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1) Title of the material

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https://www.mdpi.com/2071-1050/12/21/8759

2) Which section of the SUMP it is relevant to?

This article is a conceptual contribution that discusses the implementation of Intelligent Transport Systems in the new city models. Therefore, the article can be linked to the third, fourth and fifth sections of the SUMP circle related respectively to the determination of planning framework, analysis of the mobility situation (in particular the analysis of problems and opportunities for all modes of transport - **subsection 3.2**.), scenario building and joint evaluation (development of scenarios of possible futures - **subsection 4.1**.) and vision and strategy development (arguments for stakeholders – **subsection 5.1**).

3) Which Mobility Manager knowledge this material is the most relevant to?

It is related to Transport and mobility planning (section 1 of the Mobility Manager competencies) especially 1b (employment of ITS/ICT and smart measures).

4) Problem approached and content overview

Problem approach – general understanding of the role of modern ITS services and applying them to the city environment. According to the United Nations, by 2050 70% of the world's population will live in cities. This growth will be reflected in the demand for better services, which should be adapted to the collective and individual needs of the population. Governments and organisations are working to identify and implement strategies to respond to these challenges. The main challenges are related to transport and its management, treating transport as a key issue for the economy, sustainability and regional development. In this way, Intelligent Transport Systems (ITS) play a key role in responding to these scenarios, as they provide a framework in which new hardware and software tools are integrated, allowing the efficient development of transport systems management, taking into account aspects such as track management, communication between vehicles and infrastructure, and safety, among others. Nevertheless, the ITS concept is rapidly evolving, so it is necessary to understand its development. To this end, this study conducted a thematic analysis of ITS in the literature, assessing the intellectual structure and its evolution using SciMAT, quantifying the main bibliometric indicators and identifying the main research areas, authors, journals and countries. For this purpose, ITS-related publications from 1993-2019 available in the Web of Science (WoS) Core Collection (7649 publications) were searched and analysed. Finally, one of the main

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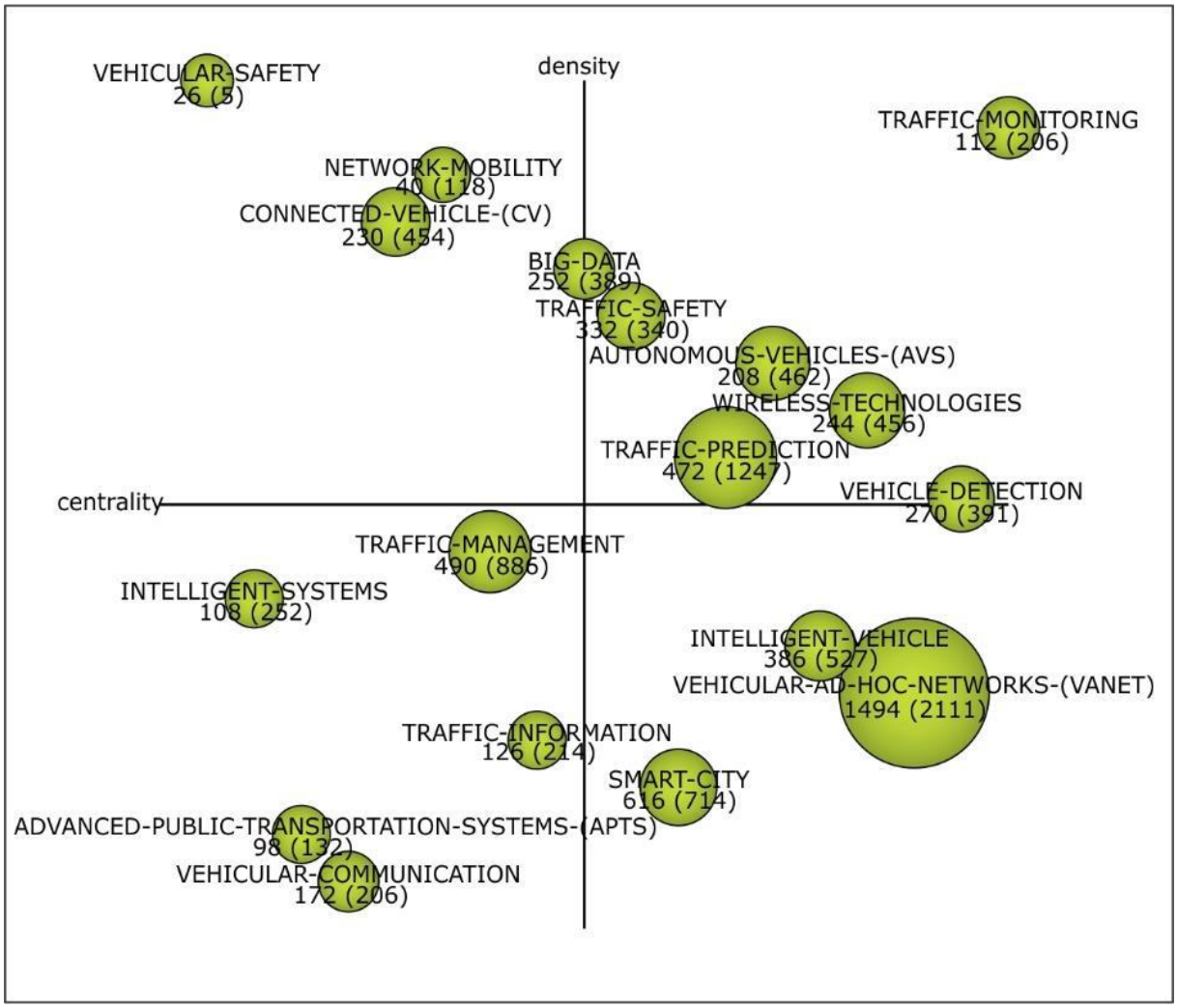
results is a recent map of ITS research topics, taking into account their intellectual structure, evolution and relationships. It helps to define and implement strategies, identify scientific, academic and business opportunities, as well as future and business and future research directions to strengthen the role of ITS in new city models.

