European Proceedings of
Social and Behavioural Sciences
EpSBS

www.europeanproceedings.com
e-ISSN: 2357-1330

DOI: 10.15405/epsbs.2021.04.80

CDSES 2020

IV International Scientific Conference "Competitiveness and the development of socio-economic systems" dedicated to the memory of Alexander Tatarkin

DEVELOPMENT OF TRANSPORTATION AND LOGISTICS SYSTEMS IN DIGITALIZATION AND INTELLECTUALIZATION

Gleb Savin (a)*
*Corresponding author

(a) Ural State University of Economics, 62, 8 Marta St., Yekaterinburg, Russia, glebsavin@ya.ru

Abstract

The city's transport and logistics system is the foundation of any regional economic system, the result, and a necessary structural component of transformations. It becomes an integral part of the strategic vision, including in the socio-spatial organization, an essential direction of modern development, and today it is experiencing some difficulties. A significant increase in the world dynamism and regional processes, the complication of the socio-economic, cultural, and epidemic situation in the future will lead to inefficiency in the functioning of cities' transport and logistics systems. At the same time, the state of the national and regional logistics system, as well as adverse external effects caused by the fact of active consumption of the city territory, industrial enterprises, and the population, have increasing influence, among them, there are aggravating environmental problems, the lack, and inefficiency of the appropriate infrastructure, congestion of the transport network and increased costs. Currently, the problem of managing these systems comes down to building intelligent transport systems in cooperation with logistics, which represent a common ideology for integrating telematics into all areas of transport and logistics activities to solve problems of an economic and social nature, and are designed to control three main areas such as security, mobility, and environment. Their development will lead to the development of the transport and logistics system called Smart City.

Keywords: Information flows, smart city, smart contract, transport and logistics system

https://doi.org/10.15405/epsbs.2021.04.80
Corresponding Author: Gleb Savin
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

1. Introduction

Most researchers (Albino et al., 2015; Angelidou, 2017; Ben-Zadok, 2019; Joss et al., 2019; Komninos, 2014; Yigitcanlar & Kamruzzaman, 2019) associate the development of Smart City with the introduction of digital technologies in the economy, healthcare, waste disposal, housing and communal services, transport and other areas of city development, i.e. we can talk about the practical implementation and the predominance of the technological approach. In few scientific studies, you can find that the development of Smart City is also associated with the development of human and social capital, and the development of non-digital technologies and innovations.

Today, the progressive development of modern cities faces the following problems such as the resource supply, the functioning of the transport and logistics system (or TLS), processing, storage and transmission of information, as well as with an increase in social and material inequality, security, deterioration of the natural environment and difficult epidemic situations (Dalton et al., 2019; Dowling et al., 2019; Hatuka et al., 2018; Jin et al., 2019; Wong et al., 2018). Of particular interest are the directions of economic discussions on the development and formation of an integrated urban digital ecosystem, where the development of modern cities' infrastructure is of the highest priority.

The historically established transport and logistics system of any city is now becoming one of the main problems that hinder the development and turnover of economic resources, which is expressed in the growth of personal consumer spending of citizens, and economic losses of businesses and budgets of different levels. At the same time, the economic losses of the state from ineffective transport and logistics systems of cities can reach 3.2% of GDP and more.

2. Problem Statement

The past 20 years have seen Smart City development initiatives aimed at developing infrastructure and services that form a comfortable urban environment for people in many cities around the world. However, Smart City development's scientific paradigm is in its infancy today, which is due to the multiplicity of similar categories as ''sustainable'', ''smart'', ''digital'', ''intelligent'', and ''eco-friendly'', etc.

Many scientists (Albino et al., 2015; Angelidou, 2017; Benner, 2019; Ben-Zadok, 2019; Dowling et al., 2019; Hatuka et al., 2018; Jin et al., 2019; Joss et al., 2019; Jonescu et al., 2020; Komninos, 2014; Wong et al., 2018; Yigitcanlar & Kamruzzaman, 2019) associate the Smart City transport and logistics system with the development of physical, digital and intellectual infrastructure, which serves as the basis for harmonizing streaming and non-streaming processes. However, the theoretical and methodological foundations of its development and functioning are in the process of formation.

