Hapres | Journal of Sustainability Research

sustainability.hapres.com

Review

Uncovering Organization Emergent Digital Transformation Strategies to deal with Crises: A Review of Bibliometric Analyses and of a European Initiative

Christos Ziozias, Antonis Tsagalis, Leonidas Anthopoulos *

Department of Business Administration, University of Thessaly, Larissa 41500, Greece

* Correspondence: Leonidas Anthopoulos, Email: lanthopo@uth.gr.

ABSTRACT

Digital transformation has become a strategic priority for the enterprises, the public organizations, and the cities. However, it remains unanswered whether business and city digital transformation strategies emerged mainly during the Covid-19 pandemic or independently while it is questioned whether organizations and cities that prioritized digital transformation before the epidemic had updated their strategies to deal with the outbreak. The main objective of this paper is to investigate the types of emergent digital transformation strategies that were caused both to the local business ecosystems and to cities due to the pandemic. This study uses a multi-method approach, including bibliometric analyses of more than 30,000 records that were produced during the outbreak to determine the effects of Covid-19 pandemic on the business and city digital transformation strategies. Findings uncover the digital transformation emergent strategic changes and highlight important trends, like the migration of the production supply chains with digital transformation. Moreover, this article uses the case study method on the European Intelligent Cities Challenge initiative, via analyzing the digital transformation strategies of the 120 participating cities, which had defined their digital transformation strategic priorities before the outbreak. The analysis shows that the pandemic did not significantly caused emergent digital transformation strategies. In general, this article's findings do not prove a causal relationship between the pandemic and city/organization digital transformation strategies but provide some useful evidence about the emergent strategic responses that are triggered by crises like the epidemic.

Background: This article explores the emergence and updates of digital transformation strategies (emergent digital transformation strategies) of businesses and cities due to the covid-19 outbreak.

Methods: A multi-method research methodology was followed: bibliometric analyses of more than 30,000 records and the in-depth analysis of the most cited articles of them (more than 50) that were published during the outbreak (not after its completion) and on the case

Received: 08 June 2024
Accepted: 23 July 2024
Published: 26 July 2024

study of the large-scale European intiative of Intelligence Cities Challenge (ICC) (more than 120 cities in Europe).

Results: (a) In terms of business emergent digital transformation strategies: (1) the enterprises adopted agile marketing techniques for their entrance to new digital markets and for the development of new digital products; (2) the enterprises prioritized digital transformation and the definition of sustainable business models; (3) the enterprises adopted emerging ICT (i.e., AI, bigdata and analytics) to measure organizational performance and predict market demands; (4) the enterprises moved their production lines closer to their suppliers and customers. (b) in terms of city emergent digital transformation strategies: (1) cities are being transformed to smart service providers and generate new types of digital values, via digital platforms and service co-creation with their citizens; (2) cities utilized their digital assets to share knowledge with innovation producers, they focused on their communities' digital upskilling, while they adopted emerging ICT (i.e., AI, big data and IoT) to enhance their utility services; (3) cities recognized the importance of their digital transformation for enhancing their resilience and they rapidly trusted the ICT and encouraged the development of ethical ecosystems; (4) the evidence from the ICC showed that only the 65.5 (80 out of the 122 cities) percent of the participating cities managed to define their DT strategies, none revised its strategic objectives in the face of the pandemic, while only the 15 percent of them (12 out of the 80 cities) prioritized objectives relative to the pandemic or launched corresponding initiatives; (5) some ICT-based measures that the cities undertook to deal with the pandemic were uncovered with the ICC (i.e., digital surveillance, smart tourism etc.).

Conclusions: The above results show how the businesses and the city governments responded with emergent digital transformation strategies to the Covid-19 pandemic, beyond dealing this liquidity issues and gaining access to government funds. These outcomes can be utilized for future estimations about business and city responses to crises like the outbreak, while future thoughts concern comparing these results with evidence from post-pandemic analyses.

KEYWORDS: business; Covid-19; digital transformation; emergent strategy; intelligent cities; smart cities; strategy

ABBREVIATIONS

ICC, intelligent cities challenge; DT, digital transformation; ICT, information and communications technologies; SC, smart city

INTRODUCTION

The main objective of this article is to investigate whether crises oblige organizations (enterprises, public organizations and cities) to perform

Digital Transformation (DT) strategic responses or DT is an independent process that is not affected by emergencies. In this respect, the recent Covid-19 outbreak is utilized and it is investigated whether organizations defined emergent—or revised their existing—DT strategies to deal with the pandemic and if so, in which directions they moved, or their DT strategies were not affected at all. The findings of this paper show that this subject has not been analyzed in depth yet, while data that were produced during the pandemic—and not post-pandemic like most recent reviews do—are explored, to highlight how the organizations' DT strategies emerged due to the pandemic.

Some reports [1] that were published during the emergency attempted to capture general business and economic changes that were caused by the pandemic. The report's data reflects the magnitude of the effort made by governments to flatten the curves and the generated economic recession. The data showed that in the end of 2020, no economy could avoid recession if they failed controlling the pandemic, which shows how fragile the cities and their local ecosystems were against an unpredicted emergency.

Moreover, this data shows that the organizations' behavior was affected in similar terms by the support of the governments and the size of the pandemic, both regarding their robustness and their response to their customer demands. Additionally, the economic uncertainty and the forecasts for economic growth evolved similarly in the same period. Another finding is that intensive DT of local ecosystems took place during the pandemic, which resulted to the rapid growth of e-business, e-commerce, and e-government, but also to the adoption of new forms of work (remote work) and new types of digital services based on cutting-edge technologies (e.g., artificial intelligence (AI)—based predictions etc.).

Respecting the above results, this article utilizes findings from the Covid-19 emergency to uncover emergent DT strategies in local ecosystems and cities and answer the following research questions (RQs):

RQ1: How did the organizations emerge DT strategies in the face of the crisis?

RQ2: How did the cities emerged DT strategies to deal with the crisis?

Both these questions are important to be answered since business and city emergent DT strategies caused by the pandemic have not been explored in detail yet, and the findings can show emergent strategic responses to future unpredicted crises. Moreover, the impact of the pandemic on the organizations and cities' DT strategies is important to be clarified. The novelty of this paper is that it does not investigate DT that was generated by the pandemic like other reviews do, neither uses post-pandemic analyses, but it explored how the organizations responded to this crisis with emergent DT strategies, with evidence that was produced only during the pandemic. Moreover, it is beyond the purposes of this paper to uncover clear causal relationships between crises—like the pandemic—and DT emergent strategies of ecosystems and cities since

more in-depth studies are needed, but to depict how the ecosystems and cities defined or emerged their DT strategies against the pandemic.

The remainder of this article is structured as follows: section 2 (BACKGROUND) provides the theoretical background of this study, including definitions and relative concepts. Section 3 (RESEARCH METHODOLOGY) contains the research methodology, which is multimethod and contains bibliometric analyses, in-depth study of the most-cited articles and the exploration of the case study of the European large-scale project entitled "Intelligent Cities Challenge" (ICC) [2]. This multi-method approach provides with answers the research questions, while it is mainly qualitative and uses retrospective evidence from bibliometric and literature findings, and evidence from a large-scale case study. Finally, section 4 (CONCLUSIONS) contains conclusions, limitations, and future thoughts.

BACKGROUND

This section defines relative terminology, including pandemics, DT, city, smart city, and strategy, together with associated concepts like sustainable city and strategic management. The pandemics (or epidemics) concern widespread diseases and they have occurred several times over the centuries, but only in the last two decades they have become more frequent and more deadly. They influence communities [3], lead to the law revision or generation, reform public health systems and encourage the application of military-style surveillance and isolation methods for their control. Infectious diseases are a threat to people regardless their age, sex, lifestyle, and socioeconomic status [4]. Improvements in urban facility—including water quality and sanitation—lead to the improvement of the living conditions, which in combination with the progress in the development of new vaccines and antibiotics, support communities combating infectious microorganisms. The economic impact and health risk of epidemics are enormous and vary from short to long-term effects.

Digital transformation (DT) on the other hand has been defined by [5] as "a fundamental change process, enabled by the innovative use of digital technologies accompanied by the strategic leverage of key resources and capabilities, aiming to radically improve an entity and redefine its value proposition for its stakeholders (an entity could be an organization, a business network, an industry, or society)". This definition shows that the DT mainly focuses on the change that is based on the information and communication technologies (ICT) and not to the ICT themselves.

A city is considered as an urban area, which according to the United Nations [6] typically begins with a population density of 1500 people per square mile but it varies across countries. Another indicative definition says that "city is an urban community falling under a specific administrative boundary" [7], which shows that a city requires a governance model. On the contrary, a "community is a group of people with an arrangement of responsibilities, activities, and relationships" [8].

Moreover, “a city is a system of systems with a unique history and set in a specific environmental and societal context. For it to flourish, all the key city actors need to work together, utilizing all their resources, to overcome the challenges and grasp the opportunities that the city faces” [9]. The city cannot be limited to the built environment, where the local community lives, but as an urban system, where the built environment is interconnected with several elements (i.e., the natural environment, industrial and rural areas, and other cities, etc.).