The main objective of this study is to create a holistic bibliometric analysis that assesses the growth, evolution and productivity of the ITS research field and updates ITS intellectual structure from 1993 to 2019. This will help all stakeholders to define, develop and implement ITS strategies and identify key authors, organisations, journals and research topics based on a complete longitudinal mapping analysis of science in which the intellectual structure is analysed from a holistic approach. The paper presents the methodology used in the study and the results of the bibliometric analysis, including the main stakeholders (countries, organisations and authors), sources, topics and publications.



Strategic diagrams from 2015 to 2019

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Furthermore, an analysis of the mapping of science in the field of intelligent transport systems in two ways is presented: strategy diagrams and a longitudinal evolution map.

5) Who could be interested in this material?

The article is aimed at students and those looking for inspiration in implementations of ITS services in cities when such measures are applied in SUMP.

6) What is worth mentioning as an innovative factor for the reader?

The ITS evolution map provides a complete overview from 1993 to 2019. With this in mind, the main topics reported in the literature were:

- ADVANCED-PUBLIC-TRANSPORTATION-SYSTEMS: Neural networks, business intelligence systems, path planning algorithms, genetic algorithms, constraint programming, GPS-based vehicles, route planning, route selection, real-time track data, floating vehicle data, and sustainable transport.
- AUTONOMOUS VEHICLES-(AVS): Cybercars, automated driving, urban transport, platooning driving, assisted driving, automated highway systems, adaptive control, road vehicle control, power control, intelligent control, fuzzy control, assisted driving, autonomous driving, accident detection, simultaneous localization, information framework, bus rapid transit, self-driving car, path planning, traffic planning, and cooperative intersection control.
- CONNECTED-VEHICLE: Real-time processing, process synchronisation, optimal control, model predictive control and intersection management.
- GEOSPATIAL INFORMATION SYSTEM (GIS): Road protection, location determination, sustainable transport, transport data, traction conditions, street network databases, platforms, global positioning systems, environments, urban traction, traction and route guidance and real-time information.
- HIGHWAY AND ROAD MANAGEMENT: Control strategies, enhanced observed time dependence, transport telematics, signal optimisation, road frontage, intersection navigation, intelligent road transport systems, pollution, kinematic waveforms, driver assistance systems, highway and road capacity, collision avoidance, video detection, variable speed limit, traffic state estimation and intelligent vehicles.
- INTELLIGENT VEHICLE: Machine vision, automatic driving, wireless communication, truth keeping system, taxi fleet management, structured data, mobile ad hoc networks, traffic signal control system, traffic light recognition, image recognition, geographic routing, advanced driver assistance system, and driver assistance systems. driver assistance system and driver assistance systems.
- NETWORK-MOBILITY: route optimisation, session initiation protocol, mobility management, host identity protocol and new protocols.
- SMART-CITY: video streaming, urban mobility, intelligent mobility, particle swarm optimisation, intelligent transport, global positioning system and genetic algorithms.

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- TRAFFIC MANAGEMENT: public and rural transport, dynamic route guidance, transport telematics, traffic signal control system, traveller information, traffic centre, traffic sensors, traffic flow theory, traffic management system, traffic dynamics, road vehicle location, real-time recognition, neural networks, new ICT technologies, integrated control, urban sustainability, optima speed model, network analysis and computational intelligence.
- TRAFFIC SIMULATION: Transport simulation systems, model abstraction method, urban logistics, ATIS next generation, dynamic routing, neural network, route prediction, network simulation and genetic algorithm.
- VEHICULAR-AD-HOC-NETWORKS: Connectivity, intelligent vehicles, wireless network and communication, vehicle-to-vehicle, vehicle-to-infrastructure, traffic signal control, broadcast protocol, cooperative positioning, information dissemination, mobility model, authentication protocol and authentication.
- VEHICLE-COMMUNICATION: wireless network and communication, traffic route and guidance, privacy technique, message authentication and standard communication.

After analysing these lines and their evolution, it can be concluded that the development of ITS technology will provide support for the development and implementation of a detailed, long-term, flexible and integrated ITS strategy with city mobility objectives. It will take into account the vision of the user to improve services, to learn about their habits and influence their behavioural patterns, and to integrate service provision with the various existing modes of transport.

It is important to stress that the field of ITS research is developing rapidly, driven mainly by developments in other fields of knowledge. In this sense, the second iteration of this analysis may be to identify areas outside ITS (e.g. big data, smart cities, smart mobility, algorithms, machine learning, sustainability, new transport business models, new vehicles) that influence its development and consolidation.

On the other hand, the definition and implementation of new city models require complementary developments, especially in the field of research on Intelligent Transport Systems, given that they determine its configuration, impact and evolution. Thus, current research identifies Traffic Management and Communication, Infrastructure and Systems as the main thematic areas to be considered in urban planning from three vectors: sustainability, "smartization" and dimension.

In addition, the impact of these thematic areas can be determined by considering the main themes included in these areas and each theme. In this context, advanced public transport systems, new vehicle technologies (smart, connected and autonomous), smart cities and ICT are of particular importance.

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7) Limitations

The problem was analysed at a high level of generality. Nevertheless, the presented conclusions may serve as an inspiration for Polish cities regarding problems that may occur during the implementation of new ITS solutions.