The need to develop a methodology for the formation and management of a modern Smart City transport and logistics system is due to social and scientific views on the comfortable development of a person, which is associated with new trends in the development of technologies and society, as well as the need to reboot the economy to a new technological order with the priority of a logistics approach taking into account current and future external and internal factors.

https://doi.org/10.15405/epsbs.2021.04.80
Corresponding Author: Gleb Savin
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

3. Research Questions

Today, the formation of the transport and logistics system does not take place in an integrated manner either within the framework of material flows or passenger flows or within the supply chains of enterprises in the economy's industrial sector.

At the same time, the development of Smart City TLS is increasingly influenced by the state of the national and regional logistics system, as well as negative external effects caused by the fact of active 'consumption' of the city territory (Næss et al., 2020), industrial enterprises and the population, among them there are aggravating environmental problems (Mneimneh et al., 2017)., their congestion of the transport network and the growth of intracity transport and logistics costs (Legacy, 2017; Sultana et al., 2019).

3.1. Special attention is paid to the theoretical and methodological significance of the study of the formation and development of Smart City TLS for several reasons.

Firstly, economic resources (i.e. labor, capital, entrepreneurship and knowledge) are concentrated in cities, the need to manage and optimize which is difficult today and, not fully, is effective (Benner, 2019; Jonescu at el, 2020; Legacy, 2017; Mneimneh et al., 2017; Yadav & Mohapatra, 2018).

Secondly, the development of a digital society imposes new principles. Automated systems completely computerize forms of future interactions and relationships, which allows us to assert that a radical transformation of the Smart City TLS will occur, since today modern tools at the micro and macro levels. In the future, this will happen in the dominant movement and transportation as a key logistic function, i.e. development of cooperative and autonomous transport and logistics systems (Anda et al., 2017; Jin et al., 2019; Legacy, 2017; Sultana et al., 2019).

Thirdly, urbanization has acquired a global scale, has become a catalyst for the further concentration of population in cities, and there is a complication of streaming and non-streaming processes in the Smart City TLS (Ahluwalia, 2019; Finewood et al., 2019).

In the fourth place, the current flow models are not fully developed for cities of different formations, and do not reflect the current features, processes and structures of the urban economy and do not reflect future factor influences (Dalton et al., 2019; Gessa & Sancha, 2020).

In the fifth place, the current epidemiological situation, in the context of a downturn in the economy and a change in the economic model of development, it is advisable and reasonably efficient to spend financial resources on advanced areas that can act as a catalyst for economic growth.

3.2. As part of the development of a 'smart' city, there is a need to consider the Smart City transport and logistics system (TLS), as a single mechanism for optimizing streaming and non-streaming processes in the conditions of the formation of a digital society.

It should be noted that Smart City TLS is associated with the following development areas such as intelligent transport systems, electronic services, infrastructure, storage systems and information processing (Anda et al., 2017, Baldwin & Stafford, 2019; Finewood et al., 2019).

https://doi.org/10.15405/epsbs.2021.04.80
Corresponding Author: Gleb Savin
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

4. Purpose of the Study

The research aims to form the Smart City transport and logistics system, aimed at achieving its efficiency, optimizing flow and non-flow processes, and improving the quality and level of people's livelihoods.

5. Research Methods

The scientific methods of system analysis, design of complex systems, forecasting, considering the current and future factor influence were used.

6. Findings

From the author's point of view, Smart City TLS is a high-tech equilibrium system, united by transport and logistics, digital and intelligent infrastructure, functioning in the system of cycles and information environment for providing streaming and non-streaming processes in real time, and associated with the development of human capital.

The functioning of any system is characterized by its expressed equilibrium state. The transition to a new state is possible only with external initiatives. We will offer an algorithm for the development of Smart City transport and logistics system (figure 1).

