered to 2019 levels.[6] Another indicator is subway ridership, which fell more than 90% during the first lockdown; by the time of writing, this still has not reached its pre-pandemic level). A significant factor contributing to this is the shift toward remote (and hybrid[7]) work.

It is noteworthy that not all aspects of the city's functioning were adversely affected by the pandemic – the residential real estate market demonstrated resilience during the COVID-19 pandemic, with family homes experiencing significant value growth as individuals sought larger living spaces amidst constrained supply (Office of the State Deputy Comptroller for the City of New York, 2023b).

Other examples of indicators and their changes compared to the pre-pandemic level (represented as the year 2019) are listed in Table 1.

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5 Pre-pandemic level in January 2020 was 4,1%. The latest update of this measure (from July 2024) indicates that unemployment rate is 5% (New York State, Department of Labor, 2024).

6 Report *Tracking the return: The TOURISM INDUSTRY in New York City* (Office of the State Deputy Comptroller for the City of New York, 2024) states that "In 2019, the number of visitors to the City reached a record 66.6 million. However, the COVID-19 pandemic devastated this thriving industry, resulting in a 66.5 percent decline in visitors to 22.3 million in 2020. Since that sharp decline, the industry has been recovering. In 2023, the number of visitors reached 62.2 million, 6.6 percent below the 2019 level."

7 Recent data published in May 2024 indicate, that the hybrid model remains the most popular office policy. 60% of employers operate on a hybrid schedule, while 34% employ a combination of hybrid, remote, and full-time in-office roles, depending on job function. Only 5% of employers require daily in-office attendance, and a mere 1% have fully remote workforces (Partnership for New York City, 2024).

Table 1. Selected indicators of various city aspects and their changes

| Indicator \ Year | 2019 | 2020 | 2023 | Change** (2019 to 2023) |
|---|---|---|---|---|
| Annual change in gross city product (%) | 2.6 | –3.9 | 1.8* | increased |
| Unemployment rate (%) | 4 | 7.2 | 5.2 | increased |
| Private employment, total, annual | 4 063.0 | 3 567.0 | 4 102.8 | increased |
| Capital spending commitments in the construction sector (billions of USD) | 12.6 | 8.1 | 15.2* | increased |
| Net domestic migration | –131.367 | –151.899 | –160.012 | decreased |
| Number of visitors (millions) | 66.6 | 22.3 | 63.2 | decreased |
| Hotel occupancy rates, seasonally adjusted (M06) (%) | 83.6 | 36.7 | 81.4 | decreased |
| Numbers of felonies*** committed | 95.606 | 95.593 | 126.786 | increased |
| Number of visitors to the Metropolitan Museum of Art (millions) | 6.48 | 1.12 | 5.36 | decreased |

*Estimations, **green indicates positive change, whilst red indicates negative, ***murder and non-negligible manslaughter, rape, robbery, felony assault, burglary, grand larceny, and grand larceny of motor vehicle.

Source: (Cheshire & da Silva, 2024; NYC, 2024; New York City, 2023; New York City Police Department, 2024; New York State, 2024; Office of the New York, n.d.).

As the city entered the recovery phase, as mentioned earlier, government officials began drawing conclusions from the devastating initial pandemic period. In the strategy titled *Rebuild, renew, reinvent: A blueprint for New York City's economic recovery* (The New York City, 2022), the statement of the necessity of revisioning the city's future economy has been made. The primary takeaway was a strong emphasis on promoting equity and environmental justice throughout the recovery process, ensuring that the benefits of economic growth are shared more widely and that the city becomes more resilient to future environmental and public health challenges. Other assumptions included:

- deep racial, health and environmental inequalities exist that need to be tackled,
- every neighbourhood needs to be resilient to future shocks of any kind,
- the city's economy needs to be more resilient, equitable, and future-focused,
- small businesses play a critical role in the city's economy[8] and thus require more support.

Based on the findings in December 2022, a new vision of the city's functioning was established[9] ("New York that works for everyone"). It considered the shifting economic and societal patterns, some of which were influenced by the pandemic:

- working models (transition towards remote or hybrid work),
- city modelling (departing from old models of isolated districts),
- racial and social justice focus.

