SMART CITY AND URBAN LOGISTICS - RESEARCH TRENDS AND CHALLENGES: SYSTEMATIC LITERATURE REVIEW

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Resume

The paper presents a systematic quantitative and qualitative literature review and classification of the last decades resources for a comprehensive and coherent view of smart city and urban logistics research trends and challenges. The review fully respects a six-step systematic literature review guideline and covers ninety-nine peer-reviewed articles from Web of Science Core Collection database.

The review focuses on the following aspects: a perspective state-of-art journal, methods, content, keywords, references, and citations. The relevant articles for subsequent detailed analysis were identified between 2014 and 2020. The analysis has brought the following result: more than one third of the articles was published in 2020, the most articles were published in the Sustainability, and the modelling method was prevailed.

Available online: https://doi.org/10.26552/com.C.2023.076

Article info

Received 15 May 2023
Accepted 4 October 2023
Online 17 October 2023

Keywords:

smart city
logistics
technology
mobility
vehicle routing problem
city logistics

ISSN 1335-4205 (print version)
ISSN 2585-7878 (online version)

1 Introduction

City logistics or in other words urban logistics is a problem that affects urban areas, provided that by this time the roads are generated by freight distribution and public service vehicles. A lot of cities around the world see an opportunity to address the challenges by adopting the concept of “Smart city” [1]. This statement is related connected with urban logistics too. However, the term Smart city is a vague concept (various definitions of the Smart city) and the absence of the commonly accepted definition of Smart city make it difficult to implement and manage Smart city programs [2-5]. Researchers and scholars thus contended that numerous challenges associated with the pursuit of urban intelligence and smart urbanization exceed the purview and capacities of extant municipal entities, institutional frameworks, and governance systems [5-7]. This emphasis can be regarded as an immediate outcome of “perceived failures or insufficient impact resulting from Smart City’s investments to date” [8-9]. The rising urbanization within European urban centers, coupled with heightened consumption rates, has engendered sustainability concerns within the cores of cities and their logistical systems [10]. The majority of urban logistics initiatives encompass a diverse array of stakeholders, including governmental bodies, participants in the supply chain, and academic research institutions [11-12]. The sustainable advancement of the logistics sector holds practical significance for the evolution of smart cities [13]. The worldwide populace is progressively concentrating within urban areas [14]. A study by Desa [15] revealed that in 2016, 45% of cities had a population between 5 and 10 million inhabitants. Thus, by 2030, a projected population of 730 million will live in cities with at least 10 million inhabitants, representing 8.7% of people in the world [16]. Considering this panorama, some cities started to manage and design their urban centers with the perspective of the Smart city concept, due to the growth of urbanization, and some aspects that move, manage, and leverage the tangible and intangible smart resources of a city, such as mobility, governance, economy, people, quality of life and environment [17].

Smart city and last mile logistics are growing research areas with a growing interest of scientists and practitioners, especially over the last seven years [18]. The last mile is frequently characterized as one of the costliest, most time-sensitive, and most environmentally detrimental segments of the supply chain [19]. Numerous definitions exist for last-mile logistics; however, there is a shared consensus that it represents the final leg of the supply chain spanning from the last distribution center to the ultimate destination of the recipient [12, 20-21]. Last mile logistics and urban logistics focus on delivering packages to the preferred location of end customers instead of buying goods in various brick-and-mortar stores, which increases the number of freight shipments, which is exacerbated by the fact that each package is often small [22-23]. Urban logistics and last mile logistics cause various externalities, in particular greenhouse gas emissions [24-25], noise [26], traffic congestion [27] and air pollution [28]. Among the pivotal constituents contributing to the realization of an efficacious Smart city, transportation and goods delivery, public transit services, and traffic management hold a central position in shaping the urban layout, business applications, and infrastructure [29]. In the context of freight transportation, urban logistics, also referred to as urban freight transport logistics, encompasses the intricate process of delivering goods to their urban destinations. This undertaking is guided by a range of objectives, including the provision of efficient services, cost-effectiveness, and the promotion of sustainable development within urban areas [22]. Urban logistics is experiencing profound transformations in response to the burgeoning urban population and the explosive growth of e-commerce [30]. Academies and the logistic industry have recognized that one of the major challenges of Smart city logistics is integrated stakeholder involvement and the development of effective decision-making tools to improve its global performance [31]. One of the important works for Smart city logistics is the problem of integrated production and transport planning [32]. Within the framework of sustainability, the goal is to mitigate the adverse external impacts of logistical operations, while concurrently guaranteeing service accessibility and enhancing the overall quality of life for all urban residents [33]. Many authors have focused on new challenges related to sustainable city logistics (sustainable urban logistics); recently published works that provide in-depth analysis of the problem [22, 29, 34-36]. The shift toward intelligent and sustainable logistics in smart cities and port cities is directed at handling the constantly escalating volumes of imports and exports, along with the ensuing congestion, in a digitally resilient manner; this approach seeks to curtail vulnerability and alleviate anthropogenic pressures on urban environments [37-38]. The study by Hu et al. [39] states trends and gaps research to a contribution of city logistic problem to sustainable urban development based on statistical analysis more than 500 publications from relevant citation databases from 1993 to 2018.

City logistics encompasses the optimization of logistical and transportation operations, involving the active engagement of private enterprises supported by advanced information systems; this optimization focuses on the urban transport landscape, its effects on traffic congestion, security, and energy conservation [40-41]. Precise, punctual, and streamlined delivery operations are imperative for the resilience of supply chains and logistics providers within a digitally empowered business ecosystem; the objectives of smart city logistics, which encompass sustainability, mobility, and viability, are aimed at mitigating the presence of trucks, traffic congestion, and pollution [42]. The movement of goods into the Smart city is economically critical. Therefore, understanding the relationship between freight flow logistics and the operation of Smart cities is essential when implementing policy in future cities [43]. The challenges associated with the coordinated development of the metropolitan (city) economy and logistics have attracted a great deal of attention [44]. The contemporary logistics sector has evolved into an increasingly significant component of the modern economy, flourishing on a global scale thanks to the swift progress of the world economy and advancements in science and technology [45-46]. In recent decades, the idea has arisen that it is necessary to use decision support systems. Decision support systems for Smart cities have been proposed in the world literature because they can face various application problems such as electro mobility [47], convenience [48-49], logistics [50-52] or cyber security [53].

Seven review articles in the field of smart city and urban logistics were identified as part of the theoretical background of the issue [28, 54-59]. However, none of these review articles strictly focuses on the areas of smart city and urban logistics, including their interconnection. In conclusion, it can be clearly stated that a research gap has been identified, or that there is no research article in the field of smart city and urban logistics, even though these are nowadays very topical and emerging societal topics. The aim of this article is to provide a systematic literature review and classification of the literature to provide comprehensive and more coherent view of smart city and urban logistics research trends and challenges.

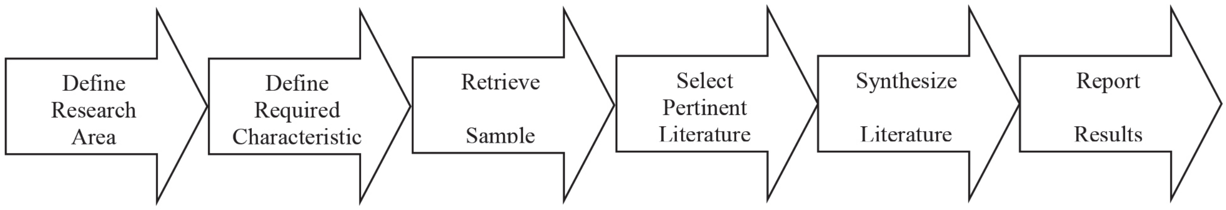

Figure 1 *Systematic literature review guideline used [60]*

2 Methodology

This systematic literature review of smart city and urban logistics fully respects a six-step guideline defined by Durach, Kembro and Wieland [60]. These steps have been proposed upon previous scientific work [61-62] and are increasingly used in supply chain management and logistics research to achieve transparent systematic literature reviews. This approach (Figure 1) was used, for example, by Olsson, Hellstrom and Palsson [18] in a systematic literature review of last mile logistics research.

The individual steps of the guideline are presented in the following subsections.

2.1 Define research and required characteristics

A state-of-the-art literature review was undertaken to identify gaps, establish the objective of the systematic literature review, and gain insight into pertinent terminology within the monitored thematic domains. A list of inclusion and exclusion criteria to select the included literature is based on the processed state of art study. Inclusion criteria include title, abstract, and keywords shall demonstrate smart city and urban logistics as the clear focus of the research; the articles must be included in the world scientific database Web of Science; articles must be classified by the scientific database as an article or review article; articles must be published in peer-reviewed journals; articles must be published between 2005 and 2020. The exclusion criterion is literature focusing on electrical engineering, electronic engineering, healthcare, social sciences is excluded from the systematic literature review performed.

2.2 Retrieve sample and select pertinent literature

Literature was analyzed exclusively in the world's largest and most widely used Web of Science database. As of 1 June 2022, the database indexed 23 218 literary outputs focused on the topic of smart city and its variations (after entering this input - topic: smart* cit*), and 443 150 literary outputs focused on the topic of logistics and its variations (after entering this input - topic: logistic*). The number of relevant literary outputs after merging with the logical conjunction “AND” was reduced to 421 outputs (after entering these inputs - topic: smart* cit* AND topic: logistic*). Only 242 of the 421 identified literary outputs were articles or reviews, and only 196 of the 242 literary outputs were published between 2005 and 2020. The next step was a three-round content analysis of all 196 identified articles by four independent researchers. The researchers evaluated each article according to inclusion and exclusion criteria and finally summarized their results to define the final basis for conducting a comprehensive qualitative and quantitative systematic literature review. Finally, researchers identified 99 scientific articles for the next steps.

2.3 Synthesize literature and report results

Firstly, we analyzed publication trends in the context of the number of publications in individual years and journals. Next, we analyzed article keywords, article references, article citations, using frequency analysis. Finally, a content analysis was carried out from the perspective of article themes, article methods, and article content. The systematic literature review clearly shows that the smart city and urban logistics issues are an emerging research area with growing interest of researchers, practitioners, and other stakeholders. On the other hand, this research area is very diversified and contains many research sub-areas that have been identified. Many scientific methods are also used, especially combinations of them.

3 Results

The results are presented in accordance with the quantitative and qualitative parts of the standardized systematic literature review. The results are divided into main article journals, article keywords, references, citations, themes, methods, and content.