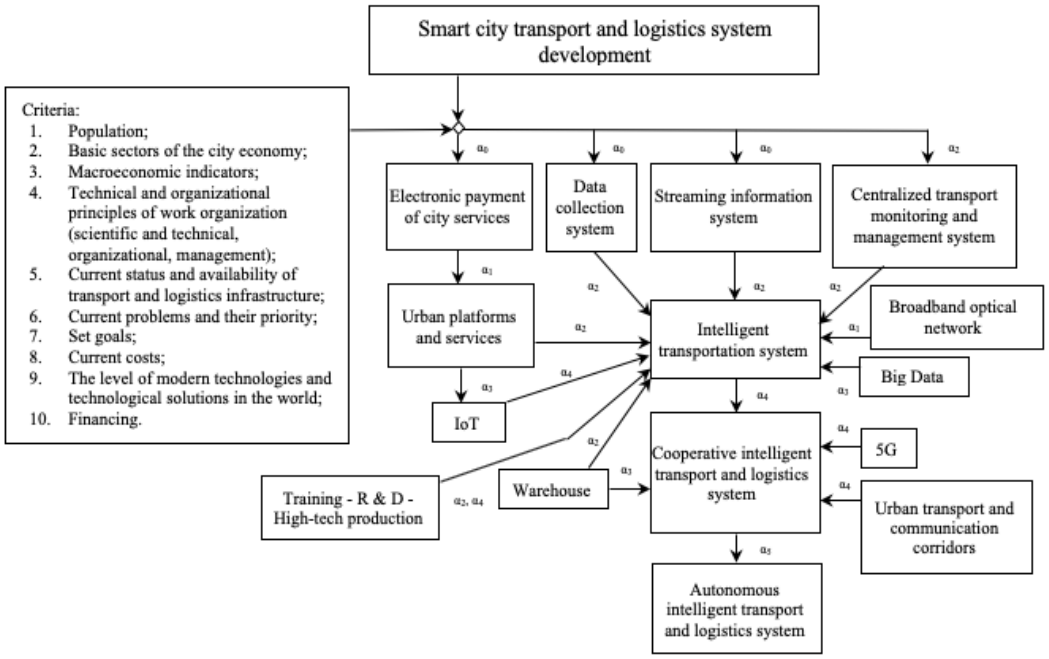

Figure 1. Multivariable algorithm of Smart City transport and logistics system development with appropriate selection criteria

Note that electronic payment for city services, systems for collecting information and informing participants in streaming processes is the basic component structure of the Smart City TLS and, according to the author, is recommended for any city. Its further promising development is associated with the

https://doi.org/10.15405/epsbs.2021.04.80
Corresponding Author: Gleb Savin
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

development of technologies and the ability to solve each city's current problems. We will form the conditions for the implementation of Smart City TLS (table 1).

Table 1. Smart City transport and logistics system implementation conditions

Model	Implementation	Terms
Minimum ($a_{0,1}$)	Urban platforms and services, broadband optical network	For any city
Optimum (a_2)	Intelligent transport system, development of the chain ‘‘training - R & D - high-tech production’’, warehouse	Population from 500 thousand, integration into the chain of at least one position, development of transport and logistics centers
Modern (a_3)	Big Data, IoT, warehouse	Population from 1 million people, development of the chain of transport and logistics centers, widespread calculation of collected data, introduction of control microprocessors in various types of domestic and industrial equipment
Perspective (a_4)	5G, cooperative intelligent transport and logistics system, urban transport and communication technologies	Population from 1.5 million people, development of transport and communication corridors, high-tech production, wireless networks, automation of cycle streaming processes
Innovation (a_5)	Smart city autonomous intelligent transport and logistics system	Development of the chain ‘‘training – R & D - high-tech production’’, service

The monovariant algorithm for the development of Smart City TLS is based on a comprehensive optimization, systemic and logistic approaches, which makes it possible to take into account a multi-criteria complex of checks and balances in order to develop balanced indicators of the flow model, which is focused on solving current and future problems of any city. At the same time, the main goal is to reduce the peak values of congestion, which is a fundamental factor affecting the costs of participants in streaming processes, and contributes to an increase in the quality of human life in cities of different formation and specialization.

The formation of the Smart City transport and logistics system should be studied from the standpoint of an integrated optimization, systemic and logistic approaches to fill the vector of its development with new meaningful characteristics. Incentives and for effective management of TLS Smart City, information is of great importance, which forms the information environment for its functioning and development to implement Smart contracts (figure 2).