A smart city (SC) is “a new concept and a new model, which applies the new generation of information technologies, such as the internet of things, cloud computing, big data and space/geographical information integration, to facilitate the planning, construction, management and smart services of cities” [9]. Quite similarly, a smart and sustainable city (SSC) is an innovative city that uses the ICT and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, and environmental aspects [10]. Thus, a quite generic SC definition could be “the utilization of ICT and innovation by cities (new, existing or districts), as a means to sustain in economic, social and environmental terms and to address several challenges dealing with six (6) dimensions (people, economy, governance, mobility, environment and living)” [11].

According to Lysons & Farrington [12], a strategy aims to depict the future direction of an organization, while the term strategic management refers to “methods of understanding, developing capabilities and finding tools for each organization, contributing to both its advancement and the acquisition of a competitive advantage”. Moreover, strategic management deals with the vision and mission of an organization, defines objectives, evaluates, and controls policies and programs, determines the long-term performance of the organization, and regularly reviews the strategy considering changing conditions, such as the technology, the political, economic, social environments etc. Strategic alignment on the other hand, can be defined as “the process of aligning all stakeholders, internal and external, so that all are focused and committed to achieving a shared organizational vision, complying with its culture” [13]. Thus, strategic alignment does not address changes or updates but concerns organizational alignment to strategic objectives. On the contrary, the term emergent strategy corresponds to “strategies that result from the emergence of opportunities and threats in the environment and from “strategies in action” (ad hoc actions across the organization)” [14]. According to its definition, emergent strategy addresses the purposes of this paper, and it is utilized under the following research methodology.

RESEARCH METHODOLOGY

This article follows a multi-method research methodology, including several bibliometric analyses about its grounded problem and the case

study of the European Intelligent Cities Challenge (ICC) [2] large scale initiative. It uses evidence that was published during the recent crisis of the Covid-19 outbreak to demonstrate how local ecosystems and cities responded with emergent DT strategies.

More specifically, the combination of the terms “covid-19” AND “strategy” returned more than 90,000 records in ScienceDirect® alone, in January 2023, which was close to the event that the outbreak was claimed to be over (late 2022) and shows the size of the addressed subject. These records were classified in the following scientific subjects [15]:

- Medicine and Dentistry (45,565)
- Social Sciences (13,902)
- Environmental Science (8762)
- Immunology and Microbiology (8205)
- Biochemistry, Genetics and Molecular Biology (7404)
- Nursing and Health Professions (6435)
- Psychology (6405)
- Business, Management and Accounting (6378)
- Engineering (6203)
- Economics, Econometrics and Finance (5073)

The inclusion of the term “strategic alignment” in the above search limited the results to 159 in ScienceDirect® and 9 in Scopus®, while “Covid-19” AND “emergent strategy” returned 30 articles in ScienceDirect and 9 from Scopus accordingly, findings which helped the primary recognition of the grounded area of this study, in terms of strategic changes due to Covid-19. Most of the extracted works emphasize the healthcare sector’s behavior during the pandemic and the application of methods for threat analysis. More specifically, Tsilonis et al. [16] applied the Strategic Alignment Maturity Model (SAMM) to several enterprises, to measure their maturity for strategic alignment before and after the pandemic. Sieber et al. [17] showed that the cultural features of the ICT use were crucial for strategic alignment during emergencies (like Covid-19). Wang et al. [18] utilized the concept of strategic synergy to calculate the benefits, the resources, and the appropriate technology under conditions of uncertainty, for project portfolio definition by an organization to structure a recovery plan from Covid-19 pandemic.

Furthermore, Heitzlhofer and Lackner [19] observed the strategic alignment between the strategic objectives of an organization, with the training and development activities during the Covid-19 outbreak. Dairo et al. [20] presented the application of the Strategic Alignment Model (SAM) on several organizations during the pandemic. Hou et al. [21] studied the work changes due to the Covid-19 pandemic in Dutch enterprises and they showed that they addressed two types of risk: management and work safety. Finally, Amankwah-Amoah et al. [22] showed that the pandemic reformed the interrelation between the market and the State, via growing

the gap between the enterprises that have political connections and those that do not have.

The above findings are based on scientific works that were published during the pandemic, which they mainly addressed the application of management methodologies (i.e., portfolio management, human resource management etc.) during emergencies, while in terms of strategic reform, the strategic alignment tools were investigated instead of the strategic change itself.

Bibliometric Analysis

The bibliometric analysis (BA) [23] was applied to analyze the pools of articles (bibtex files) that were extracted from Scopus® and Web of Science® databases and were presented in the previous section. The process took place during January and February 2023. BA is a systematic, transparent, and reproducible process based on statistical analysis of science, scientists, or the scientific activity of a specific subject. BA performs a structured analysis of a large body of information and identifies trends over time providing the "big picture" of the existing research. for the purposes of this BA the bibliometrix R-Tool® R Studio® using the R language®, which is an open-source tool for quantitative research and includes all the main bibliometric methods of analysis. The size of the analyzed data sources is mentioned in each of the performed analysis.

It is important to highlight that this study took place in early 2023, when existing publications referred mainly to the pandemic period and not to the post-pandemic period. Although this fact suggests a research limitation, it is an important strength of this article, since it collects the instant organizations' strategic responses and emergent strategies to the outbreak threat.

The BA's purpose was the answer of the RQ1, which requires the identification and mapping of the areas that need to be investigated (business DT strategic changes due to the pandemic); the highlighting of the central concepts and their chronological evolution; their correlation in groups (clusters); and the determination of concept trends. The BA was based on the following 3 searches:

- Covid-19 and strategy ("Covid-19" AND "strategy"): this search returned more than 50,000 articles in Scopus and more than 18,000 in Web of Science. The results were limited to the scientific area "Business, Management and Accounting" to avoid analysis of irrelevant works that deal with general subjects for health and humanity changes during the pandemic (Table 1) [15].

Table 1. Results for crawl "Covid-19" AND "strategy" [15].

Keywords	Scopus	Web of Science
"COVID-19" AND "strategy"	3621	1187

- Covid-19 and Business ("Covid-19" AND "business"): since this paper focuses on business strategic planning. This search returned more than 20,000 articles in Scopus and more than 24,000 articles in Web of Science, which were limited again to the scientific area "Business, Management and Accounting" (Table 2) [15].

Table 2. Results for crawl for Covid-19 and Business [15].

Keywords	Scopus	Web of Science
"COVID-19" AND "business"	10,980	19,660

- Covid-19 and City DT ("Covid-19" AND "city" AND "digital transformation"): to address city DT strategic changes. This crawl returned 60 articles in Scopus and more than 50 in Web of Science, and followed the broader search for city DT, to avoid the analysis of irrelevant works that do not address strategic changes that occurred due to the pandemic (Table 3) [15].

Table 3. Results for crawl "Covid-19" AND "city" AND "digital transformation" [15].

Keywords	Scopus	Web of Science
"city" AND "digital transformation"	1475	773
"COVID-19" AND "city" AND "digital transformation"	60	56

- Covid-19 and City ("Covid-19" AND "city"): to address city behavior during the pandemic. This crawl returned more than 600 articles in Scopus and more than 300 works in Web of Science (Table 4).

Table 4. Results for crawl "Covid-19" AND "city".

Keywords	Scopus	Web of Science
"COVID" AND "city"	663	376

- Covid-19 and Smart City ("Covid-19" AND "smart city"): to address SC utilization and response during the outbreak. This search returned more than 700 articles in Scopus and more than 200 in Web of Science (Table 5).

Table 5. Results for crawl “Covid-19” AND “smart city”.

Keywords	Scopus	Web of Science
“COVID” AND “smart city”	709	228

The R-Studio© bibliometrix library was used again, to perform the BA.

About the first collected pool of articles (“Covid-19” AND “strategy”) that was published between 2020–2023 from 9434 authors in 1105 sources, the concepts that are mainly discussed in the scientific papers in Scopus, concern decision-making and the role of humans in the face of the conditions of the pandemic (Figure 1). On the contrary, data from Web of Science (that was published the same period 2020–2023 from 3122 authors in 190 sources) is of particular interest since the evidence (Figure 2) [15]:

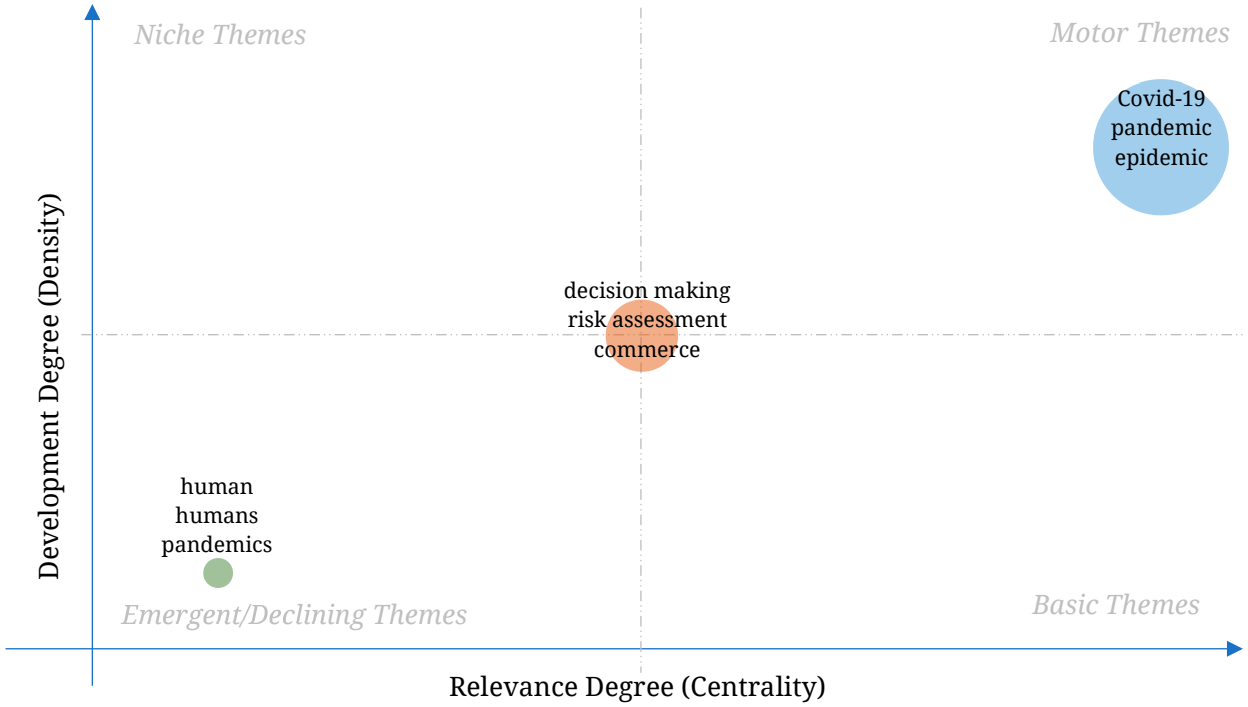

Figure 1. Concept trends extracted from Scopus (“Covid-19” AND “strategy”).

- Performance measurement models.
- Oil market and digital currency [bitcoin] change analysis.
- Strategies for sustainable organizations.
- Ethnocentric and new technology detection.

Moreover, the impact of Covid-19 on the organization strategy is highlighted, including risk analysis for decision making, performance measurement and human centricity (employee behavior job-satisfaction and work performance).

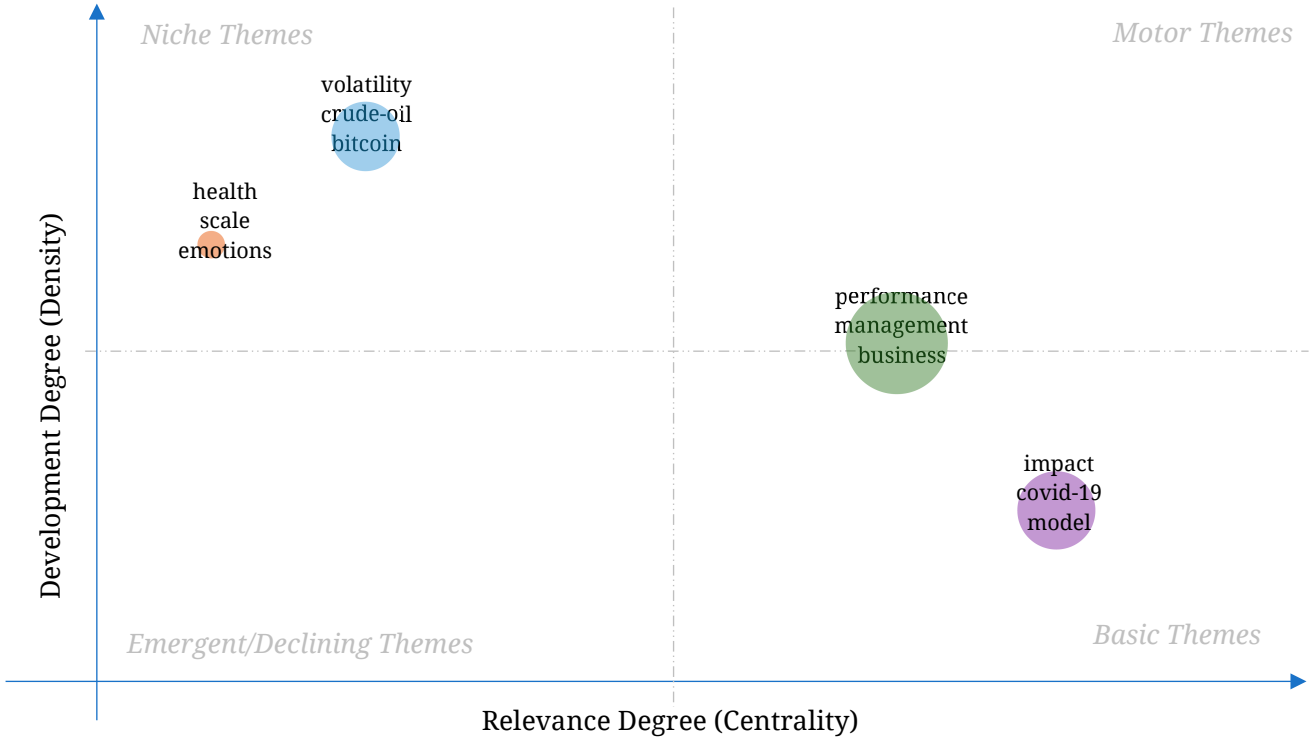

Figure 2. Concept trends extracted from Web of Science results' analysis ("Covid-19" AND "strategy").

Moreover, the analysis of the most cited articles in this collection, showed that in terms of strategic change, companies moved their production lines closer to their suppliers and to the points of high demand [24], developed corporate social responsibility, adopted flexible marketing strategies to create new markets and digitally transformed themselves by identifying new digital markets and products [25]. Moreover, Donthu and Gustaffson [24] noticed a consumers' behavior change to skills' uptake about health, while they record business growth in digital and health economies. Additionally, Wenzel et al. [26] define four strategic response tactics: retrenchment of their size and assets; persevering via risk transfer and move to local markets; innovation on digital platforms and products; and exit via shutting down. Kirk and Rifkin [27] on the other hand, analysed consumer behaviour and determined that after the outbreak they will focus on balancing work and personal life. Finally, Gössling [28] determined the following DT strategies for tourist enterprises: capitalization; shutting down; immersion in digital worlds; and usurpation.

The analysis of the second pool of articles ("Covid-19" AND "business") identified concepts from Scopus concern business resilience, sustainability and performance in the face of the pandemic and firms' workplace changes (i.e., new forms of work and telework) [15] (Figure 3).

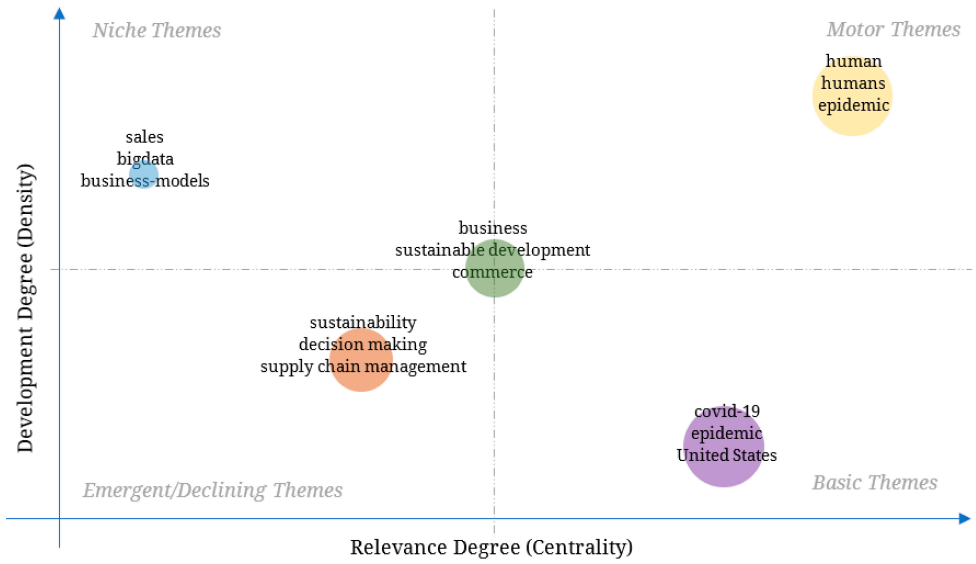

Figure 3. Concept trends extracted from Scopus results' analysis ("Covid-19" AND "business").

On the other hand, the analysis of the Web of Science's pool of articles highlights models for measuring the impact of the pandemic on human mental health, on workplace and on corporate social-responsibility. Moreover, time series, and models for demand estimation (e.g., for hospital beds, goods, energy, etc.) or for population movements and for household savings have been identified from the same analysis [15]. (Figure 4).