3.1 Evolutionary timeline and main journals

Smart city and logistics issues are an emerging research area with growing interest of researchers,

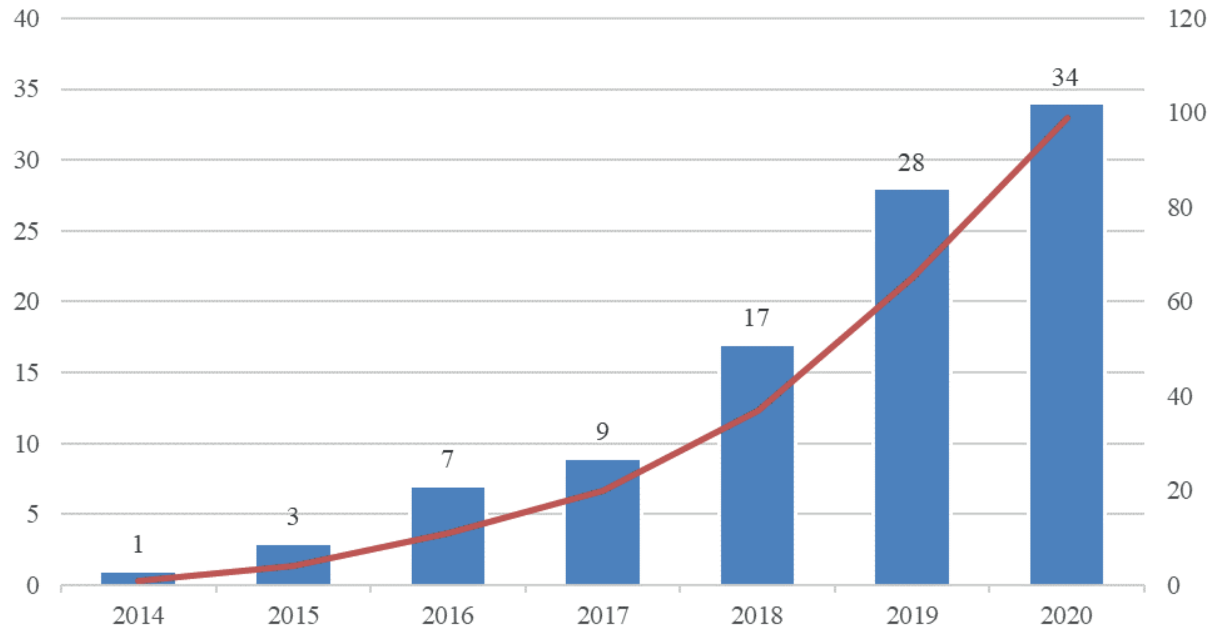

Figure 2 *Evolutionary timeline of the reviewed literature*

practitioners, and other stakeholders. The systematic literature review covers the period since 2005, but relevant articles for subsequent detailed analysis were identified only between 2014 and 2020. In total, 99 relevant articles were published in the following years: 1 article in 2014, 3 articles in 2015, 7 articles in 2016, 9 articles in 2017, 17 articles in 2018, 28 articles in 2019 and 34 articles in 2020 (Figure 2). It clearly shows the increasing trend and extreme growth of published articles in this research area. At the same time, this trend can be expected to continue in the coming years.

Most of the analyzed articles (96) are in English. Only 3 articles are in languages other than English, namely: 1 in Portuguese [63] and 2 in Russian [64-65]. Research on smart city and logistics has been published in many journals. In the period under review, there were 72 journals in total. Most articles (9) were published in the journal Sustainability, all of which were published in the last three analyzed years (2018-2020). Four articles were published in the journal Production Planning and Control and IEEE Access, three articles were published in the journal Sensors, Sustainable Cities and Society and IEEE Transactions on Intelligent Transportation Systems. Two articles were published in the other seven journals. One article was published in 59 other journals. A total of 92 out of 99 articles can be characterized as articles. The remaining 7 articles [28, 54-59] are review articles. Most of the review articles (5 out of 7) were published in 2020, which is not surprising since many articles had already been published by then and it was necessary to summarize the findings and aggregate the results. The remaining two review articles [28, 59] were published in 2017 and 2018.

3.2 Keywords

The keywords of the articles cover a wide range of areas. Most keywords (55) cover the phrase “smart” and its variations. The next most used keywords phrase (28) was “urban” and its variations. A total of 16 to 18 times the keywords phrase “transport” or “transportation”, “Internet of Things” or “IoT”, “logistic” or “logistics” and their equivalents were used. The keywords “city logistics” and “big data” and their variations were used more than ten times (twelve times in total). Other keywords and their semantic variations were used less than ten times in the analyzed articles.

3.3 References

All analyzed articles contain a total of 5 768 references. The median number of references is 48, while the average number of references corresponds to 58.26. The article by Oliveira et al. [66] contains the most references (196). The fewest references (10) include the article by Tsitsiashvili [65]. Most articles (39) contain 26-50 references. 21 articles are based on 51-75 references and 16 articles contain up to 25 references. Only 3 articles contain more than 150 references [55, 66-67] (Figure 3).

3.4 Citations

All analyzed articles have been cited 1 592 times so far. The median number of citations is 10, while the average number of references corresponds to 16.08. The

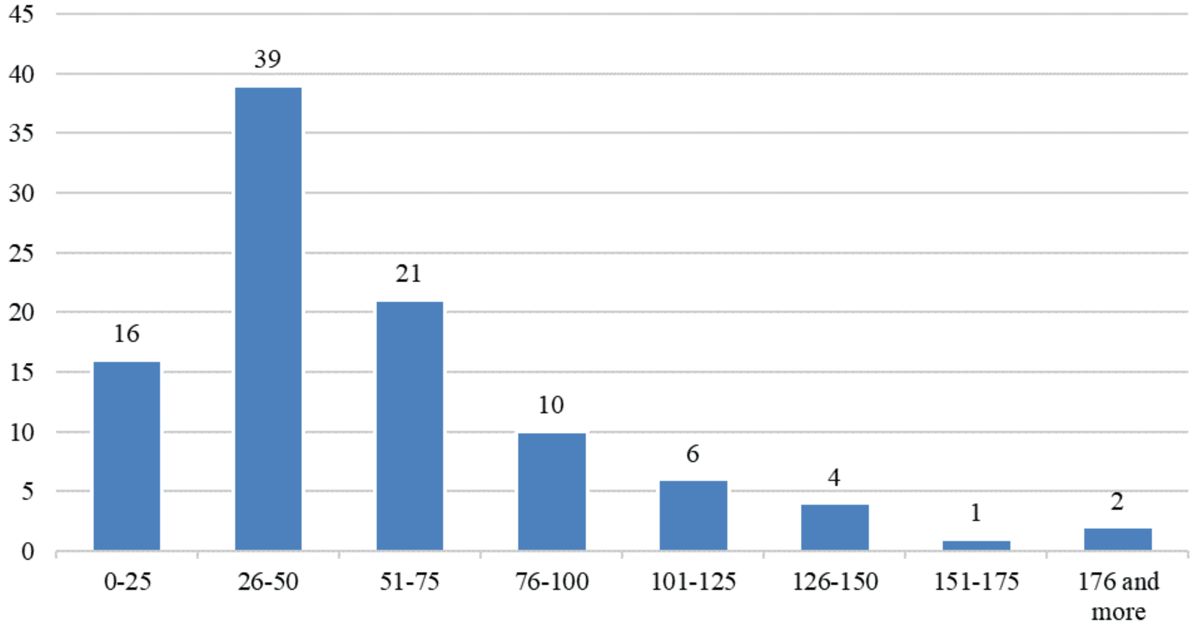

***Figure 3** Histogram of reference frequencies*

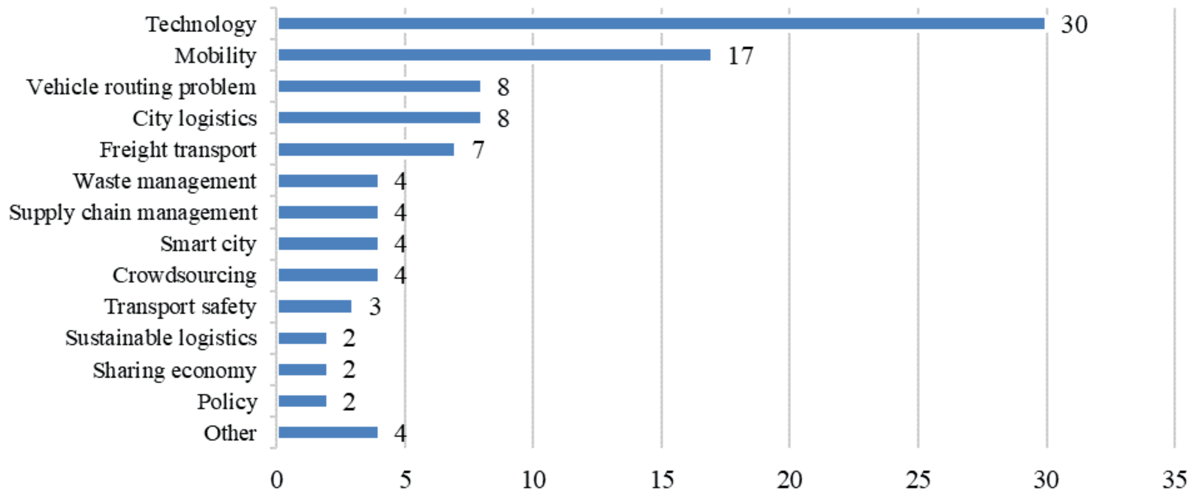

***Figure 4** Article themes*

article by Ranieri et al. [28] is the most cited analyzed article (90 citations as of 22 November 2022). This article is a research article, so it is quite understandable that it is heavily cited. Only 4 analyzed articles have no citations so far. Most articles (79) have up to 25 citations. 13 articles have 26-50 citations and 6 articles [68-73] have 51-75 citations. Only one article [28] has more than 76 citations, specifically 90 citations.

3.5 Themes

All relevant articles were thoroughly analyzed using content and semantic analysis by the author team and the main theme of each article was identified. The predominant theme of all analyzed articles is technology (30 articles in total) [54, 58, 66, 68, 70-71, 74-97]. Another important theme is mobility (17 articles) [56-57, 59, 63, 66, 98-109]. The research theme of vehicle routing problem includes a total of 8 articles [76, 110-116]. The same number of articles (8) covers the theme of city logistics [12, 28, 117-122]. The following 7 articles correspond to the freight transport theme [72, 123-128]. Other themes were always identified in fewer than five articles (Figure 4).

3.6 Methods

Most of the analyzed articles generally use multiple scientific methods. The analyzed articles mostly use the modelling method (29 articles) [65, 71, 77, 87, 90-93,

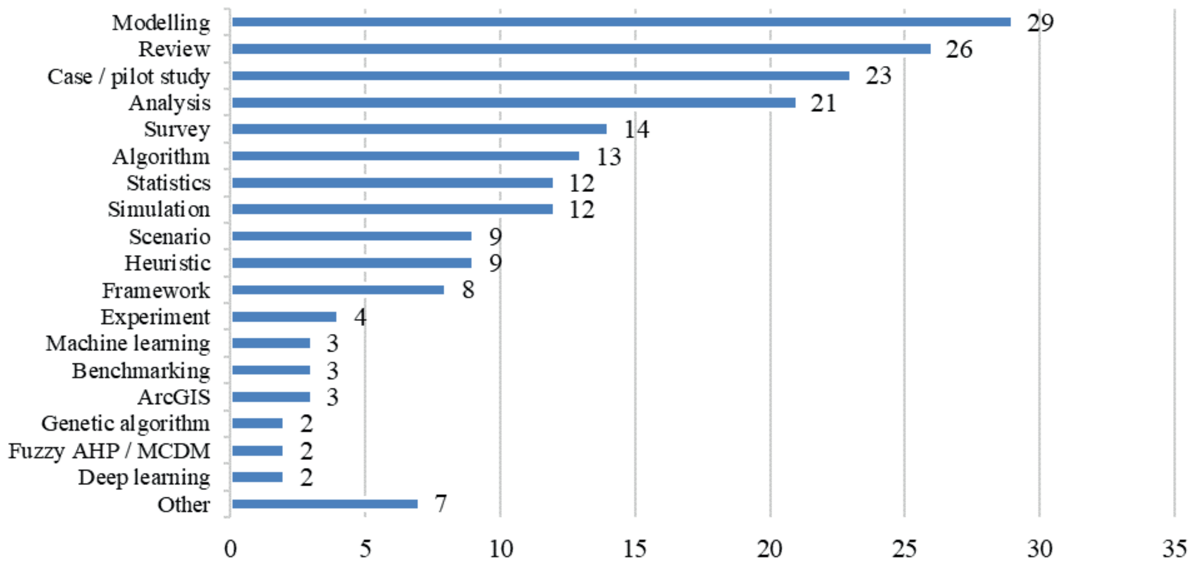

***Figure 5** Article methods*

96, 100, 105, 117, 120-122, 124-125, 127, 129-139]. The review method was used in 26 articles [28, 54-59, 63-64, 66, 68-69, 72-73, 79, 83, 89, 95, 99, 103, 119, 123, 126, 137, 140-141]. The case or pilot study method was used in 23 articles [12, 70, 77-78, 85, 87, 92, 94, 102, 106-108, 113, 115, 119, 126, 130, 136, 138, 142-144]. The analysis method and its variations was used in 21 articles [28, 64, 67, 69, 72, 73, 82, 91, 97, 104, 105, 113, 125-126, 131, 138, 141, 144-146]. The other scientific methods were used less than 14 times (Figure 5).