A smart contract is an automated algorithm based on Blockchain 2.0 technology for the operation and control of the main enlarged functions in the TLS and acts as an incentive for the introduction of modern technologies and services, the formation of infrastructure, training of personnel and the processing of collected information to plan improvements in the interests of residents and other participants in streaming processes, and also allows you to choose the optimal balance of sustainable development in the field of rational use of resources.

https://doi.org/10.15405/epsbs.2021.04.80
Corresponding Author: Gleb Savin
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

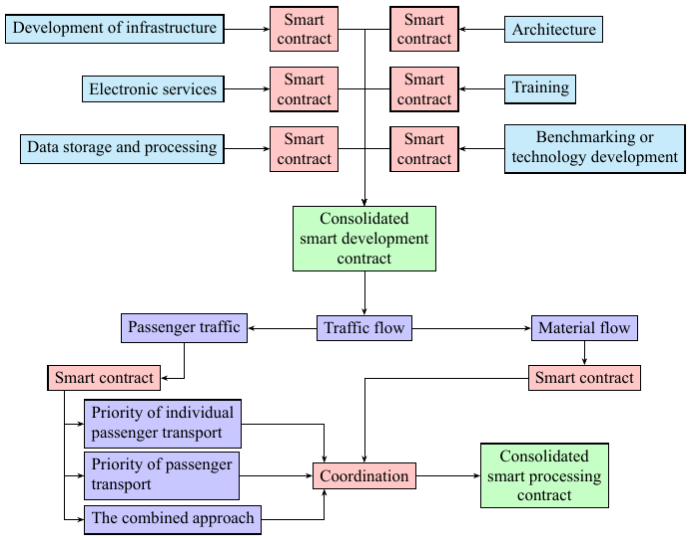

Figure 2. Smart contract in Smart City transport and logistics information environment

As a decentralized system, the Smart-contract of functioning (dApp type 2) unites the main participants in streaming processes (such as a person, a driver, a carrier, a municipality, an organization and a service company) into a new type of relationship system based on the P2P protocol, which forms the current paired interactions between them for the following types of services or the following has requirements:

- Driver-municipality, organization-municipality, service company-municipality, carrier-municipality (driving time along the route and parking, CO2 emissions);
- Driver-carrier (time on the route of transportation);
- Human carrier (time of transportation along the route using the entire range of public transport);
- Human driver (time of transportation along the route);
- Human service company (taxi, car sharing, bike rental and delivery);
- Service company-carrier (maintenance and repair).

Note that a type 2 dApp decentralized application generates its own protocols and tokens (provides access, determines the cost of a service, and performs transactions) in a secure peer-to-peer network. This approach allows you to control congestion as the main factor indicator of the proposed streaming model and form digital formalities of Smart City TLS functioning for each group of consumers, ensuring consistency in the field of restrictions, incentives and choice alternatives for each participant in streaming processes. The congestion indicator is an indicator of not only congestion in the transport and logistics infrastructure, but also the occupancy rate of public transport.

The consolidated Smart-contract for functioning as a digital formality of Smart City TLS is an automated algorithm with an appropriate variable combination of modes of movement for a person, taking into account a flexible pricing policy, and an optimal route for organizations for a certain time interval).

https://doi.org/10.15405/epsbs.2021.04.80
Corresponding Author: Gleb Savin
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

The development of the transport and logistics system Smart City is also expressed in the form of the formation of formalities for cities of different formations, which is a combination of the corresponding transport and logistics, digital and intelligent infrastructure, electronic services and their development, information storage, training, etc., as well as a mechanism implementation.

For these purposes, it is necessary to form an urban platform Blockchain 2.0 with the prospect of its development up to 3.0, which will make it possible to come to cooperative and autonomous intelligent transport and logistics systems Smart City (figure 3), while, in the future, many paired interactions, i.e. the influence of the human factor is leveled.