In order to put the vision to life, a coalition of New York civic leaders and industry experts established New York Panel, which resulted in a joined action plan by the Governor and Mayor, as the Report *Making New York work for everyone* states, is "one of the strongest partnerships between these two

[8] This finding was also corroborated by academic predictive models. The pandemic highlighted the vulnerability of small businesses, particularly high-end restaurants far from public transit. A predictive model for small-business closures in NYC showed that 17.7% of food-related, non-chain retail businesses closed permanently. Factors such as neighborhood profile and social media ratings influenced business resilience. Read more in (Wang & Laefer, 2024).

[9] It is essential to underline the American's power division which is structured across federal, state, and local levels – with New York State (NYS) falling in the state category and New York City (NYC) in the local level. This indicates that NYC operates under the legal framework established by NYS and the state government can set laws that impact how NYC operates, though the city has significant autonomy in local matters (A Division of the New York Department of State, 2023). This work primarily focuses on city-level interventions; however, these cannot be fully considered in isolation from state-level actions.

levels of New York's government in at least half a century." The action plan perceives the COVID-19 pandemic as the "both reckoning and an opportunity" and states that "New York needs to grow in order to be able to afford its transformation into a more equitable, inclusive city."

Assessing the progress of following the strategy's goals as of the end of 2023, we see that there has been growth in the number of small businesses operating in the city, which is the highest historically. As previously mentioned, the private sector jobs that the city lost during the pandemic have been recovered more than a year ahead of schedule. Achievements were evident in goals of boosting subway ridership, increasing the number of citizens returning to the office and growing the number of citizens of colour participating in the local economy (The City of New York, 2023). However, success was not achieved in every sphere. Although Mayor Adams stated that there was a record number of individuals who were transitioned from homelessness into permanent housing within a single year (The City of New York, 2024), homelessness in New York City has reached the highest level[10] since the Great Depression of the 1930s (Coalition for the Homeless, 2024b).

The complex issue of disinvestment in the city's mental health care system was underscored by the significant presence of homeless individuals with mental illnesses, which became particularly evident during the lockdown phases. Thus, a "Subway Safety Plan" was released in 2022 by the city's mayor. Since then, it has significantly reduced crime and bolstered public confidence in the subway system. Nevertheless, it continues to face challenges related to policing disparities and the broader perception of safety among all riders[11] (Mehranbod et al., 2024).

The NYC government's recovery efforts were extensive, but several key areas revealed shortcomings in the government's approach, contributing to a slower and less effective recovery than anticipated (see Figure 1).

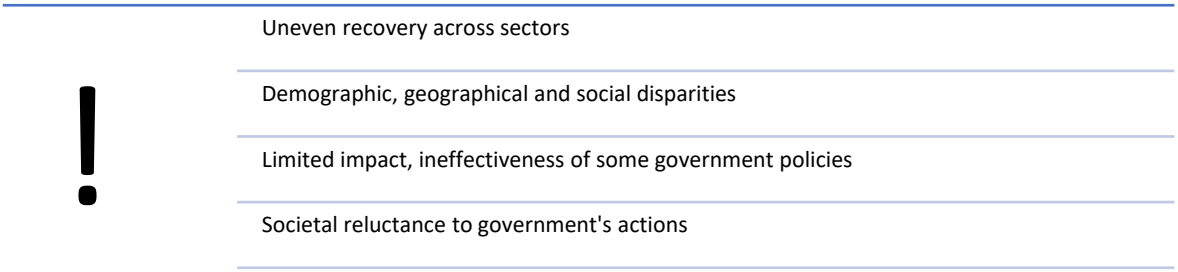


Fig. 1. Main challenges in New York City's socio-economic recovery

Source: own elaboration.

The recovery process was uneven across sectors, exposing existing disparities within society, especially one that needs to be pinpointed – the digital divide, with a significant portion of citizens lacking high--speed internet and/or adequate Internet devices (New York City Council, 2021). Internet access was critical during the pandemic but was especially crucial during lockdowns. What stands out, however, is the government's ability to identify these weak points and respond effectively. For example, in addressing the digital divide, the Office of Technology & Innovation announced a strategic plan in 2022 specifically aimed at tackling this issue (NYC Office of Technology & Innovation, 2022). Although some governmental actions were implemented too late, economic recovery programmes had positive outcomes (such as the reallocation of street space to support outdoor dining and physical activity;

[10] Furthermore, a number of people in shelters spiked significantly: January 2019 – 72,511; January 2020 – 66,456; January 2021 – 63,261; January 2022 – 55,436; January 2023 – 76,206 (Coalition for the Homeless, 2024a).