3.7 Content

The content of the articles is divided based on the processed content analysis and its results. The following subchapters provide the detailed content of the articles according to the identified thematic areas. Articles of two or less thematic areas are not considered.

3.7.1 Technology

Wong et al. [54] highlighted the lack of a comprehensive review on blockchain applications in smart sustainable cities. Wong, Tai and So [74] developed a container drayage optimization model for efficient container movements in Hong Kong. Ahad et al. [68] extensively reviewed enabling technologies in smart cities, addressing technical, socio-economic, and environmental challenges. Chauhan et al. [75] proposed a system that simplifies the process of finding available parking slots in real-time using IoT infrastructure. Chen et al. [142] developed a hierarchical service framework for transportation and traffic pattern analysis. Xia et al. [77] put forth a distributed model, employing weighted long short-term memory, to analyze time window-based data within the context of a parallel processing framework. Ryan et al. [78] explored the use of Smart Information Systems to address Sustainable Development Goals and discussed ethical considerations across various application areas. Yang et al. [79] summarized autonomous moving platforms, their taxonomy, technologies, applications, challenges, and open issues. Oliveira et al. [66] discussed transportation technologies and systems in the context of the IoT and value concepts. Guerra, Dardari and Djuric [80] proposed a dynamic radar network of unmanned aerial vehicles for real-time tracking of targets. Iranmanesh et al. [81] presented path optimization algorithms for drone multi-hop communications networks, optimizing both parcel deliveries and data transmission. Astarita et al. [58] reviewed the application of blockchain-based systems in transportation. Asthana and Dwivedi [82] analyzed the capabilities and requirements of 3PL service providers and users in the context of distributed manufacturing and smart city products. Chen [83] conducted a thorough examination of these issues and put forth relevant measures and suggestions concerning the development and practical innovation of smart cities amidst the integration of new technologies. Zhao et al. [84] used data-driven approaches to improve delivery fleet management, including destination prediction and real-time incident detection. Shao, Xu and Li [85] introduced a smart product-service system approach for the development of route optimization systems based on the IoT. Araujo et al. [86] evaluated the performance of the FIWARE cloud based IoT platform for large-scale deployments relevant to smart cities. Sicari, Rizzardi and Coen-Porisini [87] explored the use of Node-RED, a flow-based programming tool for IoT applications, in different contexts. Liu et al. [88] applied big data analytics to enhance smart manufacturing services in commercial laundry. Hussein [89] discussed the recent advancements in IoT technologies and explored future applications and research challenges in the field. Aqib et al. [90] devised a comprehensive methodology for real-time traffic prediction, harnessing the power of big data, deep learning, in-memory computing, and GPUs. Sarker et al. [91] conducted an exploration into the propensity to share travel-related information when using daily transit applications. Abbasi, Khan and Ul Haq [92] analyzed various conceptual modeling approaches for the IoT. Liao and Wang [93] scrutinized the design and utilization of blockchain technology in the context of Intercontinental Exchange logistics. Gohar, Muzammal and Rahman [94] put forth a conceptual architecture for big data analytics tailored to Intelligent Transportation Systems. Hopkins and Hawking [70] discussed the role of big data analytics and the IoT in improving driver safety and operational efficiency in logistics. Goudos et al. [95] introduced various IoT application domains, encompassing areas such as smart cities, transportation, logistics, and healthcare. Mehmood et al. [71] developed a model for load and capacity sharing in smart cities to improve operational efficiency. Erkollar and Oberer [96] investigated the integration and utilization of FLEXTRANS4.0 applications in logistics and smart city initiatives within the European Union. Li, Cao and Yao [97] examined the smart city concept, its development, motivations, and goals in China.

3.7.2 Mobility

Adamczak et al. [98] explored eco-driving incentives for drivers in short-term rentals. Ceder [56] analyzed future urban transportation, highlighting the inefficiency of private cars and advocating for autonomous and electric vehicles in urban transportation systems. Perkumiene et al. [57] conducted an integrative review on the right to a clean environment, emphasizing the importance of green logistics and sustainable tourism as solutions to climate change. Nagy and Csiszar [99] discussed the requirements and optimization needs for smart mobility. Del Vecchio et al. [100] demonstrated the utility of system dynamics in optimizing decision-making for people's mobility. Shi et al. [101] proposed ParkCrowd, a crowd-sensed parking system that provides reliable real-time parking information to drivers using logistic regression-based evaluation. De Oliveira et al. [145] presented a low-cost deployment proposal called URCa, which suggests sharing cars considering logistic aspects. Mazzarino and Rubini [102] evaluated the feasibility of a mixed passenger and freight transport system in the Venice Lagoon, addressing issues of accessibility and social cohesion. Pereira et al. [63] discussed the dimensions of logistics and urban mobility in smart city contexts, noting an increase in related publications. Peprah, Amponsah and Oduro [103] assessed the smart mobility of Ghanaian cities and proposed strategies to mitigate the adverse effects of urbanization. Mozos-Blanco et al. [104] analyzed sustainable mobility plans in Spain, emphasizing the reduction of congestion, pollution, and car dependency while promoting active transportation. Keimer et al. [105] analyzed the influence of emerging mobility services on traffic flow and transportation efficiency, offering a structured framework for modeling and understanding these evolving trends. Kresak et al. [106] explored the use of a high-speed suspended cableway for urban mobility in Slovakia. Melo, Macedo and Baptista [107] evaluated re-routing for vehicles in Lisbon, assessing the impact of guidance information on traffic performance, operational costs, and environmental conditions. Turon, Czech and Juzek [108] discussed walkability as a form of smart mobility in urban logistics, addressing sustainable development and transport. Mangiaracina et al. [59] conducted a comprehensive review of intelligent transportation systems supporting urban smart mobility, identifying research gaps and proposing future directions. Pronello, Veiga-Simao and Rappazzo [109] assessed the effects of Optimod'Lyon, a real-time information navigator, on travel behavior in Lyon, France.

3.7.3 Vehicle routing problem

Chen et al. [142] proposed a heuristic repair method for the dial-a-ride problem. Lu and Yang [110] introduced the Iterative Logistics Solution Planner, a hybrid approach for quickly finding and improving logistics solutions while considering real constraints. Reyes-Rubiano et al. [111] conducted an analysis of a practical vehicle routing problem that incorporates driving-range limitations and uncertain, stochastic travel times. Yu and Lam [112] proposed an optimal route determination method for an AV logistic system in smart cities. Alvarez et al. [113] underscored the significance of factoring in congestion expenses when optimizing delivery routes. Perboli, Gobbato and Maggioni [114] tackled the multi-path traveling salesman problem involving uncertain travel costs, specifically tailored for Smart Cities and City Logistics. Abbatecola et al. [115] introduced an urban decision support system geared towards the coordinated management of logistical services in smart cities, including tasks like postal delivery and waste collection, all within a unified framework. Muelas, LaTorre and Pena [116] introduced a distributed algorithm based on request partitioning and route combination.

3.7.4 City logistics

Kim, Moon and Jung [117] proposed a mixed integer programming model and a block stacking heuristic for drone operation planning. Iranmanesh and Raad [118] introduced a heuristic flight path planning method for drone networks that includes both parcel delivery and data delivery. Wang et al. [119] developed innovative solutions to enhance last mile parcel delivery using crowd intelligence. De Carvalho, Kalid and Rodriguez [120] proposed a model for evaluating city logistics performance. Ranieri et al. [28] conducted a literature review on recent contributions to innovative strategies for last mile logistics. Demirtas, Tuzkaya and Tanyas [121] investigated the layout design of an urban distribution center, specifically a fruits and vegetable hall. Harrington et al. [12] introduced an innovative approach to the development and assessment of last-mile solutions, taking into account the social and economic viewpoints of critical stakeholders. Ahmad and Mehmood [122] conducted a study on establishing a success predictive model for enterprise systems benefits.

3.7.5 Freight transport

He and Haasis [123] formulated a theoretical research framework for sustainable urban freight transport, encompassing considerations of future urban development, distribution innovations, and appropriate research methodologies. Comi, Schiraldi and Buttarazzi [124] introduced an architectural approach and methodology for the integration of delivery bay planning with transportation demand modeling through simulation. Cavone, Dotoli and Seatzu [125] conducted a comprehensive survey of Petri net models in the context of freight logistics and transportation systems. Heddebaut and Di Ciommo [126] focused their research on assessing the impact of intermodal transport infrastructures, such as city-hubs, on social organization and the urban environment. Gatta, Marcucci and Le Pira [127] proposed an innovative decision-making approach for urban freight planning. Rodrigue, Dablanc and Giuliano [128] introduced the concept of the freight landscape, which pertains to the spatial distribution and intensity of freight activity within metropolitan areas. Juan et al. [72] identified and reviewed research challenges associated with the adoption of electric vehicles in logistics and transportation operations.

3.7.6 Waste management

Laurieri et al. [143] found that door-to-door collection of glass waste is inefficient, with bins often remaining partially filled and less frequently emptied. Bulatov et al. [133] developed an efficient logistics system for handling solid municipal waste. Wu et al. [134] developed a mathematical model for addressing the low-carbon vehicle routing problem in the context of waste management systems, taking into account probabilistic constraints. Misra et al. [147] introduced a pioneering integrated sensing system designed to automate the solid waste management process.

3.7.7 Supply chain management

Jiang et al. [129] scrutinized the factors contributing to the effectiveness of supply chain management systems, underscoring the pivotal role of urban intelligent transportation systems in their success, encompassing aspects like safety, accessibility, information management, and flexibility. Ogbuke et al. [140] conducted an extensive review of big data supply chain analytics, investigating its applications and the advantages it offers to organizations and society. Guerlain et al. [146] proposed the implementation of decision support systems to enhance construction logistics and supply chain management, utilizing evidence-based mechanisms. Tachizawa, Alvarez-Gil and Montes-Sancho [73] examined the influence of smart city initiatives and big data on supply chain management, with a specific focus on elucidating the interconnections between smart cities, big data, and the characteristics of supply networks.

3.7.8 Smart city

Rana et al. [69] discerned the primary obstacles to smart city development by synthesizing findings from a literature review and expert opinions. Mora et al. [67] introduced a research methodology tailored for conducting multiple-case studies, offering guidance to cities on how to effectively approach smart city development. Buyukozkan and Mukul [137] tackled the evaluation of smart city logistics solutions as a multi-criteria decision-making problem, taking into account their diverse components. Paskannaya and Shaban [141] examined the characteristics of green logistics and the advantages of its implementation in urban development, drawing insights from successful Smart City projects in the USA and the EU.