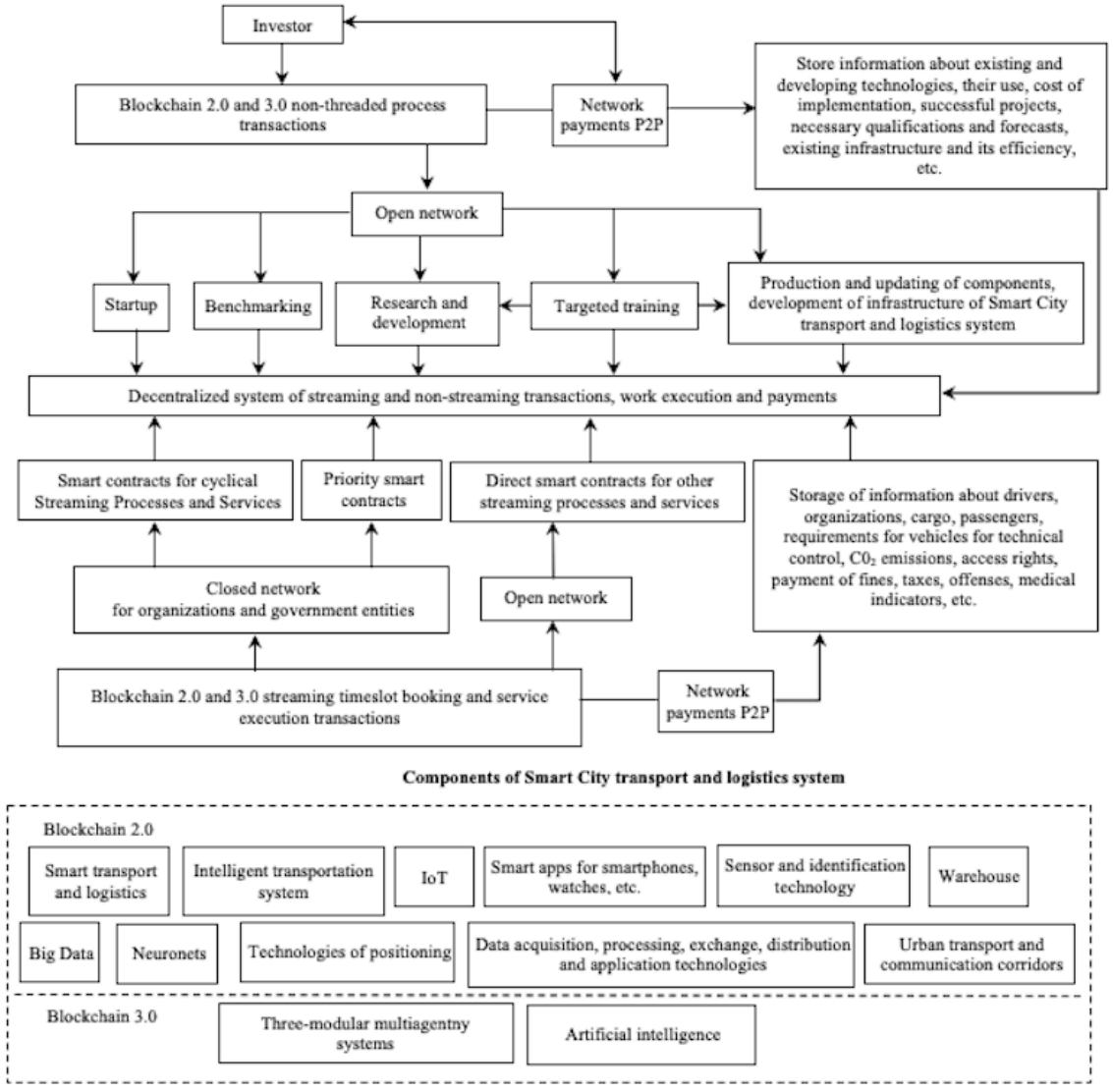

Figure 3. Smart City transport and logistics information environment functional blocks

The city digital platform TLS Smart City acts as a hyper-converged and trading system that ensures the permanent coordination of streaming processes, namely controls the execution of contracts for transportation (or movement) taking into account overload (or transfer), and also controls repairs, maintenance of transport and logistics, digital and intelligent infrastructure, service delivery, staffing and more efficient use of public transport. In addition, the city digital platform initializes and forms the

https://doi.org/10.15405/epsbs.2021.04.80
Corresponding Author: Gleb Savin
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

'Training - Research and development work - High-tech production chain' in the Smart City transport and logistics system in order to develop it and improve the quality of human life.

Today, for many cities around the world, there is a lag in the pace of development and inefficiency in the operation of infrastructure. At the same time, the development of a unified urban digital infrastructure has a number of advantages. Firstly, the stability of data transmission is ensured with uniform protocols and equipment, the risks of relationships with different owners are leveled.