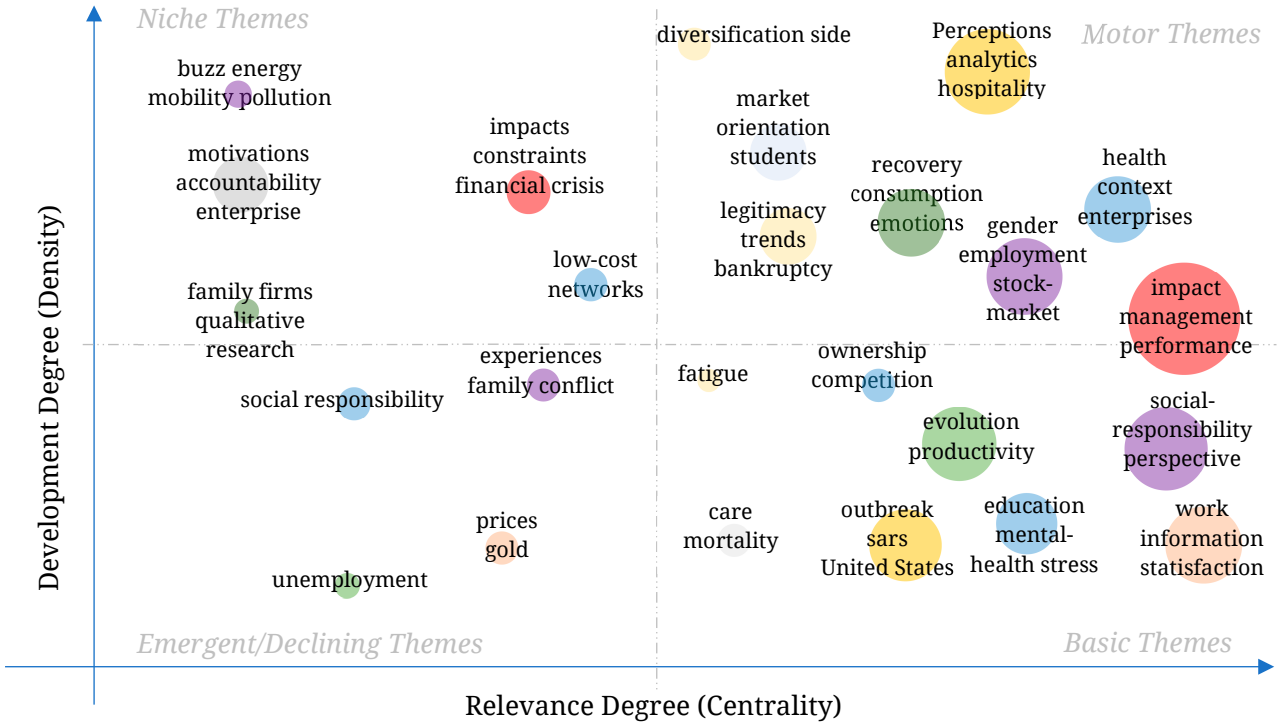

Figure 4. Concept trends extracted from Web of Science results' analysis ("Covid-19" AND "business"). Note: some trends were excluded from the figure for clarity purposes.

Furthermore, the most cited articles summarize that in terms of strategic updates [15], firms experienced liquidity problems and they tried to secure public funding as an instant response, while in the long term they moved their production sites closer to their customers [24,28]. In addition, after the "shock" from the pandemic, businesses performed structural changes and improved public health standards, followed greater digitization pathways and requested access to open innovation and knowledge, but they also adopted more sustainable business models. Moreover, Gössling and Schweiggart [29] concluded that regardless the shutting down of tourism during the pandemic, climate crisis remained. Zhang et al. [30] and Baker et al. [31] analysed markets' uncertainties and government financial support, and noticed variances among countries, based on policy making and on the outbreak's size, while Goodell [32] recorded money savings and insurance growth. Additionally, Nicola et al. [33] determined job losses and new entrants in digital and health economies. Furthermore, Bartik et al. [34] recorded liquidity problems, which obliged businesses to ask for government assistance (i.e., the Coronavirus Aid, Relief, and Economic Security (CARES)). Finally, Wojnicka-Sycz et al. [35] determined that businesses performed extensive digitization and focused on open innovation and sustainable business models.

The third collected pool of articles merged two subsets: one about city DT ("city" AND "digital transformation") and one focusing on the outbreak ("Covid-19" AND "city" AND "digital transformation"). The outcomes that were extracted from 1713 documents, were published by 4932 scholars in 967 sources and highlighted concepts in Scopus regarding the utilization of ICT-based innovation (i.e., AI-based sprawl predictions) to deal with the pandemic, and digital upskilling (Figure 5).

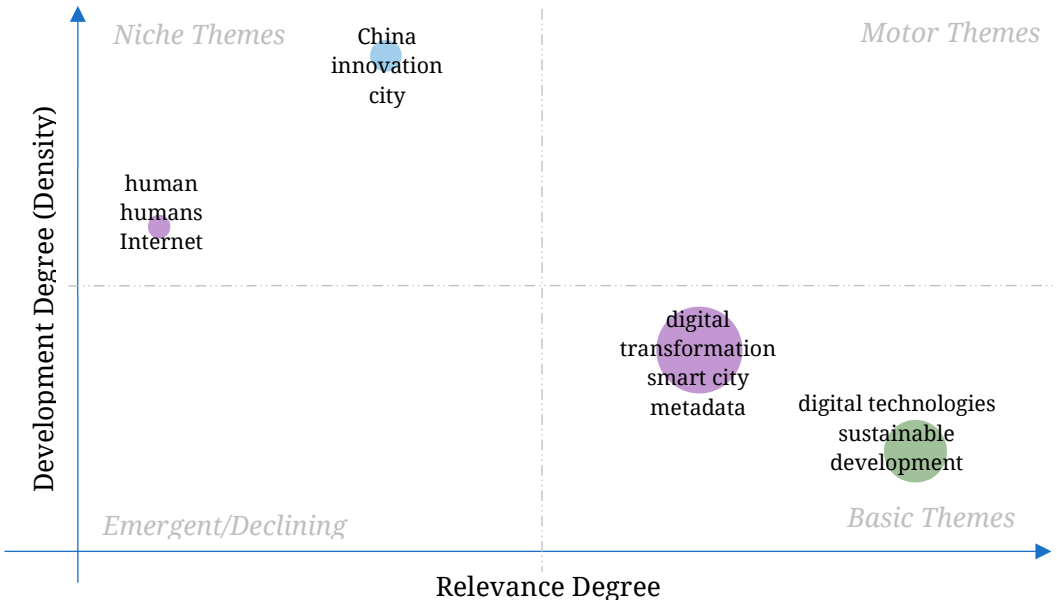

Figure 5. Concept trends in Scopus ("Covid-19" AND "city" AND "digital transformation").

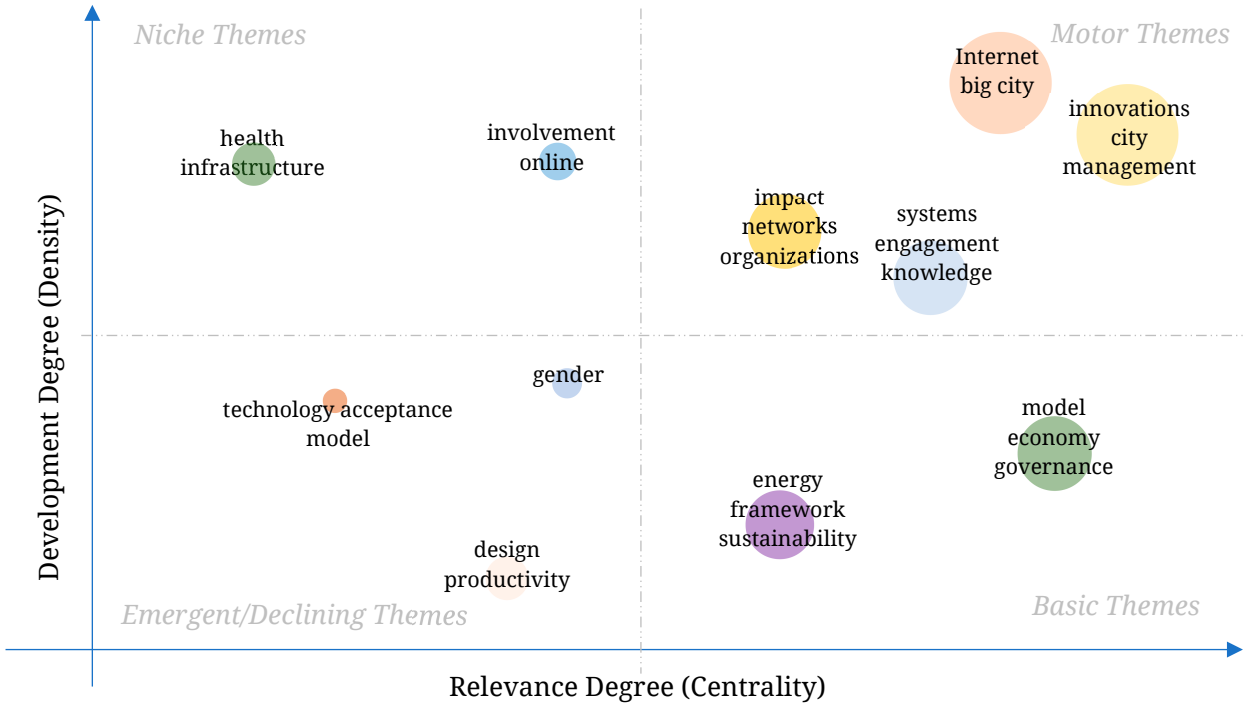

Figure 6. Concept trends extracted from Web of Science results' analysis ("Covid-19" AND "city" AND "digital transformation").

On the other hand, the main concepts that were extracted from the Web of Science pool of articles, address ICT innovation for city efficiency (i.e., in terms of health and energy) and for community engagement (Figure 6).