3.7.9 Crowdsourcing

Feng et al. [30] investigated a novel problem involving crowdsource-enabled production and transportation scheduling. This problem was formulated as a mixed-integer linear program and was proven to exhibit strong nondeterministic polynomial time-hardness. Hoseinzadeh et al. [130] assessed the accuracy of Waze speed data specifically on surface streets, conducting a case study in Sevierville. Tu et al. [148] introduced an online crowdsourced delivery approach for on-demand food services, encompassing order collection, solution generation, and sequential delivery processes within a dynamic optimization framework. Huang et al. [132]

developed a research model grounded in the Push-Pull-Mooring theory to elucidate the factors that influence the participative behavior of crowd workers.

3.7.10 Transport safety

Dominguez et al. [149] suggested utilizing machine learning models to enhance vehicle detection in smart crosswalks. Vilaca et al. [135] conducted an analysis of spatial and temporal patterns within urban areas and formulated a predictive model to assess the probability of accidents involving vulnerable road users. Dhakal et al. [150] investigated the behavior of cyclists riding in the wrong direction on one-way segments.

4 Discussion

In this article is presented a comprehensive systematic literature review within the realm of emerging trends and challenges in smart city and urban logistics research. Smart cities represent an evolved stage of information city development, characterized by the extensive utilization of cutting-edge information technologies like the IoT, cloud computing, and mobile Internet access. Additionally, they incorporate tools and methodologies derived from social networks. The detailed content of the articles according to the identified thematic areas were technology, mobility, vehicle routing problem, city logistics, freight transport, waste management, supply chain management, smart city, crowdsourcing, and transport safety. These identified thematic areas also partially correspond to the smart city logistics framework developed by Pan et al. [29].

It should be noted that some limitations may appear in this article. Although every effort has been made to make the review comprehensive, some articles may not have been included in the review, not intentionally. Another limitation is that the authors used only articles from the internationally recognized Web of Science database. On the other hand, it can be noted that this approach is also standard for other authors, e.g. [151-152]. Another limitation may be the structure of the keywords and the composition of the search phrase. Keyword selection has been discussed among researchers, but it is possible that due to the structure of search phrases and the use of search operators, some relevant articles may have been omitted from the search. Finally, it should be noted that the basis of this article has lain in the review of available research articles from the period 2012-2022. The resulting findings and conclusions are relevant in December 2022. The authors of the article state that due to the rapid development in smart cities and urban logistics, it can be assumed that many new findings and technologies will emerge soon.

5 Conclusion

The aim of this article was to provide the systematic literature review and classification of the literature to provide comprehensive and more coherent view of smart city and urban logistics research trends and challenges. Numerous cities earn the “smart” designation when they possess key attributes such as widespread broadband access, a knowledgeable workforce, and a commitment to digital inclusion. One of the primary objectives of smart cities is to enhance the quality of services provided to their residents while concurrently reducing administrative expenditures through the application of technology. Because using the IoT, while very useful, leads to security issues in data management. Cities are the breeding ground for innovation and socio-economic progress, but their dynamic development is also changing continuity and sustainability. Sustainability of cities in terms of ecology, social dynamism and vulnerability of cities requires careful management and development of a strategy with a balanced future. There is a risk of population explosions, but also extensive industrialization and urbanization. This article discussed some important aspects related to smart city, urban logistics and related scientific terms from transport sector. During the development of this article, it was felt that several key elements needed to be mentioned. The diversified approach of researchers to the issue of smart city and urban logistics, in summary, makes it possible to distinguish the mainstream and directions of further development of the concept of intelligent logistics. Urban development has exacerbated the challenges of urban logistics, especially in megacities around the world. Urban development trends, such as exogenous urban freight transport trends, have motivated logistics providers to seek endogenous solutions to meet these challenges.

Based on approaches to smart cities, a search of world literature in the field of smart city and urban logistics was examined. The quality of smart mobility should be interpreted at a strategic level around the world. The smart city will have to use innovative approaches in all human areas in the future. The growth of e-commerce also caused by the growing sales of the online market, new information and communication technology and the paradigm of industry 4.0, which enable the acquisition of huge amounts of data generated from infrastructures, equipment, and vehicles, are factors that need to be managed in the city. One of the main goals of the smart city is to significantly reduce the externalities generated by shipment delivery activities. The commitment of all stakeholders and the application of the proposed solutions are essential to achieve sustainable logistics in urban areas. The future for smart city, urban logistics and transport sector is the benefits of logistics 4.0 in terms of digitization; in a very short time, the whole supply chain will be digitized and able to work intelligently on its own, and this will be possible further research in this sector in the future.

This article also provides a basis for follow-up research, which will yield new knowledge and skills that will contribute to the development of new technologies which will soon be implemented in everyday life. As the authors hope, they also contributing to making modern cities even more "smart".

Acknowledgments

This article is published within the realization of the project "Cooperation in Applied Research between the University of Pardubice and Companies, in the Field of Positioning, Detection and Simulation Technology for Transport Systems (PosiTrans)", registration No.: CZ.0 2.1.01/0.0/0.0/17_049/0008394.

Conflicts of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

[1] ALLWINKLE, S., CRUICKSHANK, P. Creating smarter cities: an overview. *Journal of Urban Technology* [online]. 2011, **18**(2), p. 1-16. ISSN 1063-0732, eISSN 1466-1853. Available from: https://doi.org/10.1080/10630732.2011.601103

[2] ALBINO, V., BERARDI, U., DANGEICO, R. M. Smart cities: definitions, dimensions, performance, and initiatives. *Journal of Urban Technology* [online]. 2015, **22**(1), p. 3-21. ISSN 1063-0732, eISSN 1466-1853. Available from: https://doi.org/10.1080/10630732.2014.942092

[3] ALKANDARI, A., ALNASHEET, M., ALSHEKHLY, I. F. T. Smart cities: Survey. *Journal of Advanced Computer Science and Technology Research* [online]. 2012, **2**(2), p. 79-90. ISSN 2231-8852. Available from: http://irep.iium.edu.my/24446/1/smart_cities-2012.pdf

[4] CHOURABI, H., NAM, T., WALKER, S., GIL-GARCIA, J.R., MELLOULI, S., NAHON, K., SCHOLL, H. J. Understanding smart cities: an integrative framework. In: Annual Hawaii International Conference on System Sciences: proceedings [online]. IEEE. 2012. ISBN 978-1-4577-1925-7, eISBN 978-0-7695-4525-7, p. 2289-2297. Available from: https://doi.org/10.1109/HICSS.2012.615

[5] GIL-GARCIA, J. R., PARDO, T. A., NAM, T. What makes a city smart? Identifying core components and proposing an integrative and comprehensive conceptualization. *Information Polity* [online]. 2015, **20**(1), p. 61-87. ISSN 1570-1255, eISSN 1875-8754. Available from: https://doi.org/10.3233/IP-150354

[6] BOLIVAR, M. P. R. Mapping dimensions of governance in smart cities. In: 17th International Digital Government Research Conference on Digital Government Research: proceedings [online]. 2016. ISBN 978-1-4503-4339-8, p. 312-324. Available from: https://doi.org/10.1145/2912160.2912176

[7] CARAGLIU, A., DEL BO, C. Smartness and European urban performance: assessing the local impacts of smart urban attributes. *Innovation: The European Journal of Social Science Research* [online]. 2012, **25**(2), p. 97-113. ISSN 1351-1610, eISSN 1469-8412. Available from: https://doi.org/10.1080/13511610.2012.660323

[8] BARNS, S. Smart cities and urban data platforms: designing interfaces for smart governance. *City, Culture and Society* [online]. 2018, **12**, p. 5-12. ISSN 1877-9166, eISSN 1877-9174. Available from: https://doi.org/10.1016/j.ccs.2017.09.006

[9] RUHLANDT, R. W. S. The governance of smart cities: a systematic literature review. *Cities* [online]. 2018, **81**, p. 1-23. ISSN 0264-2751, eISSN 1873-6084. Available from: https://doi.org/10.1016/j.cities.2018.02.014

[10] TOLENTINO-ZONDERVAN, F., BOGERS, E., VAN DE SANDE, L. A managerial and behavioral approach in aligning stakeholder goals in sustainable last mile logistics: a case study in the Netherlands. *Sustainability* [online]. 2021, **13**(8), 4434. eISSN 2071-1050. Available from: https://doi.org/10.3390/su13084434

[11] MACHARIS, C., TURCKSIN, L., LEBEAU, K. Multi actor multi criteria analysis (MAMCA) as a tool to support sustainable decisions: state of use. *Decision Support Systems* [online]. 2012, **54**(1), p. 610-620. ISSN 0167-9236, eISSN 1873-5797. Available from: https://doi.org/10.1016/j.dss.2012.08.008

[12] HARRINGTON, T. S., SINGH SRAI, J., KUMAR, M., WOHLRAB, J. Identifying design criteria for urban system 'last-mile' solutions - a multi-stakeholder perspective. *Production Planning and Control* [online]. 2016, **27**(6), p. 456-476. ISSN 0953-7287, eISSN 1366-5871. Available from: https://doi.org/10.1080/09537287.2016.1147099

[13] LAN, S., TSENG, M.L., YANG, C., HUISINGH, D. Trends in sustainable logistics in major cities in China. *Science of The Total Environment* [online]. 2020, **712**, 136381. ISSN 0048-9697, eISSN 1879-1026. Available from: https://doi.org/10.1016/j.scitotenv.2019.136381

[14] FOLTYNSKI, M. Sustainable urban logistics plan - current situation of the city of Poznan. *Transportation Research Procedia* [online]. 2019, **39**, p. 42-53. Available from: https://doi.org/10.1016/j.trpro.2019.06.006

[15] DESA, U. N. World urbanization prospects. The 2014 revision [online]. United Nations, Department of Economic and Social Affairs, Population Division, 2015. Available from: https://population.un.org/wup/publications/files/wup2014-report.pdf

[16] SEE, S. Artificial intelligence computing for a smart city. In: International Conference on Smart Cities, Infrastructure, Technologies and Applications: proceedings. Springer. 2017. ISBN 978-3-319-94179-0, eISBN 978-3-319-94180-6, p. 6-8. Available from: https://doi.org/10.1007/978-3-319-94180-6

[17] GIFFINGER, R. City-ranking of European medium-sized cities [online]. Vienna: Centre of Regional Science, Vienna University of Technology, 2007. Available from: https://ign.ku.dk/ansatte/landskabsarkitektur-planlaegning/?pure=files%2F37640170%2Fsmart_cities_final_report.pdf

[18] OLSSON, J., HELLSTROM, D., PALSSON, H. Framework of last mile logistics research: a systematic review of the literature. *Sustainability* [online]. 2019, **11**(24), 7131. eISSN 2071-1050. Available from: https://doi.org/10.3390/su11247131

[19] GEVAERS, R., VAN DE VOORDE, E., VANELSLANDER, T. Cost modelling and simulation of last-mile characteristics in an innovative B2C supply chain environment with implications on urban areas and cities. *Procedia - Social and Behavioral Sciences* [online]. 2014, **125**, p. 398-411. ISSN 1877-0428. Available from: https://doi.org/10.1016/j.sbspro.2014.01.1483

[20] LIM, S. F. W. T., JIN, X., SRAI, J. S. Consumer-driven e-commerce: a literature review, design framework, and research agenda on last-mile logistics models. *International Journal of Physical Distribution and Logistics Management* [online]. 2018, **48**(3), p. 308-332. ISSN 0960-0035. Available from: https://doi.org/10.1108/IJPDLM-02-2017-0081