Secondly, there is no need to duplicate equipment for different services, departments and organizations, which ultimately leads to savings in acquisition and maintenance, as well as to more operational and flexible modernization and improvement.

Thirdly, more efficient integration of sensor and identification technologies and standards and protocols of machine-to-machine communication is realized;

Fourthly, with the development of Blockchain technology, there is no need to develop large servers.

In addition, it becomes possible to operate already implemented processing systems, analysis, data using cloud computing, sensor networks in combination with Web 2.0, social networks, crowdsourcing platforms for collective computing, rather than building new facilities.

We emphasize that the digital, intelligent, as well as transport and logistics infrastructure of TLS Smart City is an innovative component of sustainable development. At the same time, an integrated management system for this infrastructure, as well as the development of non-digital technologies, 'green' and energy-efficient buildings, enterprises and engineering facilities, are acquiring particular importance. In this situation, infrastructure management requires the development of theoretical and methodological principles of management in order to coordinate and unite the efforts of the main stakeholders and other stakeholders.

The development of the urban digital platform TLS Smart City as an infrastructure project should have following strategic goals, there are as follows:

- Development of intelligent solutions with an open architecture that contributes to the complete management of technological resources and information with a given level of service for all its participants;
- Ensuring a high level of cybersecurity and transparency of streaming and non-streaming processes;
- Permanent coordination, contributing to the achievement of a controlled level of congestion, money and time;
- Formation of an innovative research and crowdsourcing system focused on the creation of technologies, services and solutions that improve the quality of human life;
- Stimulating the development of digital and high-tech sectors of the city's economy;
- Attracting investments, reducing the impact of sanctions risks and monitoring the environmental, epidemiological and other spheres of human life;
- Attracting 'best' infrastructure management practices (ITIL, BISML, ASL, COBIT, etc.) with full or partial use of developed ISO standards, as well as scalability of digital and intelligent infrastructure.

https://doi.org/10.15405/epsbs.2021.04.80
Corresponding Author: Gleb Savin
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

7. Conclusion

This study allows us to draw the following conclusions. Firstly, the transport and logistics system Smart City acts as an infrastructure project that ensures sustainable economic growth within the scientific paradigm of sustainable development, environmental protection, the formation of a high-tech and science-intensive complex with the development of human capital. Secondly, its development is associated with the development of intelligent transport systems operating on the principle of smart contracts, for the development of which it is necessary to form an information environment and infrastructure. Thirdly, for the effective development of this system, the priority is the formation of a unified streaming model, as well as a mechanism for managing transport and logistics, digital and intelligent infrastructure of the Smart City TLS. The main result is the formation of an urban digital platform TLS Smart City in order to optimize streaming and non-streaming processes.

References

Ahluwalia, I. J. (2019). Urban governance in India. *Journal of Urban Affairs*, *41*(1), 83-102. https://doi.org/10.1080/07352166.2016.1271614

Albino, V., Berardi, U., & Dangelico, R. M. (2015). Smart Cities: definitions, dimensions, performance, and initiatives. *Journal of Urban Technology*, *22*(1), 3-21. https://doi.org/10.1080/10630732.2014.942092

Anda, C., Erath, A., & Fourie, P. J. (2017). Transport modelling in the age of big data. *International Journal of Urban Sciences, 21*(sup1), 19-42. https://doi.org/10.1080/12265934.2017.1281150

Angelidou, M. (2017). The role of smart city characteristics in the plans of fifteen cities. *Journal of Urban Technology*, *24*(4), 3-28. https://doi.org/10.1080/10630732.2017.1348880

Baldwin, C., & Stafford, L. (2019). The role of social infrastructure in achieving inclusive liveable communities: voices from regional Australia. *Planning Practice & Research*, *34*(1), 18-46. https://doi.org/10.1080/02697459.2018.1548217

Benner, M. (2019). Smart specialization and institutional context: the role of institutional discovery, change and leapfrogging. *European Planning Studies*, *27*(9), 1791-1810. https://doi.org/10.1080/09654313.2019.1643826