Moreover, findings from the analysis of the most cited articles show that DT in cities enhance the produced values, improve strategic responses, while the cities become a digital service provider that generates new types of value (i.e., efficient, and new digital services) [36]. Verhoef et al. [37] and Livari et al. [38] conclude that cities utilize digital platforms for data provision and for service co-creation with the community. Soto-Acosta [39] determined that the pandemic accelerated the digitization of the supply chains and cross-border service delivery, while the cities utilized the ICT for innovation co-creation. Priyono et al. [40] showed that cities follow alternative DT paths according to their digital maturity: more matured cities accelerated their transformation during the pandemic, while the less matured ones focused on the DT of their supply chains. Finally, Fletcher και Griffiths [41] proved that DT enhances city resilience against several types of emergencies, including the pandemics.

The BA was applied again to explore the impact of the pandemic on cities ("Covid-19" AND "city"), since the collected number of articles that was published between 2021–2023 was extensive (866 works after the removal of duplicates). These articles were published by 3005 authors in 566 sources, and the concepts that were mainly discussed in the scientific papers in Scopus and Web of Science, concern the DT's importance and the application of emerging technologies (i.e., AI, big data and IoT etc.) on health (Figure 7

and Figure 8). Moreover, issues like DT management (management of innovation, of Internet and of impact) and governance (e-government, city community government, decision making and involvement) and adoption models (absorptive capacity) were discussed, together with digital upskilling education methods. Subjects of lower interest concern health-related issues in cities (health infrastructure, allergic rhinitis, chronic diseases) and urban challenges (energy, sustainability, and growth).

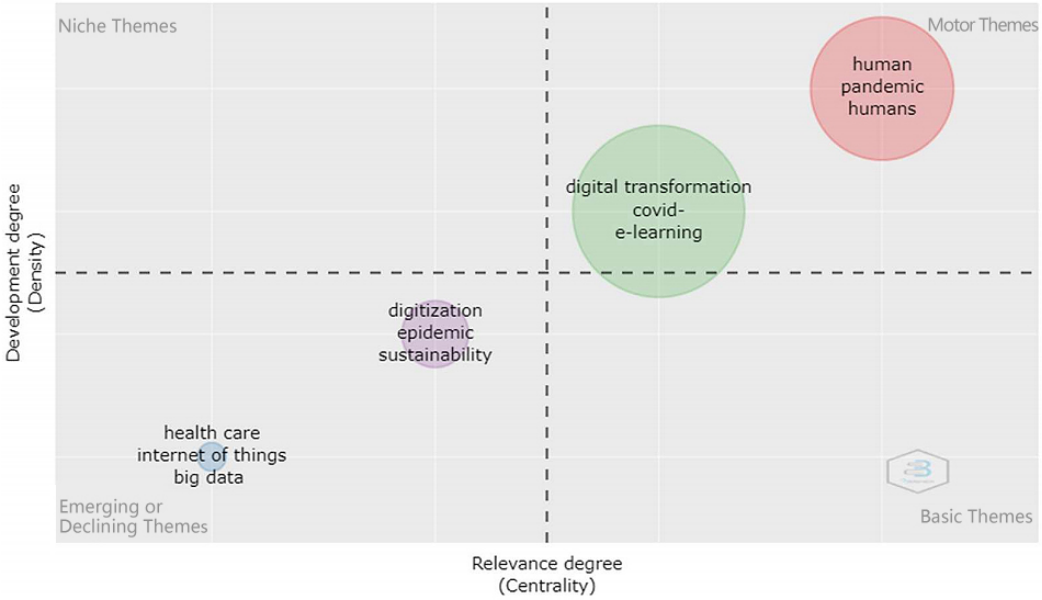

Figure 7. Concept trends extracted from Scopus results' analysis ("Covid-19" AND "city digital transformation").

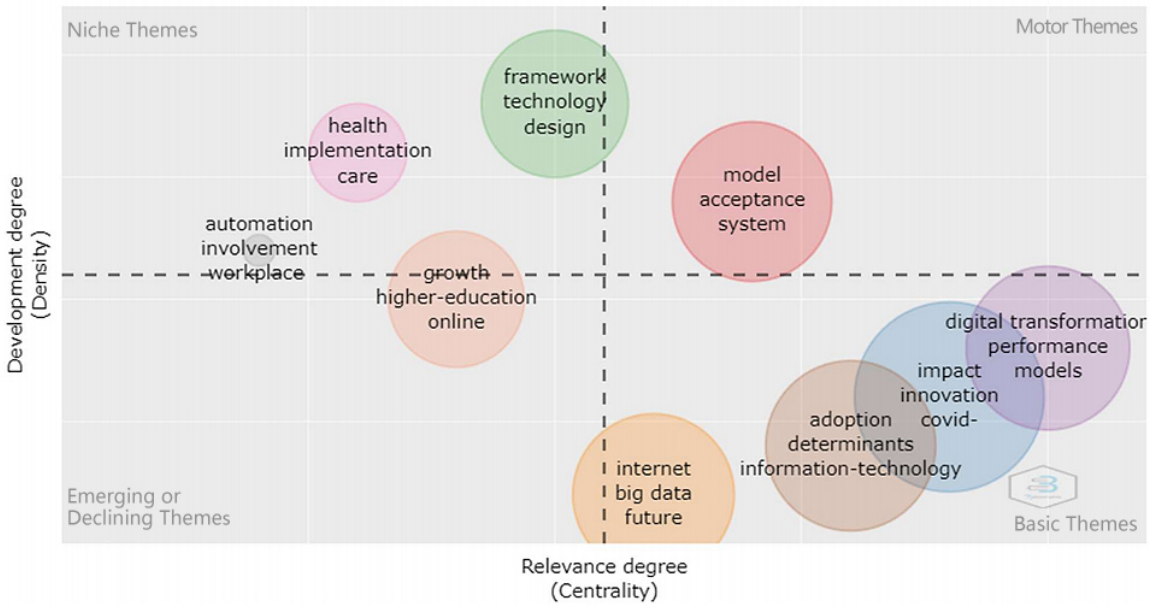

Figure 8. Concept trends extracted from Web of Science results' analysis ("Covid-19" AND "city digital transformation").

Moreover, the analysis of the most cited articles delivers cumulative findings: innovative business models (market and product portfolio models, and multi-sided platform business model) were applied during the pandemic and contributed to new value generation from the creative economy in cities [42]. Additionally, the local governments were obliged to trust the ICT during the outbreak in their attempts to deal with economic, social, and environmental challenges [43]. In terms of waste management, AI was utilized to predict garbage collection points and enhance the waste utility performance [44]. Finally, a code of ethics was explored for city DT (digital connectivity, algorithmization and datafication) by Calvo [45], who claimed that both the citizen engagement and privacy rights are required during the service co-creation.

Regarding the last pool of articles ("Covid-19" AND "smart city"), two extracted datasets were merged: 702 articles that were published in 384 sources during 2019–2023, by 1960 authors from Scopus; and 228 articles that were published in 136 sources during 2020–2024, by 761 authors from Web of Science. The identified concepts (Figure 9 and Figure 10) deal with DT's adoption by the community (user acceptance and perceived ease), as well as issues about management of the pandemic (management Covid-19, social vulnerability, care) and of space. Some more trends—but with less importance—were also identified, regarding health and the city (urbanization and congestion), together with quality of life's issues (physical activity, CO_2 emissions).

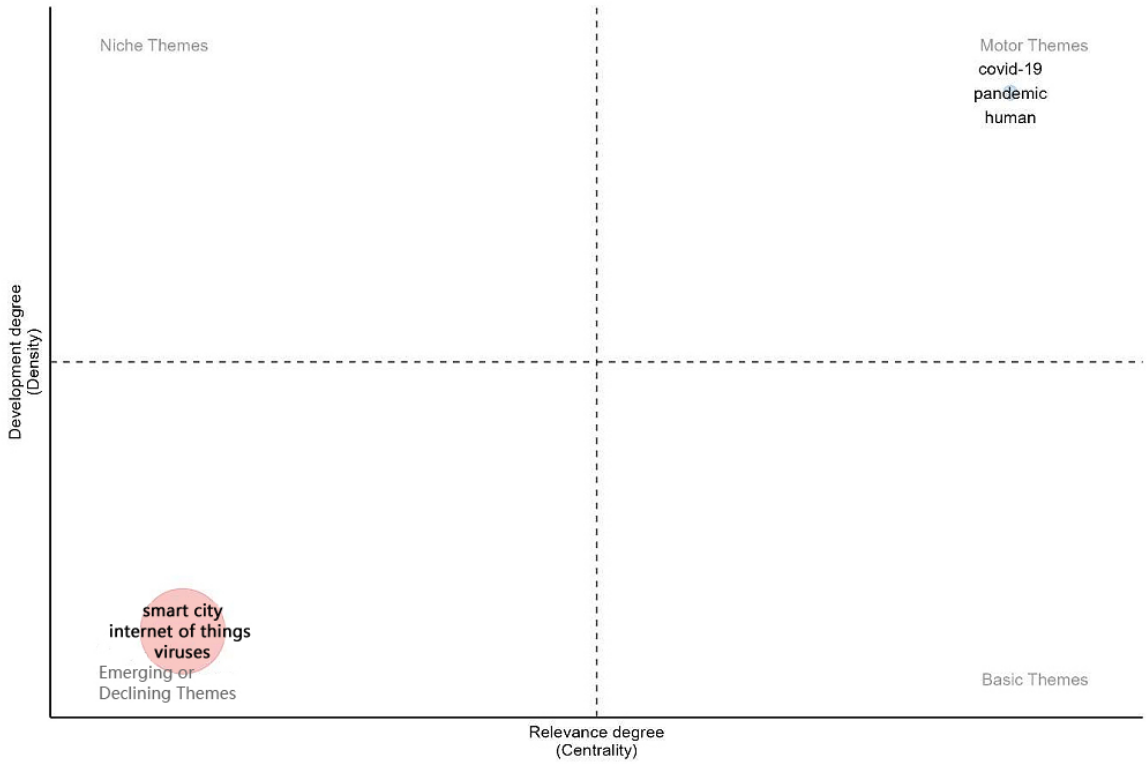

Figure 9. Concept trends extracted from Scopus results' analysis ("Covid-19" AND "city digital transformation").