[11] Increased policing has reduced crime but raised concerns about over-policing, especially in communities of color. Critics argue that this focus may overlook other safety aspects, such as reducing wait times and improving station cleanliness, which are also vital for public safety and health.

generally, those were the initiatives that received substantial public support). Various support measures, including tax suspensions, were implemented to assist small businesses. Nevertheless, not all government actions were successful. For instance, many individuals depended on private transfers and limited government support to cope with the economic impact, which was not always effectively targeted[12] (Dupas et al., 2023).

NYC's contact tracing program, the most extensive in the country (which identified, assessed and managed exposed to COVID-19 people), faced significant challenges – for example, it struggled to effectively reach exposed contacts (due to trust issues, communication barriers, and limited community engagement). Additionally, the system was overwhelmed during surges, revealing deficiencies in real-time data management and communication adaptability (NYU Langone, 2023) – ultimately highlighting a lack of resilience.

The above-mentioned programme exemplifies the challenge of building public trust, especially in communities sceptical of government interventions. During the pandemic, this problem was additionally exacerbated by the spread of misinformation, which the city struggled to counter effectively, leading to lower compliance with public health guidelines (NYU Langone, 2023).

While the primary focus of this work is not on state or federal government actions, one issue warrants attention due to its direct connection to NYC during the pandemic and post-pandemic periods: food insecurity. With the onset of the pandemic, food insecurity surged,[13] prompting federal intervention through emergency programs such as the Supplemental Nutrition Assistance Program (Office of the State of New York, 2024). These initiatives helped mitigate the problem in 2020 and 2021; however, with the closure of many of these programs, food insecurity has resurfaced (food insecurity rates vary between 5% and 32% across different city regions) (New York City Council, 2024). This resurgence presents a significant challenge for the city's government.[14]

Government officials did not exclusively draw conclusions from the COVID-19 pandemic; various influential stakeholders also emphasised the need for the city to strengthen its resilience by implementing new goals, strategies, and initiatives.

In early 2023, the New York Building Congress,[15] a non-governmental organisation, released a 100-year strategic blueprint. The document emphasises the Congress's role as a stabilising force during the COVID-19 pandemic and other major disruptions, highlighting the critical importance of resilience in organisational adaptability and industry practices (New York Building Congress, 2023).

Lastly, it is essential to underscore the significance of additional city initiatives and collaborative efforts in mitigating the pandemic's adverse impacts.[16] Key institutional contributions included the WNY COVID-19 Research Collaborative, the NYC COVID-19 Rapid Response Coalition, and the COVID-19 Technology Swat Team. Furthermore, the city's strong academic sector was a vital contributor to these efforts.

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12 A further example is presented by the study of Dupas et al. (2023), conducted in a case study with survey mods. The conclusion was that less than 1% of respondents reported receiving any government transfer, and during the pandemic, only 5.4% recalled receiving in-kind government transfers like face masks and antiseptic gel. This further underscores the limited reach and impact of government support, in other words low baseline of government support.

13 This phenomenon can be attributed to a combination of factors, including job loss, rising food costs, and school closures that previously provided children with access to meals (Office State of New York, 2024).

14 In 2021, the NYC government implemented a 10-year plan to address the issue, but it has not yet sufficiently resolved the problem. More information in (Office State of New York, 2024; Phenix, 2024).

15 A broad-based membership association that represents various sectors within New York's building industry.

16 Further described in the prior work.

# 4. Smart City functionality in New York City: A COVID-19 case study

After detailing the specific conditions surrounding New York City's pandemic recovery, it is now possible to assess how these conditions align with the foundational principles and objectives of the smart city concept. Firstly, the definition of a smart city is reiterated. In the second part, conclusions regarding the whole pandemic period are restated. Finally, a comprehensive summary assesses the alignment between the smart city concept and New York City's actions throughout the pandemic, evaluating whether the city embodies smart city components in its overall functioning.