[21] GEVAERS, R., VAN DE VOORDE, E., VANELSLANDER, T. Characteristics of innovations in last mile logistics-using best practices, case studies and making the link with green and sustainable logistics [online]. 2021. Available from: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.676.5843andrep=rep1andtype=pdf

[22] SAVELSBERGH, M., VANWOENSEL, T. City logistics: challenges and opportunities. *Transportation Science* [online]. 2016, **50**(2), p. 579-590. ISSN 0041-1655, eISSN 1526-5447. Available from: https://doi.org/10.1287/trsc.2016.0675

[23] ROSENBERG, L. N., BALOUKA, N., HERER, Y. T., DANI, E., GASPARIN, P., DOBERS, K., RUEDIGER, D., PATTINIEMI, P., PORTHEINE, P., VAN UDEN S. Introducing the shared micro-depot network for last-mile logistics. *Sustainability* [online]. 2021, **13**(4), 2067. eISSN 2071-1050. Available from: https://doi.org/10.3390/su13042067

[24] EDWARDS, J. B., MCKINNON, A. C., CULLINANE, S. L. Comparative analysis of the carbon footprints of conventional and online retailing: a “last mile” perspective. *International Journal of Physical Distribution and Logistics Management* [online]. 2010, **40**, p. 103-123. ISSN 0960-0035. Available from: https://doi.org/10.1108/09600031011018055

[25] VAN LOON, P., DEKETELE, L., DEWAELE, J., MCKINNON, A., RUTHERFORD, C. A comparative analysis of carbon emissions from online retailing of fast moving consumer goods. *Journal of Cleaner Production* [online]. 2015, **106**, p. 478-486. ISSN 0959-6526, eISSN 1879-1786. Available from: https://doi.org/10.1016/j.jclepro.2014.06.060

[26] ALJOHANI, K., THOMPSON, R. G. A stakeholder - based evaluation of the most suitable and sustainable delivery fleet for freight consolidation policies in the inner - city area. *Sustainability* [online]. 2018, **11**(1), 124. eISSN 2071-1050. Available from: https://doi.org/10.3390/su11010124

[27] ALLEN, J., BEKTAS, T., CHERRETT, T., FRIDAY, A., MCLEOD, F., PIECYK, M., PIOTROWSKA, M., AUSTWICK, M. Z. Enabling a freight traffic controller for collaborative multidrop urban logistics: practical and theoretical challenges. *Transportation Research Record: Journal of the Transportation Research Board* [online]. 2017, **2609**, p. 77-84. ISSN 0361-1981, eISSN 2169-4052. Available from: https://doi.org/10.3141/2609-09

[28] RANIERI, L., DIGIESI, S., SILVESTRI, B., ROCCOTELLI, M. A review of last mile logistics innovations in an externalities cost reduction vision. *Sustainability* [online]. 2018, **10**(3), 782. eISSN 2071-1050. Available from: https://doi.org/10.3390/su10030782

[29] PAN, S., ZHOU, W., PIRAMUTHU, S., GIANNIKAS, V., CHEN, C. Smart city for sustainable urban freight logistics. *International Journal of Production Research* [online]. 2021, **59**, p. 2079-2089. Available from: https://doi.org/10.1080/00207543.2021.1893970

[30] FENG, X., CHU, F., CHU, C. B., HUANG, Y. Crowdsource-enabled integrated production and transportation scheduling for smart city logistics. *International Journal of Production Research* [online]. 2021, **59**(7), p. 2157-2176. ISSN 0020-7543, eISSN 1366-588X. Available from: https://doi.org/10.1080/00207543.2020.1808258

[31] WITKOWSKI, J., KIBA-JANIAK, M. The role of local governments in the development of city logistics. *Procedia - Social and Behavioral Sciences* [online]. 2014, **125**, p. 373-385. ISSN 1877-0428. Available from: https://doi.org/10.1016/j.sbspro.2014.01.1481
[32] HALL, N. G., POTTS, C. N. Supply chain scheduling: batching and delivery. *Operations Research* [online]. 2003, **51**(4), p. 566-584. ISSN 0030-364X, eISSN 1526-5463. Available from: https://doi.org/10.1287/opre.51.4.566.16106
[33] ANDERSON, S., ALLEN, J., BROWNE, M. Urban logistics-how can it meet policy makers' sustainability objectives? *Journal of Transport Geography* [online]. 2005, **13**(1), p. 71-81. ISSN 0966-6923, eISSN 1873-1236. Available from: https://doi.org/10.1016/j.jtrangeo.2004.11.002
[34] TANIGUCHI, E., THOMPSON, R. G., YAMADA, T. New opportunities and challenges for city logistics. *Transportation Research Procedia* [online]. 2016, **12**, p. 5-13. 2352-1457, eISSN 2352-1465. Available from: https://doi.org/10.1016/j.trpro.2016.02.004
[35] DABLANC, L., MORGANTI, E., ARVIDSSON, N., WOXENIUS, J., BROWNE, M., SAIDI, N. The rise of on-demand 'instant deliveries' in European cities. *Supply Chain Forum: An International Journal* [online]. 2017, **18**(4), p. 203-217. ISSN 1625-8312, eISSN 1624-6039. Available from: https://doi.org/10.1080/16258312.2017.1375375
[36] HOLGUIN-VERAS, J., AMAYA LEAL, J., SANCHEZ-DIAZ, I., BROWNE, M., WOJTOWICZ, J. State of the art and practice of urban freight management: Part I: Infrastructure, vehicle- related, and traffic operations. *Transportation Research Part A: Policy and Practice* [online]. 2020, **137**, p. 360-382. ISSN 0965-8564, eISSN 1879-2375. Available from: https://doi.org/10.1016/j.tra.2018.10.037
[37] ALZAHRANI, A., PETRI, I., REZGUI, Y. Analysis and simulation of smart energy clusters and energy value chain for fish processing industries. *Energy Reports* [online]. 2020, **6**(1), p. 534-540. eISSN 2352-4847. Available from: https://doi.org/10.1016/j.egyr.2019.09.022
[38] D'AMICO, G., SZOPIK-DEPCZYNSKA, K., DEMBINSKA, I., IOPPOLO, G. Smart and sustainable logistics of port cities: a framework for comprehending enabling factors, domains and goals. *Sustainable Cities and Society* [online]. 2021, **69**, 102801. ISSN 2210-6707, eISSN 2210-6715. Available from: https://doi.org/10.1016/j.scs.2021.102801
[39] HU, W., DONG, J., HWANG, B., REN, R., CHEN, Z. A scientometrics review on city logistics literature: research trends, advanced theory and practice. *Sustainability* [online]. 2019, **11**(10), 2724. eISSN 2071-1050. Available from: https://doi.org/10.3390/su11102724
[40] MAJERCAK, J., MAJERCAK, P. *Logistics / Logistika*. Bratislava: DOLIS, 2015. ISBN 978-80-8181-019-0.
[41] SKULTETY, F., BENOVA, D., GNAP, J. City Logistics as an imperative smart city mechanism: scrutiny of clustered EU27 capitals. *Sustainability* [online]. 2021, **13**(7), 3641. eISSN 2071-1050. Available from: https://doi.org/10.3390/su13073641
[42] BUYUKOZKAN, G., GOCER, F. Prioritizing the strategies to enhance smart city logistics by intuitionistic fuzzy CODAS. In: 11th Conference of the European Society for Fuzzy Logic and Technology EUSFLAT 2019: proceedings [online]. Vol. 1. 2019. ISBN 10.2991/eusflat-19.2019.110, p. 805-811. Available from: https://doi.org/10.2991/eusflat-19.2019.110
[43] SHEE, H., MIAH, S., TABOADA, I., DE VASS, T. Smart city - smart logistics amalgamation. In: 2020 IEEE European Technology and Engineering Management Summit E-TEMS: proceedings [online]. IEEE. 2020. eISBN 978-1-7281-0903-9, p. 1-4. Available from: https://doi.org/10.1109/E-TEMS46250.2020.9111852
[44] EKICI, S., KABAK, O., ULENGIN, F. Linking to compete: logistics and global competitiveness interaction. *Transport Policy* [online]. 2016, **48**, p. 117-128. ISSN 0967-070X, eISSN 1879-310X. Available from: https://doi.org/10.1016/j.tranpol.2016.01.015
[45] HIRSCHINGER, M. The Future of logistics in emerging markets - fuzzy clustering scenarios grounded in institutional and factor-market rivalry theory. In: *Essays on supply chain management in emerging markets. Essays on Supply Chain Management* [online]. Wiesbaden, Germany: Springer Fachmedien, 2016. ISBN 978-3-658-11945-4, eISBN 978-3-658-11946-1. Available from: https://doi.org/10.1111/jscm.12074
[46] JAISWAL, A., SAMUEL, C., GANESH, G. A. Pollution optimisation study of logistics in SMEs. *Management of Environmental Quality* [online]. 2019, **30**(4), p. 731-750. ISSN 1477-7835. Available from: https://doi.org/10.1108/MEQ-04-2018-0077
[47] CLEMENTE, M., FANTI, M. P, IACOBELLIS, G., NOLICH, M., UKOVICH, W. A decision support system for user-based vehicle relocation in car sharing systems. *IEEE Transactions on Systems, Man, and Cybernetics: Systems* [online]. 2018, **48**(8), p. 1283-1296. ISSN 2168-2216, eISSN 2168-2232. Available from: https://doi.org/10.1109/TSMC.2017.2665881
[48] NOLICH, M., SPOLADORE, D., CARCIOTTI, S. BUQI, R., SACCO, M. Cabin as a home: A novel comfort optimization framework for IoT equipped smart environments and applications on cruise ships. *Sensor* [online]. 2019, **19**(5), 1060. eISSN 1424-8220. Available from: https://doi.org/10.3390/s19051060

[49] SPOLADORE, D., ARLATI, S., CARCIOTTI, S., NOLICH, M., SACCO. M. Roomfort: an ontology-based comfort management application for hotels. *Electronics* [online]. 2018, ***7***(12), 345. eISSN 2079-9292. Available from: https://doi.org/10.3390/electronics7120345

[50] CASCETTA, E., CARTENI, A., PAGLIARA, F., MONTANINO, M. A new look at planning and designing transportation systems: a decision-making model based on cognitive rationality, stakeholder engagement and quantitative methods. *Transport Policy* [online]. 2015, ***38***, p. 27-39. ISSN 1879-310X, eISSN 0967-070X. Available from: https://doi.org/10.1016/j.tranpol.2014.11.005

[51] FANTI, M. P., IACOBELLIS, G., NOLICH, M., RUSICH, A., UKOVICH, W. A decision support system for cooperative logistics. *IEEE Transactions on Automation Science and Engineering* [online]. 2017, ***14***(2), p. 732-744. ISSN 1545-5955, eISSN 1558-3783. Available from: https://doi.org/10.1109/TASE.2017.2649103

[52] CUZZOCREA, A., NOLICH, M., UKOVICH, W. A Big-data-analytics framework for supporting logistics problems in smart-city environments. *Procedia Computer Science* [online]. 2019, ***159***, p. 2589-2597. eISSN 1877-0509. Available from: https://doi.org/10.1016/j.procs.2019.09.257

[53] CUZZOCREA, A., NOLICH, M., UKOVICH, W. An innovative architecture for supporting cyber-physical security systems. In: Computational Science and Its Applications ICCSA 2018: proceedings [online]. 2018. ISBN 978-3-319-95173-7, eISBN 978-3-319-95174-4, p. 658-667. Available from: https://doi.org/10.1007/978-3-319-95174-4