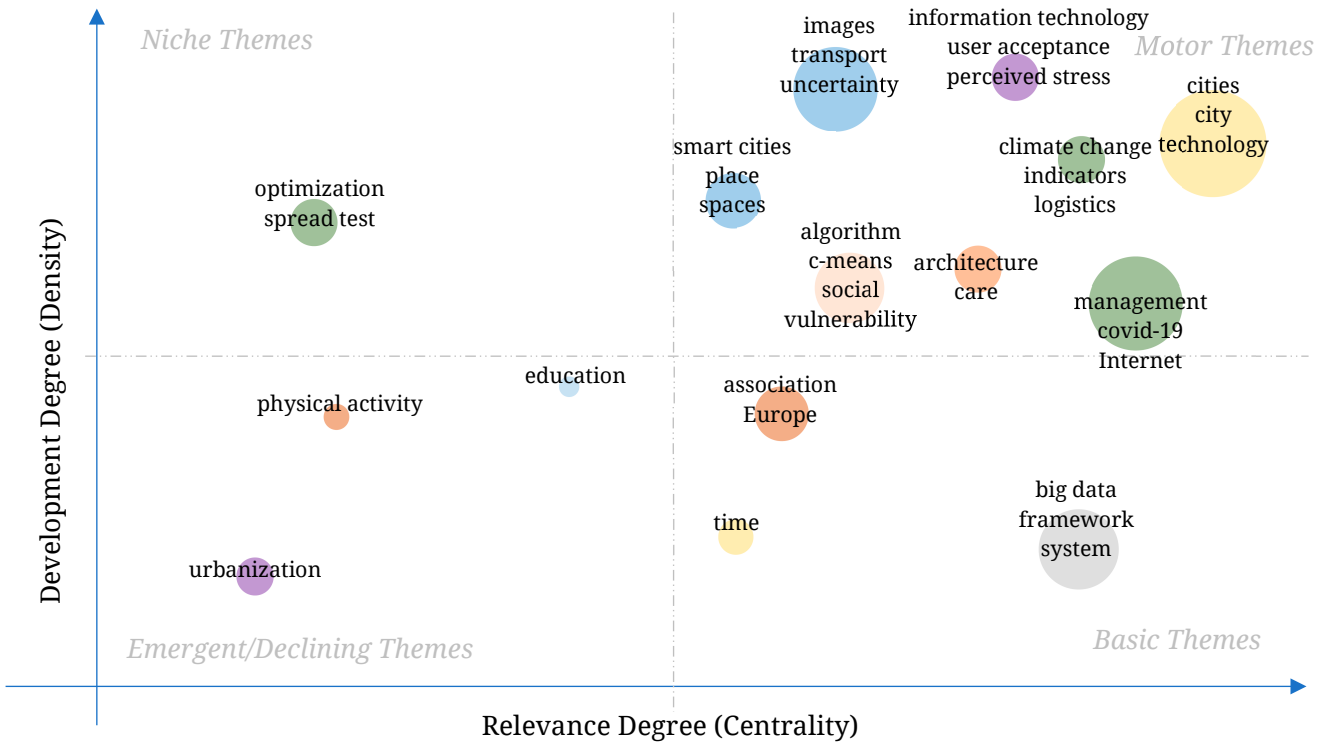

Figure 10. Concept trends extracted from Web of Science results' analysis ("Covid-19" AND "city digital transformation"). Note: some trends were excluded from the figure for clarity purposes.

Finally, the analysis of the most cited articles highlighted the importance for cities to perform risk estimation and raise early warnings against emergencies [46–48]. Moreover, the crucial role of the emerging ICT (online learning, digital strategy, AI, information management, social interaction, cyber security, big data, blockchain, privacy, and mobile technology) during the pandemic in cities was justified [49].

On the other hand, the impact of the pandemic on the DT of local supply chains—especially the ones of high demand—was explored [50,51] and three resilient strategies (preparedness, response, and mitigation) were extracted [52]. Local businesses also affected by the pandemic and were digitally transformed, while they showed agility in terms of adopting new work forms [53].

Finally, city behavior during the pandemic was investigated by several scholars, who noticed emission reduction due to the lockdowns [54] and performance changes in mobility [51], waste management [55] and vulnerable community difficulties [56]. On the other hand, the necessity for data-driven management of the pandemic was discussed [57,58], while the capacity for city recovery was estimated with means of an increased government force and of virtual tourism [59].

Bibliometric Analyses Results

The previously performed BAs generated a collection of useful outcomes that can be aggregated and discussed. The analysis of strategic

changes due to the pandemic ("Covid-19" AND "strategy") highlighted organizational sustainability in terms of strategic responses (risk management, decision-making, performance measurement), emerging technologies (AI, bigdata, crypto-currency etc.) and the role of humans (behavior, job-satisfaction, and performance).

Similar findings were extracted in terms of business changes during the pandemic ("Covid-19" AND "business"). The results depicted again resilience and sustainability as motor themes for businesses, and people in the workplace (i.e., human health, new forms of work and telework) together with social responsibility.

The analysis of the most cited articles in both the above data sources showed that in terms of strategic updates, companies in the short-term experienced liquidity problems, so they tried to secure funding from public sources, while in the long term they reviewed their supply chains by moving their production lines closer to their suppliers and to areas of higher consumer demand. Moreover, they adopted flexible marketing techniques, while their DT strategies focused on new digital markets and products.

On the other hand, city's DT responses to the pandemic ("city" AND "digital transformation" AND "Covid-19") highlighted the utilization of ICT-based innovation and emerging ICTs for city efficiency (i.e., AI-based sprawl predictions) and for community health, and digital upskilling to engage citizens in this transformation.

Moreover, the most cited articles in this pool of articles discussed city DT to enhance their resilience and the produced values (i.e., new digital services and new business models), to improve strategic responses, and to become digital service providers. In addition, the local governments were obliged to trust the ICT during the outbreak in their attempts to deal with economic, social, and environmental challenges.

Finally, SC in the face of the pandemic ("Covid-19" AND "smart city") uncovered DT's adoption by the community and pandemic management. Some less important trends deal with community health and quality of life.

The most cited articles of this collection highlighted the role of emerging ICT during the pandemic and the importance of risk estimation and early warning release against emergencies. Cities applied increased government forces, utility management with the ICT and sector DT (i.e., virtual tourism) for their recovery from the pandemic. Additionally, three resilient strategies (preparedness, response, and mitigation) were adopted by the DT of local supply chains. These outcomes comply with the findings of other more recent studies like [60], while they also address some of the legal aspects of the investigated subject [61], regarding health and safety at work, social responsibility, and surveillance and privacy etc.

The Intelligent Cities Challenge (ICC)

The ICC was a large-scale European initiative that launched by the European Committee before the pandemic in 2019 to assist 122 selected

European cities defining and developing their DT strategies [2]. The ICC asked the participating cities to define their priorities in compliance with the European Green Deal, the European Bauhaus and the Upskilling and Reskilling common European strategies. Due to the outbreak, the cities participated remotely in the project activities (teleconferences, virtual rooms, and remote training), while only 80 (the 65.5 percent of them), located in 20 member States, managed to complete the project. The analysis of their initial visions shows that only 12 cases had defined a vision relative to public health or the pandemic (Table 6) [15].

Table 6. Strategic visions relative to public health or the pandemic*.

ID	Strategic vision
1	Healthy and sustainable city.
2	Resilient regional economy.
3	Responsible and efficient resource and environmental management".
4	A European reference on green economy.
5	Resilient and livable city.
6	Cultural and sustainable city.
7	Inclusive and transparent city government.
8	Sustainable transportation in the city.
9	Coherent community at neighborhood level.
10	Active ageing and care provision.
11	Transformation City, Resilient City.
12	Resilient City.

* Visions are not associated with the city for project anonymity requirements.

By the project completion, none of the 80 participants revised its strategic vision due to the pandemic, which can be justified by the fact that the ICC did not authorize emergent strategic planning and corresponding revisions. Moreover, only the cities with relative vision statements launched initiatives that respected the outbreak (Table 7), which questions their ability to associate their DT with the city's potential to deal with future emergencies.

Table 7. City initiatives that respected the pandemic*.