## 4.1. Smart city concept

A smart city is an urban area that leverages advanced technologies, particularly information and communication technologies (ICT), to enhance the quality of life for its inhabitants, promote sustainable development, and improve the efficiency of urban management. The concept of a smart city encompasses several key attributes:

1. High quality of life.
2. Intelligence is the 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.

Such cities are characterised by integrating physical infrastructure, social systems, and business environments to harness collective intelligence and enhance decision-making processes. While the definition of a smart city can vary depending on the entity describing it – be it urban planners, businesses, or academics – there is a consensus that smart cities prioritise the well-being of their residents and the sustainability of their environments through the strategic use of technology. This approach enables cities to respond effectively to challenges, such as those presented by the COVID-19 pandemic, by maintaining essential services, supporting economic activities, and ensuring public health, thereby showcasing the critical role that smart cities play in modern urban governance. This summary expands on the foundational concepts introduced in the prior work, where the smart city framework is explored in greater detail.

## 4.2. Smart city attributes in the context of New York City

NYC's post-pandemic recovery strategies reflect its efforts to enhance the quality of life – the first key attribute of a smart city – with a strong focus on job recovery, small business support, and the reallocation of public spaces for outdoor dining. However, a critical analysis shows that the recovery has been uneven across various sectors and demographics. Furthermore, while the city's approach to addressing racial and social inequities has been ambitious, the results have been mixed. The deep-rooted disparities – particularly in health and environmental justice – were exacerbated during the pandemic, and while initiatives like the COVID-19 Equity Action Plan were introduced, their long-term effectiveness in closing these gaps remains to be seen. Additionally, the resurgence of issues like food insecurity post-pandemic (as noted in the city's reports) highlights ongoing challenges that question the robustness of the city's efforts to ensure a high quality of life for all residents. Therefore, while NYC has made strides, the uneven recovery and persistent inequalities suggest that its alignment with a smart city's high quality of life component is still a work in progress, with significant areas requiring sustained focus and improvement.

The ability to adapt to changing conditions – whether they are exogenous, such as a global pandemic, or endogenous, like evolving urban needs – is a fundamental aspect of a smart city, deeply intertwined with the concept of urban resilience. New York City's use of ICT during the pandemic exemplifies its

commitment to resilience through adaptation. The city quite effectively utilised its advanced data systems to monitor the spread of the virus, manage public health responses, and communicate with residents. What is crucial to underline is the technological integration of such technologies. However, these efforts were not entirely successful, as they encountered several varying challenges, with societal and infrastructural issues particularly critical.

The third smart city's foundation – namely sustainable development – is reflected in several key initiatives undertaken in response to the pandemic crisis. The "Open Restaurants Program" is a prime example of how the city has sought to embed sustainability into its recovery, which aligns with contributing to a more resilient urban environment. Moreover, efforts to enhance green spaces in response to increased public demand during the pandemic further underscore the city's commitment to sustainability (and, again, serves as the exemplification of urban resilience). Despite these few positive steps, there have been notable challenges. The city's approach to sustainable development has sometimes been undermined by inconsistent execution and the unequal distribution of resources. [17] Furthermore, the ongoing issue of environmental justice, particularly in areas disproportionately affected by pollution and lacking green spaces, suggests that NYC's efforts, while significant, have not yet fully realised the principles of equitable and inclusive sustainable development. This brings to the conclusion whether the city's sustainability initiatives are genuinely comprehensive or whether they risk perpetuating existing disparities, which could potentially undermine its long-term resilience.

New York City is recognised as a hub of creativity and innovation,[18] and this was evident in the city's collaborative approach to the pandemic. The formation of the COVID-19 Technology SWAT Team and partnerships between government, academia, and the private sector to address the crisis demonstrate the city's capacity for innovation. The active participation of institutions like Columbia University and the creation of initiatives like the Pandemic Response Institute illustrates the city's strength in promoting a creative and innovative community. On the other hand, the effectiveness of these efforts was uneven. While specific initiatives successfully harnessed the city's innovative potential, others struggled due to bureaucratic inertia and coordination challenges. For example, although impactful, the NYC COVID-19 Rapid Response Coalition highlighted the difficulties in maintaining sustained, cross-sector collaboration under the pressure of an ongoing crisis. Moreover, the uneven recovery across different sectors and communities raises questions about how inclusive the city's innovation ecosystem is. The disparities in outcomes suggest that this innovative potential is not fully realised across all demographics and areas of the city, which could weaken the city's overall resilience in future unexpected events and crises.