[54] WONG, P. F., CHIA, F. C., KIU, M. S., LOU, E. C. W. Potential integration of blockchain technology into smart sustainable city (SSC) developments: a systematic review. *Smart and Sustainable Built Environment* [online]. 2020, ***11***(3), p. 559-574. ISSN 2046-6099. Available from: https://doi.org/10.1108/SASBE-09-2020-0140

[55] SZMELTER-JAROSZ, A., RZESNY-CIEPLINSKA, J., JEZIERSKI, A. Assessing resources management for sharing economy in urban logistics. *Resources* [online]. 2020, ***9***(9), 30. eISSN 2079-9276. Available from: https://doi.org/10.3390/resources9090113

[56] CEDER, A. Urban mobility and public transport: future perspectives and review. *International Journal of Urban Sciences* [online]. 2020, ***25***(4), p. 455-479. ISSN 1226-5934, eISSN 2161-6779. Available from: https://doi.org/10.1080/12265934.2020.1799846

[57] PERKUMIENE, D., PRANSKUNIENE, R., VIENAZINDIENE, M., GRIGIENE, J. The right to a clean environment: considering green logistics and sustainable tourism. *International Journal of Environmental Research and Public Health* [online]. 2020, ***17***(9), 23. eISSN 1660-4601. Available from: https://doi.org/10.3390/ijerph17093254

[58] ASTARITA, V., GIOFRE, V.P., MIRABELLI, G., SOLINA, V. A Review of Blockchain-based systems in transportation. *Information* [online]. 2020, ***11***(1), 24. eISSN 2078-2489. Available from: https://doi.org/10.3390/info11010021

[59] MANGIARACINA, R., PEREGO, A., SALVADORI, G., TUMINO, A. A comprehensive view of intelligent transport systems for urban smart mobility. *International Journal of Logistics Research and Applications* [online]. 2017, **20**(1), p. 39-52. ISSN 1367-5567, eISSN 1469-848X. Available from: https://doi.org/10.1080/13675567.2016.1241220

[60] DURACH, C. F., KEMBRO, J., WIELAND, A. A new paradigm for systematic literature reviews in supply chain management. *Journal of Supply Chain Management* [online]. 2017, **53**(4), p. 67-85. ISSN 2051-3771, eISSN 2050-7399. Available from: https://doi.org/10.1111/jscm.12145

[61] MULROW, C. D. The medical review article: state of the science. *Annals of Internal Medicine* [online]. 1987, **106**, p. 485-488. ISSN 0003-4819, eISSN 1539-3704. Available from: https://doi.org/10.7326/0003-4819-106-3-485

[62] TRANFIELD, D., DENYER, D., SMART, P. Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal Management* [online]. 2003, **14**, p. 207-222. eISSN 1467-8551. Available from: https://doi.org/10.1111/1467-8551.00375

[63] PEREIRA, B. G. R., GUIMARAES, L. G., ANTONIO, L., NETO, A. R., MENDONCA, C. M. Bibliometric analysis in publications related to logistics and urban mobility in the smart city context. *Revista Tecnologia e Sociedade* [online]. 2019, **15**(36), p. 58-76. ISSN 1984-3526. Available from: https://doi.org/10.3895/rts.v15n36.8148

[64] GRISHAEVA, Y. M., MATANTSEVA, O. Y., SPIRIN, I. V., SAVOSINA, M. I., TKACHEVA, Z. N., VASIN, D. V. Sustainable development of transportation the cities of russia: experience and priorities. *South of Russia: Ecology, Development* [online]. 2018, **13**(4), p. 24-46. ISSN 1992-1098, eISSN 2413-0958. Available from: https://doi.org/10.18470/1992-1098-2018-4-24-46

[65] TSITSIASHVILI, G. S. Non stationary poisson model of continuously functioning queuing system. *Journal of Physics: Conference Series* [online]. 2020, **1680**, 012050. ISSN 1742-6596. Available from: https://doi.org/10.17223/19988605/52/12

[66] OLIVEIRA, T. A., GABRICH, Y. B., RAMALHINHO, H., OLIVER, M., COHEN, M. W., OCHI, L. S.,

GUEYE, S., PROTTI, F., PINTO, A. A., FERREIRA, D. V. M., COELHO, I. M., COELHO, V. N. Mobility, citizens, innovation and technology in digital and smart cities. *Future Internet* [online]. 2020, **12**(2), 27. eISSN 1999-5903. Available from: https://doi.org/10.3390/fi12020022

[67] MORA, L., DEAKIN, M., REID, A., ANGELIDOU, M. How to overcome the dichotomous nature of smart city research: proposed methodology and results of a pilot study. *Journal of Urban Technology* [online]. 2019, **26**(2), p. 89-128. ISSN 1063-0732, eISSN 1466-1853. Available from: https://doi.org/10.1080/10630732.2018.1525265

[68] AHAD, M. A., PAIVA, S., TRIPATHI, G., FEROZ, N. Enabling technologies and sustainable smart cities. *Sustainable Cities and Society* [online]. 2020, **61**, 12. ISSN 2210-6707, eISSN 2210-6715. Available from: https://doi.org/10.1016/j.scs.2020.102301

[69] RANA, N. P., LUTHRA, S., MANGLA, S. K., ISLAM, R., RODERICK, S., DWIVEDI, Y. K. Barriers to the development of smart cities in indian context. *Information Systems Frontiers* [online]. 2019, **21**, p. 503-525. ISSN 1387-3326, eISSN 1572-9419. Available from: https://doi.org/10.1007/s10796-018-9873-4

[70] HOPKINS, J., HAWKING, P. Big data analytics and IoT in logistics: a case study. *The International Journal of Logistics Management* [online]. 2018, **29**(2), p. 575-591. ISSN 0957-4093. Available from: https://doi.org/10.1108/IJLM-05-2017-0109

[71] MEHMOOD, R., MERITON, R., GRAHAM, G., HENNELLY, P., KUMAR, M. Exploring the influence of big data on city transport operations: a Markovian approach. *International Journal of Operations and Production Management* [online]. 2017, **37**(1), p. 75-104. ISSN 0144-3577. Available from: https://doi.org/10.1108/IJOPM-03-2015-0179

[72] JUAN, A., ALEJANDRO MENDEZ, C., FAULIN, J., DE ARMAS, J., GRASMAN, S. E. Electric vehicles in logistics and transportation: a survey on emerging environmental, strategic, and operational challenges. *Energies* [online]. 2016, **9**(2), 21. eISSN 1996-1073. Available from: https://doi.org/10.3390/en9020086

[73] TACHIZAWA, E. M., ALVAREZ-GIL, M. J., MONTES-SANCHO, M. J. How smart cities will change supply chain management. *Supply Chain Management* [online]. 2015, **20**(3), p. 237-248. ISSN 1359-8546. Available from: https://doi.org/10.1108/SCM-03-2014-0108

[74] WONG, E. Y. C., TAI, A. H., SO, S. Container drayage modelling with graph theory-based road connectivity assessment for sustainable freight transportation in new development area. *Computers and Industrial Engineering* [online]. 2020, **149**, 11. Available from: https://doi.org/10.1016/j.cie.2020.106810

[75] CHAUHAN, V., PATEL, M., TANWAR, S., TYAGI, S., KUMAR, N. IoT Enabled real-Time urban transport management system. *Computers and Industrial Engineering* [online]. 2020, **86**, 106810. ISSN 0360-8352, eISSN 1879-0550. Available from: https://doi.org/10.1016/j.compeleceng.2020.106746

[76] CHEN, M., CHEN, J., YANG, P., LIU, S., TANG, K. A heuristic repair method for dial-a-ride problem in intracity logistic based on neighborhood shrinking. *Multimedia Tools and Applications* [online]. 2020, **80**, p. 30775-30787. ISSN 1380-7501, eISSN 1573-7721. Available from: https://doi.org/10.1007/s11042-020-08894-7

[77] XIA, D., ZHANG, M., YAN, X., BAI, Y., ZHENG, Y., LI, Y., LI, H. A distributed WND-LSTM model on MapReduce for short-term traffic flow prediction. *Neural Computing and Applications* [online]. 2021, **33**, p. 2393-2410. ISSN 0941-0643, eISSN 1433-3058. Available from: https://doi.org/10.1007/s00521-020-05076-2

[78] RYAN, M., ANTONIOU, J., BROOKS, L., JIYA, T., MACNISH, K., STAHL, B. The ethical balance of using smart information systems for promoting the united nations' sustainable development goals. *Sustainability* [online]. 2020, **12**(12), 22. eISSN 2071-1050. Available from: https://doi.org/10.3390/su12124826

[79] YANG, J., GUIZANI, N., HU, L., GHONEIM, A., ALRASHOUD, M., HOSSAIN, M. S. Smart autonomous moving platforms. *IEEE Network* [online]. 2020, **34**(3), p. 116-123. ISSN 0890-8044, eISSN 1558-156X. Available from: https://doi.org/10.1109/MNET.011.1900263

[80] GUERRA, A., DARDARI, D., DJURIC, P. M. Dynamic radar network of UAVs: a joint navigation and tracking approach. *IEEE Access* [online]. 2020, **8**, p. 116454-116469. eISSN 2169-3536. Available from: https://doi.org/10.1109/ACCESS.2020.3001393

[81] IRANMANESH, S., RAAD, R., RAHEEL, M. S., TUBBAL, F., JAN, T. Novel DTN mobility-driven routing in autonomous drone logistics networks. *IEEE Access* [online]. 2020, **8**, p. 13661-13673. eISSN 2169-3536. Available from: https://doi.org/10.1109/ACCESS.2019.2959275

[82] ASTHANA, S., DWIVEDI, A. Performance measurement of India-based third party logistics sector: an empirical study of user versus provider perspectives. *Production Planning and Control* [online]. 2020, **31**(2-3), p. 259-272. ISSN 0953-7287, eISSN 1366-5871. Available from: https://doi.org/10.1080/09537287.2019.1631467

[83] CHEN, X. The development trend and practical innovation of smart cities under the integration of new technologies. *Frontiers of Engineering Management* [online]. 2019, **6**, p. 485-502. ISSN 2095-7513, eISSN 2096-0255. Available from: https://doi.org/10.1007/s42524-019-0057-9

[84] ZHAO, B., TEO, Y.S., NG, W.S., NG, H.H. Data-driven next destination prediction and ETA improvement for urban delivery fleets. *IET Intelligent Transport Systems* [online]. 2019, **13**, p. 1624-1635. eISSN 1751-9578. Available from: https://doi.org/10.1049/iet-its.2019.0148