ID	Description of The Solution	Title/Label of the Solution	Link to Vision
1	Intelligent video surveillance with AI. Automatic number plate reading (ANPR). Emergency call points. Mobile Apps for the Municipal Police. Drone unit for the Municipal to detect illegal activities.	Safe city	Healthy and sustainable city.
2	Active ageing and care provision with innovative technology.	Home assistance system (in consortium with Torrent's city).	Resilient Regional Economy.

Table 7. *Cont.*

ID	Description of The Solution	Title/Label of the Solution	Link to Vision
3	Zero emissions. Water management. Waste management.	Sustainable city.	European reference on green economy.
4	Local energy communities and municipal self-consumption.	Towards energy self-sufficient municipalities.	European reference on green economy
5	Integrate policy making and public money with the private sector.	Innovation district.	Resilient and livable city.
6	Risk management information system.	Business and citizens digital platforms.	Cultural and sustainable city.
7	Actions to attract visitors after COVID-19 restrictions. Digital upskilling. Smart open mall.	Smart tourism.	Inclusive and transparent city government.
8	Telecare smart services.	Home assistance system.	Active ageing and care provision.
9	Green and circular economy for city branding.	Image of green city.	Transformation city, resilient city.
10	Big data analytics for climate resilience.	Resilient data driven.	Resilient city.

* Initiatives are not associated with the city for project anonymity requirements.

CONCLUSIONS

This paper questioned the potential changes that the Covid-19 pandemic caused to the organizations' DT strategies. More specifically, this article observed a rapid DT of all human and business activities during the pandemic, and it grounded two research questions: the first research question (RQ1) addressed the emergent DT strategies on the business ecosystem that the crisis caused, while the second research question (RQ2) concerned city emergent DT strategies against the same crisis.

A multi-method research methodology was followed, and literature evidence, which mainly published during the pandemic, highlighted management methodologies that were applied during the outbreak, while in terms of DT strategic reform, the strategic alignment tools were uncovered instead of strategic changes or emergent strategies that the pandemic caused to the organizations.

BA findings can be considered limited since most articles were based on data that were collected during the pandemic, which however was the purpose of this work: to highlight the emergent strategies and to avoid depicting clear post-pandemic understandings. Moreover, some important trends have been extracted that provide with answer the RQs. More specifically, the analysis on the impact of the emergency on the local business ecosystem DT strategies showed that the enterprises adopted agile marketing techniques for their entrance to new digital markets and for the development of new digital products. Additionally, the enterprises

prioritized their DT and the definition of sustainable business models. Furthermore, they adopted emerging ICT (i.e., AI, bigdata and analytics) to measure organizational performance and predict market demands. These findings provide with answer the RQ1.

Beyond answering the RQ1, the BAs depicted some more DT strategic changes that the businesses performed to ensure their sustainability against emergencies, including the transformation of their supply chains and the migration of their production lines closer to their suppliers and to their consumers. Moreover, the analysis of strategic changes due to the pandemic highlighted the requirements for organizational sustainability, which can be established with successful strategic responses that follow careful risk analyses, decision-making and performance measurement, which are based on the adoption of emerging technologies and the prioritization of the human capital at work.

About the second research question (RQ2), BA findings showed that the cities are being transformed to smart service providers and generate new types of digital values, via digital platforms and service co-creation with their citizens. During the emergency the cities utilized their digital assets to share knowledge with innovation producers, they focused on their communities' digital upskilling, while they adopted cutting-edge ICT (i.e., AI, big data and IoT) to enhance their utility services. Moreover, the cities recognized the importance of their DT for enhancing their resilience, they rapidly trusted the ICT and encouraged the development of ethical ecosystems. These findings were extracted regardless the fact that cities had launched DT strategies before the outbreak. On the contrary, the evidence from the ICC showed that only the 65.5 (80 out of the 122 cities) percent of the participating cities completed the definition of their DT strategies, none proceeded to emergent DT strategy in the face of the pandemic, while only the 15 percent of them (12 out of the 80 cities) prioritized objectives relative to the emergency or launched corresponding initiatives. The defined projects represent some ICT-based measures against the pandemic (i.e., digital surveillance, smart tourism etc.). These findings provide with answer the RQ2.

It is expected that the above outcomes can be utilized for future estimations about business and city responses to crises like the outbreak. However, no clear causality between crises—like the pandemic—and DT strategies was identified with this study, which was beyond the purposes of this article. Bibliometrics analysis alone cannot prove such a causal relationship between the pandemic and emergent DT strategies of cities and of their ecosystems. Additionally, the evidence of the ICC was not enough to prove such a causal relationship. More in-depth studies are needed to empirically prove the issue, which can generate future thoughts of this work. Additionally, some future thoughts for this work concern the collection and analysis of updated literature evidence about the post-pandemic period, which can be compared and validate whether this article's outcomes remained, or the organizations (businesses and cities)

followed different DT strategic directions than the ones that were highlighted in this study.

DATA AVAILABILITY

All data generated from the study are available in the manuscript or supplementary files.

AUTHOR CONTRIBUTIONS

Conceptualization, CZ and LA; methodology, CZ, AT and LA; software, CZ and AT; validation, CZ, AT and LA; formal analysis, CZ and LA; investigation, CZ, AT and LA; resources, CZ and LA; data curation, CZ and LA; writing—original draft preparation, CZ; writing—review and editing, CZ and LA; visualization, CZ and AT; supervision, LA; project administration, LA. All authors have read and agreed to the published version of the manuscript.

CONFLICTS OF INTEREST

The authors declares that they have no conflicts of interest.

ACKNOWLEDGMENTS

Some evidence of this article has been produced under an MSc thesis entitled “City Digital Transformation and Covid-19” that was developed under the MSc in Agile Management, University of Thessaly, Greece. Moreover, some evidence was collected via the participation of the authors in the Intelligent Cities Challenge (ICC) initiative on behalf of the city of Trikala, Greece.

The research project was supported by the Hellenic Foundation for Research and Innovation (H.F.R.I.) under the “2nd Call for H.F.R.I. Research Projects to support Faculty Members & Re-searchers” (Project Number: 2652).

REFERENCES

1. McKinsey & Company. Looking beyond the pandemic: Could the world economy gain more than it lost to COVID-19? Available from: https://www.mckinsey.com/capabilities/strategy-and-corporate-finance/our-insights/beyond-the-pandemic-eight-charts-on-covid-19-and-the-next-phase-of-global-economic-growth#. Accessed 2022 Mar 20.
2. European Commission. Intelligent Cities Challenge: Guide for Applicants. Available from: https://www.intelligentcitieschallenge.eu/sites/default/files/2020-03/ICC%20Applicant%20Guidlines_17032020.pdf. Accessed 2022 Feb 10.
3. Snowden F. Epidemics and Society. New Haven (US): Yale University Press; 2019.
4. Morse SA, Kocik J. Preventing Emerging Infectious Diseases: Epidemiology and Laboratory Capacity Support. In: Kocik J, Janiak M, Negut M, editors.

Preparedness Against Bioterrorism and Re-Emerging Infectious Diseases. Amsterdam (Netherlands): IOS Press; 2004. p. 17-25.
5. Gong Y, Yang Y, Shi X. Towards a comprehensive understanding of digital transformation in government: Analysis of flexibility and enterprise architecture. Gov Inform Q. 2020;37(3):101487.
6. United Nations. Demographic Yearbook 2005. Available from: http://unstats.un.org/unsd/demographic/sconcerns/densurb/Defintion_of%20Urban.pdf. Accessed 2023 Jun 10.
7. International Standards Organization (ISO). ISO 37120:2014: Sustainable Development of Communities—Indicators for City Services and Quality of Life. Available from: https://share.ansi.org/ANSI%20Network%20on%20Smart%20and%20Sustainable%20Cities/ISO%2B37120-2014_preview_final_v2.pdf. Accessed 2023 Jun 10.
8. International Standards Organization (ISO). Sustainable Development in Communities. Available from: http://www.iso.org/iso/iso_37101_sustainable_development_in_communities.pdf. Accessed 2023 Jun 10.
9. International Standards Organization (ISO). Smart cities Preliminary Report. Available from: http://www.iso.org/iso/smart_cities_report-jtc1.pdf. Accessed 2023 Jun 10.
10. International Telecommunications Union (ITU). Smart sustainable cities: An analysis of definitions. Available from: www.itu.int/en/ITU-T/focusgroups/ssc/Documents/Approved_Deliverables/TR-Definitions.docx. Accessed 2022 Mar 20.
11. Anthopoulos LG. Understanding Smart Cities—A tool for Smart Government or an Industrial Trick? Cham (Switzerland): Springer International Publishing; 2017.
12. Lysons K, Farrington B. Purchasing and Supply Chain Management. Hoboken (US): Prentice Hall Publishing; 2006.
13. Hertz H. So What Is Strategic Alignment? Available from: https://www.nist.gov/blogs/blogrige/so-what-strategic-alignment. Accessed 2022 Mar 24.
14. Moncrief J. Is strategy making a difference? Long Range Plan. 1999;32(2):273-6.
15. Anthopoulos L, Ziozias C. Business Digital Transformation Strategic Changes During the Covid-19 Pandemic: findings from Bibliometric Analysis. Available from: https://ieeexplore.ieee.org/abstract/document/10442868. Accessed 2024 Jul 25.
16. Tsilonis T, Wautelet Y, Martinet D. Evaluating the Impact of the Covid-19 Pandemic on the Strategic Alignment Competences of Organizations: A Case Study in Logistics. In: Visvizi A, Troisi O, Grimaldi M, editors. The Springer Proceedings in Complexity. Cham (Switzerland): Springer; 2023. p. 631-43.
17. Sieber MR, Russ C, Kurz K. Organizational Culture and Business-IT Alignment in COVID-19: A Swiss Higher Education Case Study. Int J Innov Technol Manage. 2023;20(3):2242004.
18. Wang Z, Esangbedo MO, Bai S. Project portfolio selection based on multi-project synergy. J Ind Manag Optim. 2023;19(1):117-38.