Regarding the next cornerstone of the smart city concept – effective management – NYC's response to the pandemic provides a mixed picture in this regard. On the one hand, the city's ability to recover jobs and support small businesses more than a year ahead of schedule is indicative of strong managerial capabilities. The strategic planning involved in the "Rebuild Renew Reinvent" blueprint and the coordination between city and state governments also reflect effective governance and a commitment to rebuilding the city's economy in a resilient and equitable manner. On the other hand, several aspects of the city's management during the pandemic reveal shortcomings. The resurgence of homelessness to levels not seen since the Great Depression, coupled with the disinvestment in the mental health care system, suggests a failure in effectively managing some of the most pressing social issues which are crucial for other smart city foundations, like quality of life and adaptability. Additionally, the

[17] For example, while some neighborhoods benefited from enhanced public spaces and sustainable initiatives, others, particularly those with lower-income populations, did not receive the same level of investment or attention.

[18] In Innovation Cities Index Ranking 2022-2023 prepared by 2ThinkNow, NYC is placed on the 3rd place (2ThinkNow, n.d.). Moreover, the city has various initiatives and organizations driving technological and urban advancements, for example governmental NYC Office of Technology and Innovation or numerous corporate innovation hubs, with companies listed on the Fortune 500 list (Buildinnyc, n.d.).

challenges faced by the contact tracing program and the ongoing struggles with public health compliance point to gaps in crisis management and real-time adaptability. Such issues highlight the need for a more integrated and responsive management framework that can better address both immediate crises and long-term challenges.

During the pandemic period, in addition to actions directly aimed at counteracting the crisis, the city also undertook initiatives and established plans that aligned with smart city goals,[19] with some explicitly articulating the objective of becoming a smart city. The city has released specific development strategies for neighbourhoods and boroughs that, while not explicitly mentioning the aim of becoming a smart city, closely align with the principles of the smart city concept.[20]

When comparing New York City to other cities in terms of embodying smart city values, particularly during the pandemic period, there is a general lack of consensus. Rankings compiled by academic institutions and research centres vary due to differing methodologies stemming from varying interpretations of the smart city concept. Considering the IMD Smart City Index Ranking, one of the leading rankings in the field, it is evident that New York City's position as a smart city declined between 2020 and 2023 (from 12th to 21st place).[21] However, this decline is not attributable to the city becoming 'less smart' but to other cities advancing more rapidly. Indeed, New York City demonstrated progress in most areas under examination. The most significant decline was observed in the category of "the current internet speed and reliability meet connectivity needs" (IMD, 2020, 2023). In the ranking prepared by IESE Business School – IESE Cities in Motion Index – the position of NYC through the pandemic years has not changed and has remained in high, 2nd place. Since 2020, positions across a great range of dimensions have improved,[22] with mild deterioration and technology. The city received its lowest scores in social cohesion and environment (IESE Business School, 2020, 2022, 2024). The weak areas align with the findings in this work, which highlight that social inequality – particularly the technological divide within the city – and sustainability challenges were especially emphasised by the realities of the pandemic.

## 5. Conclusions

The COVID-19 pandemic caused significant disruptions in urban areas, exposing weaknesses in governance, planning, and social systems. It emphasised the urgent need for cities to develop more resilient structures to better withstand future crises, with some changes likely becoming permanent in urban environments.

New York City's recovery from the COVID-19 pandemic between 2022 and 2023 was marked by a shift from emergency responses (characteristic for the first phase) to long-term strategies, reflecting gradual progress in various sectors, such as employment and slight business recovery. However, the recovery was uneven, with persistent challenges in areas like tourism, public transport, and social equity, particularly in addressing homelessness and the digital divide. While some aspects of the city's economy rebounded strongly, others have yet to return to pre-pandemic levels, highlighting the complexities and ongoing challenges in the city's post-pandemic recovery efforts.

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19 Some of these initiatives were prepared prior to the onset of the pandemic, whilst some during the pandemic and released after.

20 Examples include: Hunts Point in Bronx (New York City Economic Development Corporation, 2022a), Lower Manhattan in Manhattan (The Official Website of the City of New York, 2023).

21 An interesting side note is that this decline was even more pronounced between 2023 and 2024, with New York City falling to 34th place.

22 These dimensions are human capital, social cohesion, governance, environment, mobility, international profile. The comparison utilized scores from the years 2020, 2022, and 2024, as data for these specific years is available.