[85] SHAO, S., XU, G., LI, M. The design of an IoT-based route optimization system: a smart product-service system (SPSS) approach. *Advanced Engineering Informatics* [online]. 2019, **42**, 9. ISSN 1474-0346, eISSN 1873-5320. Available from: https://doi.org/10.1016/j.aei.2019.101006
[86] ARAUJO, V., MITRA, K., SAGUNA, S., AHLUND, C. Performance evaluation of FIWARE: a cloud-based IoT platform for smart cities. *Journal of Parallel and Distributed Computing* [online]. 2019, **132**, p. 250-261. ISSN 0743-7315, eISSN 1096-0848. Available from: https://doi.org/10.1016/j.jpdc.2018.12.010
[87] SICARI, S., RIZZARDI, A., COEN-PORISINI, A. How to evaluate an internet of things system: models, case studies, and real developments. *Software: Practice and Experience* [online]. 2019, **49**(11), p. 1663-1685. eISSN 1097-024X. Available from: https://doi.org/10.1002/spe.2740
[88] LIU, C., LI, H.Y., TANG, Y.W., LIN, D.T., LIU, J.W. Next generation integrated smart manufacturing based on big data analytics, reinforced learning, and optimal routes planning methods. *International Journal of Computer Integrated Manufacturing* [online]. 2019, **32**(9), p. 820-831. ISSN 0951-192X, eISSN 1362-3052. Available from: https://doi.org/10.1080/0951192X.2019.1636412
[89] HUSSEIN, A. H. Internet of things (IOT): research challenges and future applications. *International Journal of Advanced Computer Science and Applications (IJACSA)* [online]. 2019, **10**(6), p. 77-82. ISSN 2156-5570, eISSN 2158-107X. Available from: https://doi.org/10.14569/IJACSA.2019.0100611
[90] AQIB, M., MEHMOOD, R., ALZAHRANI, A., KATIB, I., ALBESHRI, A., ALTOWAIJRI, S. M. Smarter traffic prediction using big data, in-memory computing, deep learning and GPUs. *Sensors* [online]. 2019, **19**(9), 34. eISSN 1424-8220. Available from: https://doi.org/10.3390/s19092206
[91] SARKER, R. I., KAPLAN, S., ANDERSON, M. K., HAUSTEIN, S., MAILER, M., TIMMERMANS, H. J. P. Obtaining transit information from users of a collaborative transit app: platform-based and individual-related motivators. *Transportation Research Part C: Emerging Technologies* [online]. 2019, **102**, p. 173-188. ISSN 0968-090X, eISSN 1879-2359. Available from: https://doi.org/10.1016/j.trc.2019.03.011
[92] ABBASI, K. M., KHAN, T. A., UL HAQ, I. Hierarchical modeling of complex internet of things systems using conceptual modeling approaches. *IEEE Access* [online]. 2019, **7**, p. 102772-102791. eISSN 2169-3536. Available from: https://doi.org/10.1109/ACCESS.2019.2930933
[93] LIAO, D. Y., WANG, X. Applications of Blockchain technology to logistics management in integrated casinos and entertainment. *Informatics* [online]. 2018, **5**(4), 21. eISSN 2227-9709. Available from: https://doi.org/10.3390/informatics5040044
[94] GOHAR, M., MUZAMMAL, M., RAHMAN, A. U. SMART TSS: Defining transportation system behavior using big data analytics in smart cities. *Sustainable Cities and Society* [online]. 2018, **41**, p. 114-119. ISSN 2210-6707, eISSN 2210-6715. Available from: https://doi.org/10.1016/j.scs.2018.05.008
[95] GOUDOS, S. K., DALLAS, P. I., CHATZIEFTHYMIOU, S., KYRIAZAKOS, S. A survey of IoT key enabling and future technologies: 5G, mobile IoT, sematic web and applications. *Wireless Personal Communications* [online]. 2017, **97**, p. 1645-1675. ISSN 0929-6212, eISSN 1572-834X. Available from: https://doi.org/10.1007/s11277-017-4647-8
[96] ERKOLLAR, A., OBERER, B. Flextrans 4.0 - smart logistics for smart cities. *Sigma Journal of Engineering and Natural Sciences* [online]. 2017, **8**(4), p. 269-277. ISSN 1304-7191, e-ISSN 1304-7205. Available from: https://sigma.yildiz.edu.tr/storage/upload/pdfs/1635949255-en.pdf
[97] LI, D. R., CAO, J. J., YAO, Y. Big data in smart cities. *Science China Information Sciences* [online]. 2015, **58**, 12. ISSN 1674-733X, eISSN 1869-1919. Available from: https://doi.org/10.1007/s11432-015-5396-5
[98] ADAMCZAK, M., TOBOLA, A., FIJALKOWSKA, J., CYPLIK, P., TORZ, M. Analysis of incentives to eco-driving for car rental companies' customers. *Sustainability* [online]. 2020, **12**(24), 20. eISSN 2071-1050. Available from: https://doi.org/10.3390/su122410579
[99] NAGY, S., CSISZAR, C. The quality of smart mobility: a systematic review. *Scientific Journal of Silesian University of Technology. Series Transport* [online]. 2020, **109**, p. 117-127. ISSN 0209-3324, eISSN 2450-1549. Available from: https://doi.org/10.20858/sjsutst.2020.109.11
[100] DEL VECCHIO, P., SECUNDO, G., MARUCCIA, Y., PASSIANTE, G. A system dynamic approach for the smart mobility of people: implications in the age of big data. *Technological Forecasting and Social Change* [online]. 2019, **149**, 15. ISSN 0040-1625, eISSN 1873-5509. Available from: https://doi.org/10.1016/j.techfore.2019.119771
[101] SHI, F., WU, D., ARKHIPOV, D.I., LIU, Q., REGAN, A.C., MCCANN, J. A. ParkCrowd: reliable crowdsensing for aggregation and dissemination of parking space information. *IEEE Transactions on Intelligent Transportation Systems* [online]. 2019, **20**(11), p. 4032-4044. ISSN 1524-9050, eISSN 1558-0016. Available from: https://doi.org/10.1109/TITS.2018.2879036
[102] MAZZARINO, M., RUBINI, L. Smart urban planning: evaluating urban logistics performance of innovative solutions and sustainable policies in the Venice lagoon - the results of a case study. *Sustainability* [online]. 2019, **11**(17), 27. eISSN 2071-1050. Available from: https://doi.org/10.3390/su11174580
[103] PEPRAH, C., AMPONSAH, O., ODURO, C. A system view of smart mobility and its implications for Ghanaian

cities. *Sustainable Cities and Society* [online]. 2019, **44**, p. 739-747. ISSN 2210-6707, eISSN 2210-6715. Available from: https://doi.org/10.1016/j.scs.2018.10.025

[104] MOZOS-BLANCO, A. M., POZO-MENENDEZ, E., ARCE-RUIZ, R., BAUCELLS-ALETA, N. The way to sustainable mobility. A comparative analysis of sustainable mobility plans in Spain. *Transport Policy* [online]. 2018, **72**, p. 45-54. ISSN 0967-070X, eISSN 1879-310X. Available from: https://doi.org/10.1016/j.tranpol.2018.07.001

[105] KEIMER, A., LAURENT-BROUTY, N., FAROKHI, F., SIGNARGOUT, H., CVETKOVIC, V., BAYEN, A. M., JOHANSSON, K. H. Information patterns in the modeling and design of mobility management services. *Proceedings of the IEEE* [online]. 2018, **106**(4), p. 554-576. ISSN 0018-9219, eISSN 1558-2256. Available from: https://doi.org/10.1109/JPROC.2018.2800001

[106] KRESAK, J., CAGANOVA, D., BINDZAR, P., BARTAKOVA, G. P. Use of mining FREIGHT cableway in urban mobility as a part of an integrated transport system. *Acta Montanistica Slovaca / Acta Montanistica Slovaca* [online]. 2018, **23**(2), p. 194-205. ISSN 1335-1788. Available from: https://actamont.tuke.sk/pdf/2018/n2/8kresak.pdf

[107] MELO, S., MACEDO, J., BAPTISTA, P. Guiding cities to pursue a smart mobility paradigm: an example from vehicle routing guidance and its traffic and operational effects. *Research in Transportation Economics* [online]. 2017, **65**, p. 24-33. ISSN 0739-8859, eISSN 1875-7979. Available from: https://doi.org/10.1016/j.retrec.2017.09.007

[108] TURON, K., CZECH, P., JUZEK, M. The concept of a walkable city as an alternative form of urban mobility. *Scientific Journal of Silesian University of Technology. Series Transport* [online]. 2017, **95**, p. 223-230. ISSN 0209-3324, eISSN 2450-1549. Available from: https://doi.org/10.20858/sjsutst.2017.95.20

[109] PRONELLO, C., VEIGA-SIMAO, J., RAPPAZZO, V. Can multimodal real-time information systems induce a more sustainable mobility? *Transportation Research Record: Journal of the Transportation Research Board* [online]. 2016, **2566**(1), p. 64-70. ISSN 0361-1981, eISSN 2169-4052. Available from: https://doi.org/10.3141/2566-07

[110] LU, E. H. C., YANG, Y. W. A hybrid route planning approach for logistics with pickup and delivery. *Expert Systems with Applications* [online]. 2019, **118**, p. 482-492. ISSN 0957-4174, eISSN 1873-6793. Available from: https://doi.org/10.1016/j.eswa.2018.10.031

[111] REYES-RUBIANO, L., FERONE, D., JUAN, A. A., FAULIN, J. A simheuristic for routing electric vehicles with limited driving ranges and stochastic travel times. *SORT-Statistics and Operations Research Transactions* [online]. 2019, **43**(1), p. 3-24. eISSN 2013-8830. Available from: https://doi.org/10.2436/20.8080.02.77

[112] YU, J. J. Q., LAM, A. Y. S. Autonomous vehicle logistic system: joint routing and charging strategy. *IEEE Transactions on Intelligent Transportation Systems* [online]. 2018, **19**(7), p. 2175-2187. ISSN 1524-9050, eISSN 1558-0016. Available from: https://doi.org/10.1109/TITS.2017.2766682

[113] ALVAREZ, P., LERGA, I., SERRANO-HERNANDEZ, A., FAULIN, J. The impact of traffic congestion when optimising delivery routes in real time. a case study in Spain. *International Journal of Logistics Research and Applications* [online]. 2018, **21**(5), p. 529-541. ISSN 1367-5567, eISSN 1469-848X. Available from: https://doi.org/10.1080/13675567.2018.1457634

[114] PERBOLI, G., GOBBATO, L., MAGGIONI, F. A progressive hedging method for the multi-path travelling salesman problem with stochastic travel times. *IMA Journal of Management Mathematics* [online]. 2017, **28**(1), p. 65-86. eISSN 1471-6798. Available from: https://doi.org/10.1093/imaman/dpv024

[115] ABBATECOLA, L., FANTI, M.P., MANGINI, A.M., UKOVICH, W. A decision support approach for postal delivery and waste collection services. *IEEE Transactions on Automation Science and Engineering* [online]. 2016, **13**(4), p. 1458-1470. ISSN 1545-5955, eISSN 1558-3783. Available from: https://doi.org/10.1109/TASE.2016.2570121

[116] MUELAS, S., LATORRE, A., PENA, J. M. A distributed VNS algorithm for optimizing dial-a-ride problems in large-scale scenarios. *Transportation Research Part C: Emerging Technologies* [online]. 2015, **54**, p. 110-130. ISSN 0968-090X, eISSN 1879-2359. Available from: https://doi.org/10.1016/j.trc.2015.02.024

[117] KIM, J., MOON, H., JUNG, H. Drone-based parcel delivery using the rooftops of city buildings: model and solution. *Applied Sciences* [online]. 2020, **10**(12), 20. eISSN 2076-3417. Available from: https://doi.org/10.3390/app10124362

[118] IRANMANESH, S., RAAD, R. A novel data forwarding strategy for a drone delay tolerant network with range extension. *Electronics* [online]. 2019, **8**(6), 14. eISSN 2079-9292. Available from: https://doi.org/10.3390/electronics8060659

[119] WANG, F. X., WANG, F., MA, X., LIU, J. Demystifying the crowd intelligence in last mile parcel delivery for smart cities. *IEEE Network* [online]. 2019, ***33***(2), p. 23-29. ISSN 0890-8044, eISSN 1558-156X. Available from: https://doi.org/10.1109/MNET.2019.1800228

[120] DE CARVALHO, S. P. P., KALID, R. A., RODRIGUEZ, M. J. L. Evaluation of the city logistics performance through structural equations model. *IEEE Access* [online]. 2019, **7**, p. 121081-121094. eISSN 2169-3536.