Ben-Zadok, E. (2019). The sustainable city. *Journal of Urban Affairs*, *41*(3), 419-421. https://doi.org/10.1080/07352166.2018.1507209

Dalton, C., Wilmott, C., Fraser, E., & Thatcher, J. (2019). Smart discourses, the limits of representation, and new regimes of spatial data. *Annals of the American Association of Geographers*, *110*(2), 1-12. https://doi.org/10.1080/24694452.2019.1665493

Dowling, R., McGuirk, P., & Gillon, C. (2019). Strategic or piecemeal? Smart City initiatives in Sydney and Melbourne. *Urban Policy and Research*, *37*(4), 429-441. https://doi.org/10.1080/08111146.2019.1674647

Finewood, M. H., Matsler, A. M., & Zivkovich, J. (2019). Green Infrastructure and the hidden politics of urban stormwater governance in a postindustrial city. *Annals of the American Association of Geographers*, *109*(3), 909-925. https://doi.org/10.1080/24694452.2018.1507813

Gessa, A., & Sancha, P. (2020). Environmental open data in urban platforms: an approach to the Big Data life cycle. *Journal of Urban Technology*, *27*(1), 27-45. https://doi.org/10.1080/10630732.2019.1656934

Hatuka, T., Rosen-Zvi, I., Birnhack, M., Toch, E., & Zur, H. (2018). The political premises of contemporary urban concepts: the global city, the sustainable city, the resilient city, the creative city, and the smart city. *Planning Theory & Practice*, *19*(2), 160-179. https://doi.org/10.1080/14649357.2018.1455216

Joss, S., Sengers, F., Schraven, D., Caprotti, F., & Dayot, Y. (2019). The Smart City as global discourse: storylines and critical junctures across 27 cities. *Journal of Urban Technology*, *26*(1), 3-34. https://doi.org/10.1080/10630732.2018.1558387

Jonescu, E., Mercea, T., Do, K., & Sutrisna, M. (2020). In support of sustainable densification in urban planning: a proposed framework for utilising CCTV for propagation of human energy from movement within urban spaces. *Urban, Planning and Transport Research*, *8*(1), 24-43. https://doi.org/10.1080/21650020.2019.1703800

Jin, S. T., Kong, H., & Sui, D. Z. (2019). Uber, public transit, and urban transportation equity: a case study in New York City. *The Professional Geographer*, *71*(2), 315-330. https://doi.org/10.1080/00330124.2018.1531038

Komninos, N. (2014). The age of intelligent cities: environments and innovation-for-all strategies. https://doi.org/10.4324/9781315769349

Legacy, C. (2017). Transport planning in the urban age. *Planning Theory & Practice*, *18*(2), 177-180. https://doi.org/10.1080/14649357.2017.1309789

Mneimneh, F., Srour, I., Kaysi, I., & Harb, M. (2017). Eco-City projects: incorporating sustainability requirements during pre-project planning. *Journal of Urban Technology*, *24*(1), 47-74. https://doi.org/10.1080/10630732.2016.1175828

Næss, P., Saglie, I.-L., & Richardson, T. (2020). Urban sustainability: is densification sufficient? *European Planning Studies*, *28*(1), 146-165. https://doi.org/10.1080/09654313.2019.1604633

Sultana, S., Salon, D., & Kuby, M. (2019). Transportation sustainability in the urban context: a comprehensive review. *Urban Geography*, *40*(3), 279-308. https://doi.org/10.1080/02723638.2017.1395635

Wong, C.-Y., Ng, B.-K., Azizan, S. A., & Hasbullah, M. (2018). Knowledge structures of city innovation systems: Singapore and Hong Kong. *Journal of Urban Technology*, *25*(1), 47-73. https://doi.org/10.1080/10630732.2017.1348882

Yadav, S., & Mohapatra, G. (2018). Big Data in the context of Smart Cities: exploring urban planning and governance. *Data Science Landscape. Towards Research Standards and Protocols*, *38*, 141-150. https://doi.org/10.1007/978-981-10-7515-5_10

Yigitcanlar, T., & Kamruzzaman, Md. (2019). Smart Cities and mobility: does the smartness of Australian cities lead to sustainable commuting patterns? *Journal of Urban Technology*, *26*(2), 21-46. https://doi.org/10.1080/10630732.2018.1476794