The assessment of New York City's post-pandemic recovery within the framework of smart city attributes reveals a complex and nuanced picture. The city made notable progress in areas such as job recovery, support for small businesses, and implementing sustainability initiatives, reflecting an effort to align with key smart city principles like improving quality of life and fostering resilience. However, the recovery has been characterised by significant disparities, particularly in addressing longstanding social equity and environmental justice issues. Challenges in effective management were also evident, as certain sectors and communities experienced uneven recovery outcomes, underscoring the limitations in fully realising the smart city vision. While New York City's response demonstrates a commitment to integrating smart city attributes, the persistence of these gaps highlights the need for more comprehensive and inclusive strategies to achieve a genuinely resilient and equitable urban environment.

It is important to acknowledge that the considerations presented in this study do not provide a definitive answer to whether New York City qualifies as a smart city or accurately determines its stage in the transformation process toward becoming a smart city. The scope of this study is confined to the period of the COVID-19 pandemic, spanning from 2020 to early 2023. During this time, the city implemented various initiatives and plans aligned with smart city objectives; however, a comprehensive assessment of New York City's smart city status requires an evaluation of the broader context, including actions taken before and after this period. Such an analysis falls outside the scope of this work, and therefore, any conclusions regarding the city's smart city transformation must be viewed within the limitations of the timeframe studied.

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## Odpowiedź Nowego Jorku na COVID-19 w kontekście koncepcji inteligentnego miasta

### Streszczenie

**Cel:** Niniejsze badanie ma na celu krytyczną analizę zgodności strategii i działań podjętych przez Nowy Jork w odpowiedzi na pandemię COVID-19 z fundamentalnymi zasadami koncepcji smart city. Rozszerzając zakres wcześniejszych badań, które koncentrowały się na początkowej, doraźnej reakcji miejskiej, niniejsza praca obejmuje całokształt działań podejmowanych w trakcie pandemii, ze szczególnym uwzględnieniem strategicznych zmian oraz długofalowych mechanizmów adaptacyjnych w zarządzaniu kryzysowym i budowaniu odporności miejskiej.

**Metodyka:** Badanie opiera się na metodzie studium przypadku i obejmuje analizę dokumentów strategicznych, danych statystycznych oraz źródeł wtórnych w celu oceny ewolucji podejścia Nowego Jorku – od natychmiastowej reakcji kryzysowej do systematycznych działań na rzecz odbudowy. Ocena została przeprowadzona w oparciu o jakościową analizę strategii zarządzania, polityk na rzecz równości społecznej oraz inicjatyw związanych ze zrównoważonym rozwojem.

**Wyniki:** Wyniki badania wskazują, że pomimo istotnego postępu w zakresie odbudowy rynku pracy i rewitalizacji gospodarczej, pandemia COVID-19 ujawniła strukturalne nierówności w dostępie do technologii, sprawiedliwości środowiskowej oraz równości społecznej. Miasto wdrożyło inicjatywy zgodne z koncepcją *smart city*, obejmujące cyfrową transformację oraz programy zrównoważonego rozwoju. Niemniej jednak, ograniczenia w zakresie efektywnego zarządzania, niski poziom zaufania społecznego oraz nierównomierna dystrybucja zasobów stanowiły istotne bariery dla osiągnięcia pełnej odporności miejskiej. Proces odbudowy cechowała znaczna asymetria, co unaoczniło deficyty w długoterminowym zarządzaniu kryzysowym oraz podkreśliło konieczność wdrożenia bardziej inkluzywnych i adaptacyjnych strategii w zakresie budowania odporności miejskiej.

**Implikacje i rekomendacje:** Badanie akcentuje konieczność wdrożenia bardziej zintegrowanego i inkluzywnego modelu zarządzania kryzysowego w kontekście miejskim. Podkreśla również kluczową rolę eliminacji nierówności strukturalnych oraz zapewnienia powszechnego i sprawiedliwego dostępu do technologii oraz zasobów, jako niezbędnych elementów pełnej realizacji idei *smart city*.

**Oryginalność/wartość:** Niniejsza analiza wnosi wkład w dyskurs naukowy dotyczący odporności *smart city*, oferując długoterminową perspektywę na odpowiedź Nowego Jorku na pandemię COVID-19. Badanie dostarcza istotnych wniosków dotyczących złożoności zarządzania miejskiego w warunkach kryzysowych oraz znaczenia strategii *smart city* w kształtowaniu zrównoważonej i odpornej przyszłości miast.

**Słowa kluczowe:** COVID-19, pandemia, *smart city*, New York, rezyliencja