Available from: https://doi.org/10.1109/ACCESS.2019.2934647

[121] DEMIRTAS, N., TUZKAYA, U. R., TANYAS, M. Layout of urban distribution center using possibilistic programming. *International Journal of Computational Intelligence Systems* [online]. 2016, **9**(6), p. 1068-1081. ISSN 1875-6891, eISSN 1875-6883. Available from: https://doi.org/10.1080/18756891.2016.1256559

[122] AHMAD, N., MEHMOOD, R. Enterprise systems and performance of future city logistics. *Production Planning and Control* [online]. 2016, **27**(6), p. 500-513. ISSN 0953-7287, eISSN 1366-5871. Available from: https://doi.org/10.1080/09537287.2016.1147098

[123] HE, Z., HAASIS, H. D. A theoretical research framework of future sustainable urban freight transport for smart cities. *Sustainability* [online]. 2020, **12**(5), 28. eISSN 2071-1050. Available from: https://doi.org/10.3390/su12051975

[124] COMI, A., SCHIRALDI, M.M., BUTTARAZZI, B. Smart urban freight transport: tools for planning and optimising delivery operations. *Simulation Modelling Practice and Theory* [online]. 2018, **88**, p. 48-61. ISSN 1569-190X, eISSN 1878-1462. Available from: https://doi.org/10.1016/j.simpat.2018.08.006

[125] CAVONE, G., DOTOLI, M., SEATZU, C. A survey on petri net models for freight logistics and transportation systems. *IEEE Transactions on Intelligent Transportation Systems* [online]. 2018, **19**(6), p. 1795-1813. ISSN 1524-9050, eISSN 1558-0016. Available from: https://doi.org/10.1109/TITS.2017.2737788

[126] HEDDEBAUT, O., DI CIOMMO, F. City-hubs for smarter cities. The case of Lille EuraFlandres interchange. *European Transport Research Review* [online]. 2018, **10**, 10. ISSN 1866-8887, eISSN 1867-0717. Available from: https://doi.org/10.1007/s12544-017-0283-3

[127] GATTA, V., MARCUCCI, E., LE PIRA, M. Smart urban freight planning process: integrating desk, living lab and modelling approaches in decision-making. *European Transport Research Review* [online]. 2017, ***9***, 32. ISSN 1866-8887, eISSN 1867-0717. Available from: https://doi.org/10.1007/s12544-017-0245-9

[128] RODRIGUE, J. P., DABLANC, L., GIULIANO, G. The freight landscape: convergence and divergence in urban freight distribution. *Journal of Transport and Land Use* [online]. 2017, **10**(1), p. 557-572. ISSN 1938-7849. Available from: https://doi.org/10.5198/jtlu.2017.869

[129] JIANG, N., TIAN, E., DANESHMAND MALAYERI, F., BALALI, A. A new model for investigating the impact of urban knowledge, urban intelligent transportation systems and IT infrastructures on the success of SCM systems in the distributed organizations. *Kybernetes / Kybernetika* [online]. 2020, **49**(11), p. 2799-2818. ISSN 0368-492X. Available from: https://doi.org/10.1108/K-04-2019-0288

[130] HOSEINZADEH, N., LIU, Y.D., HAN, L.D., BRAKEWOOD, C., MOHAMMADNAZAR, A. Quality of location-based crowdsourced speed data on surface streets: a case study of Waze and Bluetooth speed data in Sevierville, TN. *Computers, Environment and Urban Systems* [online]. 2020, **83**, 14. ISSN 0198-9715, eISSN 1873-7587. Available from: https://doi.org/10.1016/j.compenvurbsys.2020.101518

[131] PAN, X., LI, M., WANG, M., ZONG, T., SONG, M. The effects of a smart logistics policy on carbon emissions in China: a difference-in-differences analysis *Transportation Research Part E: Logistics and Transportation Review* [online]. 2020, **137**, 101939. ISSN 1366-5545, eISSN 1878-5794. Available from: https://doi.org/10.1016/j.tre.2020.101939

[132] HUANG, L., XIE, G., BLENKINSOPP, J., HUANG, R., BIN, H. Crowdsourcing for sustainable urban logistics: exploring the factors influencing crowd workers' participative behavior. *Sustainability* [online]. 2020, **12**(8), 20. eISSN 2071-1050. Available from: https://doi.org/10.3390/su12083091

[133] BULATOV, N. K., TOILYBAYEV, A. E., SULEYEVA, N. Z., SARZHANOV, D. K. Development of the model (algorithm) of the efficient transportation logistics with the purpose of collection and transportation of the solid municipal waste to the places of their recycling. *Environment, Development and Sustainability* [online]. 2021, **23**, p. 2015-2037. ISSN 1387-585X, eISSN 1573-2975. Available from: https://doi.org/10.1007/s10668-020-00661-w

[134] WU, H., TAO, F., QIAO, Q., ZHANG, M. A Chance-constrained vehicle routing problem for wet waste collection and transportation considering carbon emissions. *International Journal of Environmental Research and Public Health* [online]. 2020, **17**(2), 21. eISSN 1660-4601. Available from: https://doi.org/10.3390/ijerph17020458

[135] VILACA, M., MACEDO, E., TAFIDIS, P., COELHO, M. C. Multinomial logistic regression for prediction of vulnerable road users risk injuries based on spatial and temporal assessment. *International Journal of Injury Control and Safety Promotion* [online]. 2019, **26**(4), p. 379-390. ISSN 1745-7300, eISSN 1745-7319. Available from: https://doi.org/10.1080/17457300.2019.1645185

[136] AQIB, M., MEHMOOD, R., ALZAHRANI, A., KATIB, I., ALBESHRI, A., ALTOWAIJRI, S. M. Rapid transit systems: smarter urban planning using big data, in-memory computing, deep learning, and GPUs. *Sustainability* [online]. 2019, **11**(10), 33. eISSN 2071-1050. Available from: https://doi.org/10.3390/su11102736

[137] BUYUKOZKAN, G., MUKUL, E. Evaluation of smart city logistics solutions with fuzzy MCDM methods. *Pamukkale University Journal of Engineering Sciences* [online]. 2019, **25**(9), p. 1033-1040. ISSN 1300-7009, eISSN 2147-5881. Available from: https://doi.org/10.5505/pajes.2019.32956

[138] RUSSO, F., RINDONE, C., PANUCCIO, P. European plans for the smart city: from theories and rules to logistics test case. *European Planning Studies* [online]. 2016, **24**(9), p. 1709-1726. ISSN 0965-4313, eISSN 1469-5944. Available from: https://doi.org/10.1080/09654313.2016.1182120

[139] BARRIOS, J. A., GODIER, J. D. Fleet sizing for flexible carsharing systems simulation-based approach. *Transportation Research Record: Journal of the Transportation Research Board* [online]. 2014, **2416**(1), p. 1-9. ISSN 0361-1981, eISSN 2169-4052. Available from: https://doi.org/10.3141/2416-01

[140] OGBUKE, N. J., YUSUF, Y. Y., DHARMA, K., MERCANGOZ, B. A. Big data supply chain analytics: ethical, privacy and security challenges posed to business, industries and society. *Production Planning and Control* [online]. 2020, ***15***(2-3), p. 123-137. ISSN 0953-7287, eISSN 1366-5871. Available from: https://doi.org/10.1080/09537287.2020.1810764

[141] PASKANNAYA, T., SHABAN, G. Innovations in green logistics in smart cities: USA and EU experience. *Marketing and Management of Innovations* [online]. 2019, **10**(1), p. 173-181. ISSN 2218-4511, eISSN 2227-6718. Available from: https://doi.org/10.21272/mmi.2019.1-14

[142] CHEN, X., ZHANG, S., DING, X., KADRY, S.N., HSU, C. IoTcloud platform for information processing in smart city. *Computational Intelligence* [online]. 2020, **37**(3), p. 1428-1444. eISSN 1467-8640. Available from: https://doi.org/10.1111/coin.12387

[143] LAURIERI, N., LUCCHESE, A., MARINO, A., DIGIESI, S. A door-to-door waste collection system case study: a survey on its sustainability and effectiveness. *Sustainability* [online]. 2020, **12**(14), 24. eISSN 2071-1050. Available from: https://doi.org/10.3390/su12145520

[144] RYBICKA, I., DROZDZIEL, P., STOPKA, O., LUPTAK, V. Methodology to propose a regional transport organization within specific integrated transport system: a case study. *Transport Problems* [online]. 2018, **13**(4), p. 115-125. ISSN 1896-0596, eISSN 2300-861X. Available from: https://doi.org/10.20858/tp.2018.13.4.11

[145] DE OLIVEIRA, R. C. H., FERREIRA COSTA, A. P., THOMAZ, V. F., SILVA, I. A. Low-cost deployment proposal to urban mobility in smart cities. *The Journal of Supercomputing* [online]. 2019, **75**, p. 7265-7289. ISSN 0920-8542, eISSN 1573-0484. Available from: https://doi.org/10.1007/s11227-019-02941-3

[146] GUERLAIN, C., RENAULT, S., FERRERO, F., FAYE, S. Decision support systems for smarter and sustainable logistics of construction sites. *Sustainability* [online]. 2019, **11**(10), 22. eISSN 2071-1050. Available from: https://doi.org/10.3390/su11102762

[147] MISRA, D., DAS, G., CHAKRABORTTY, T., DAS, D. An IoT-based waste management system monitored by cloud. *Journal of Material Cycles and Waste Management* [online]. 2018, **20**, p. 1574-1582. ISSN 1438-4957, eISSN 1611-8227. Available from: https://doi.org/10.1007/s10163-018-0720-y

[148] TU, W., ZHAO, T., ZHOU, B., JIANG, J., XIA, J., LI, Q. OCD: Online crowdsourced delivery for on-demand food. *IEEE Internet of Things Journal* [online]. 2020, **7**(8), p. 6842-6854. eISSN 2327-4662. Available from: https://doi.org/10.1109/JIOT.2019.2930984

[149] DOMINGUEZ, J. M. L., AL-TAM, F., DE J. MATEO SANGUINO, T., CORREIA, N. Analysis of machine learning techniques applied to sensory detection of vehicles in intelligent crosswalks. *Sensors* [online]. 2020, **20**(21), 17. eISSN 1424-8220. Available from: https://doi.org/10.3390/s20216019

[150] DHAKAL, N., CHERRY, C. R., LING, Z., AZAD, M. Using CyclePhilly data to assess wrong-way riding of cyclists in Philadelphia. *Journal of Safety Research* [online]. 2018, **67**, p. 145-153. ISSN 0022-4375, eISSN 1879-1247. Available from: https://doi.org/10.1016/j.jsr.2018.10.004

[151] RADOCAJ, D., PLASCAK, I., JURISIC, M. Global navigation satellite systems as state-of-the-art solutions in precision agriculture: a review of studies indexed in the Web of Science. *Agriculture* [online]. 2023, **13**(7), 1417. eISSN 2077-0472. Available from: https://10.3390/agriculture13071417

[152] MALANSKI, P. D., SCHIAVI, S. M. D., DEDIEU, B., DAMANSCENO, J. C. International research on labor in agri-food value chains: a bibliometric review from web of science. *Frontiers in Sustainable Food Systems* [online]. 2022, **6**, 852178. eISSN 2571-581X. Available from: https://10.3389/fsufs.2022.852178