19. Heitzlhofer U, Lackner K. How the digital world turned us into narcissistic multitaskers.": Ulrich Heitzlhofer on experiences from personnel development work during the COVID-19 crisis. Z Angew OrganisationsPsychol. 2022;53(1):125-9.
20. Dairo M, Adekola J, Apostolopoulos C, Tsaramirsis G. Benchmarking strategic alignment of business and IT strategies: opportunities, risks, challenges and solutions. Int J Inf Technol. 2021;13(6):2191-7.
21. Hou H, Remøy H, Jylhä T, Vande Putte H. A study on office workplace modification during the COVID-19 pandemic in The Netherlands. J Corp Real Estate. 2021;23(3):186-202.
22. Amankwah-Amoah J, Khan Z, Wood G. COVID-19 and business failures: The paradoxes of experience, scale, and scope for theory and practice. Eur Manag J. 2021;39(2):179-84.
23. Donthu N, Kumar S, Debmalya M, Nitesh P, Weng Marc L. How to conduct a bibliometric analysis: An overview and guidelines. J Bus Res. 2021;133:285-96.
24. Donthu N, Gustafsson A. Effects of COVID-19 on business and research. J Bus Res. 2020;117:284-9.
25. He H, Harris L. The impact of Covid-19 pandemic on corporate social responsibility and marketing philosophy. J Bus Res. 2020;116:176-82.
26. Wenzel M, Stanske S, Lieberman MB. Strategic responses to crisis. Strat Mgmt J. 2020;41:V7-18.
27. Kirk CP, Rifkin LS. I'll trade you diamonds for toilet paper: Consumer re-acting, coping and adapting behaviors in the COVID-19 pandemic. J Bus Res. 2020;117:124-31.
28. Gössling S. Tourism, technology and ICT: a critical review of affordances and concessions. J Sustain Tour. 2021;29(5):733-50.
29. Gössling S, Schweiggart N. Two years of COVID-19 and tourism: what we learned, and what we should have learned. J Sustain Tour. 2022;30(4):915-31.
30. Zhang D, Hu M, Ji O. Financial markets under the global pandemic of COVID-19. Financ Res Lett. 2020;36:101528.
31. Baker SR, Bloom N, Davis SJ, Sammon M, Viratyosin T. The Unprecedented Stock Market Reaction to COVID-19. Rev Asset Pricing Stud. 2020;10:742-58.
32. Goodell JW. COVID-19 and finance: Agendas for future research. Financ Res Lett. 2020;35:101512.
33. Nicola M, Alsafi Z, Sohrabi C, Kerwan A, Al-Jabir A, Iosifidis C, et al. The socio-economic implications of the coronavirus pandemic (COVID-19): A review. Int J Surg. 2020;78:185-93.
34. Bartik AW, Bertrand M, Cullen Z, Glaeser EL, Luca M, Stanton C. The impact of COVID-19 on small business outcomes and expectations. P Natl Acad Sci USA. 2020;117(30):17656-66.
35. Wojnicka-Sycz E, Piróg K, Tutaj J, Walentynowicz P, Sycz P, TenBrink C. From adjustment to structural changes—innovation activity of enterprises in the time of COVID-19 pandemic, Innovation. Eur J Soc Sci Res. 2022;1-26. doi: 10.1080/13511610.2022.2036951
36. Vial G. Understanding digital transformation: A review and a research Agenda. J Strategic Inf Syst. 2019;28:118-44.

37. Verhoef PC, Broekhuizen T, Bart Y, Bhattacharya A, Dong JQ, Fabian N, et al. Digital transformation: A multidisciplinary reflection and research agenda. J Bus Res. 2021;122:889-901.
38. Livari N, Sharma S, Ventä-Olkkonen L. Digital transformation of everyday life—How COVID-19 pandemic transformed the basic education of the young generation and why information management research should care? Int J Inform Manage. 2020;55:102183.
39. Soto-Acosta P. COVID-19 Pandemic: Shifting Digital Transformation to a High-Speed Gear. Inform Syst Manage. 2020;37(4):260-6.
40. Priyono A, Moin A, Oktaviani Putri VNA. Identifying Digital Transformation Paths in the Business Model of SMEs during the COVID-19 Pandemic. J Open Innov Technol Mark Complex. 2020;6(4):104.
41. Fletcher G, Griffiths M. Digital transformation during a lockdown. Int J Inform Manage. 2020;55:102185.
42. Li F. The digital transformation of business models in the creative industries: A holistic framework and emerging trends. Technovation. 2020;92:102012.
43. Barrutia JM, Echebarria C. Effect of the COVID-19 pandemic on public managers' attitudes toward digital transformation. Technol Soc. 2021;67:101776.
44. Maiurova A, Kurniawan TA, Kustikova M, Bykovskaia E, Othman MHD, Singh D, et al. Promoting digital transformation in waste collection service and waste recycling in Moscow (Russia): Applying a circular economy paradigm to mitigate climate change impacts on the environment. J Clean Prod. 2022;354:131604.
45. Calvo P. The ethics of Smart City (EoSC): moral implications of hyperconnectivity, algorithmization and the datafication of urban digital society. Ethics Inf Technol. 2020;22:141-9.
46. Dryhurst S, Schneider CR, Kerr J, Freeman ALJ, Recchia G, van der Bles AM, et al. Risk perceptions of COVID-19 around the world. J Risk Res. 2020;23(7–8):994-1006.
47. Tuli S, Tuli S, Tuli R, Gill SS. Predicting the growth and trend of COVID-19 pandemic using machine learning and cloud computing. Internet Things. 2020;11:100222.
48. Allam Z, Jones DS. On the Coronavirus (COVID-19) Outbreak and the Smart City Network: Universal Data Sharing Standards Coupled with Artificial Intelligence (AI) to Benefit Urban Health Monitoring and Management. Healthcare. 2020;8(1):46.
49. Dwivedi YK, Hughes DL, Coombs C, Constantiou I, Duan Y, Edwards JS, et al. Impact of COVID-19 pandemic on information management research and practice: Transforming education, work and life. Int J Inform Manage. 2020;55:102211.
50. Belhadi A, Kamble S, Jabbour CJC, Gunasekaran A, Ndubisi NO, Venkatesh M. Manufacturing and service supply chain resilience to the COVID-19 outbreak: Lessons learned from the automobile and airline industries. Technol Forecast Soc Change. 2021;163:120447.

51. Abu-Rayash A, Dincer I. Analysis of mobility trends during the COVID-19 coronavirus pandemic: Exploring the impacts on global aviation and travel in selected cities. Energy Res Soc Sci. 2020;68:101693.
52. Chowdhury P, Paul SK, Kaisar S, Moktadir MA. COVID-19 pandemic related supply chain studies: A systematic review. Transport Res E Log. 2021;148:102271.
53. Pantano E, Pizzi G, Scarpi D, Dennis C. Competing during a pandemic? Retailers' ups and downs during the COVID-19 outbreak. J Bus Res. 2020;116:209-13.
54. Adam MG, Tran PTM, Balasubramanian B. Air quality changes in cities during the COVID-19 lockdown: A critical review. Atmos Res. 2021;264:105823.
55. Chauhan A, Jakhar SK, Chauhan C. The interplay of circular economy with industry 4.0 enabled smart city drivers of healthcare waste disposal. J Clean Prod. 2021;279:123854.
56. Pineda VS, Corburn J. Disability, Urban Health Equity, and the Coronavirus Pandemic: Promoting Cities for All. J Urban Health. 2020;97(3):336-41.
57. Allam Z, Jones DS. Pandemic stricken cities on lockdown. Where are our planning and design professionals [now, then and into the future]? Land Use Policy. 2020;97:104805.
58. Shorfuzzaman M, Hossain MS, Alhamid MF. Towards the sustainable development of smart cities through mass video surveillance: A response to the COVID-19 pandemic. Sustain Cities Soc. 2021;64:102582.
59. Kunzmann KR. Smart Cities After Covid-19: Ten Narratives. Disp. 2020;56(2):20-31.
60. Kaššaj M, Peráček T. Synergies and Potential of Industry 4.0 and Automated Vehicles in Smart City Infrastructure. Appl Sci. 2024;14(9):3575.
61. Nekit K, Kolodin D, Fedorov V. Personal data protection and liability for damage in the field of the internet of things. Jurid Trib. 2020;10(1):80-93.

How to cite this article:
Ziozias C, Tsagalis A, Anthopoulos L. Uncovering Organization Emergent Digital Transformation Strategies to deal with Crises: A Review of Bibliometric Analyses and of a European Initiative. J Sustain Res. 2024;6(3):e240041. https://doi.org/10.20900/jsr20240041