Sustainable Transport Development Strategy in Developed and Developing Countries

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ABSTRACT

This study aims to explore the idea *of sustainable transportation* in the United States, China, Canada, and South Korea which they are the top four countries from the keywords sustainable transportation. This study uses a bibliometric analysis method based on 306 previous research articles (Scopus) using keywords *"sustainable transportation"* in 2012-2022. The highest number of research trends in the United States is 166 articles; China has 102 articles, Canada has 46 articles, and South Korea has 26 articles. The data analysis uses several *tools,* VosViewer and Nvivo 12 Plus. The results show that each country has a different focus measured from three aspects: planning, information, and investment. Planning aspects include transportation, routes, costs, carbon emissions, and applications. The information aspect consists of estimation, trip, and performance. The investment aspect includes current demands and issues to shape future policies. US have development strategy *Sustainable Transportation* in the planning stage only focuses on vehicle emissions. In contrast, travel modes become information aspect, then, there is no attention to future policies related to investment nowadays. In the planning aspect of *Sustainable Transportation*, China focusses on varies aspect: the type of transportation used, emissions, and the route. Contrary, the Chinese state has not paid attention to this focus for the information and investment aspects. Meanwhile, Canada and South Korea have not focused on planning, information, and investment. rom these findings, it is hoped that it can provide input for various countries to pay more attention to these aspects to achieve sustainable transportation in smart cities.

Keywords: Sustainable transportation, Smart city, SDG's

INTRODUCTION

Concern for environmental quality has sparked great attention to sustainability in recent decades (Marleau Donais *et al.*, 2022). Governments in various countries have also begun to declare sustainable development efforts through the *Sustainable Development Goals* (SDGs) agenda. Sustainable development can be reflected in multiple infrastructure systems that can be measured by economic aspects environmental and social impacts (Guo and Zhang, 2021) and (Liu *et al.*, 2015). One component of intelligent city sustainability is sustainable transportation and access (Mahmoudi *et al.*, 2019). This is also explained by (Lee *et al.*, 2017), who state that sustainable transport is one of

the principles of sustainable development efforts in the transportation sector. The issue of transportation in the context of sustainability was brought up by Willim R. Black (2001) in "An Unpopular Essay on Transportation"(Xu, Aziz and Guensler, 2019). It discusses nine predictions related to transportation in the future. The predictions have proven to be accurate, including the prediction of the transportation revolution that contributes to the sustainability of transport. This is because the development of transportation is about the speed and sophistication of vehicles and the need to consider the use of energy and the production of the resulting emissions. The massive use of public transportation is also considered to reduce energy use and the disposal of harmful emissions to environmental sustainability. As stated by (Rice *et al.*, 2020), the use of emissions is detrimental to public health.

Intelligent city transportation is also often combined with technological developments such as implementing the *Intelligent Transporting System* (ITS), one of the innovative city applications that utilize 5G technology (Gohar and Nencioni, 2021). The use of sensors in city infrastructure such as roads (Badii *et al.*, 2019), automated electric buses to optimize public transportation (Bublyk *et al.*, 2020), and the use of big data in the development of intelligent city transportation (Gohar, Muzammal and Ur Rahman, 2018). However, there are still very few governments that pay attention to sustainable transport from a policy aspect that can affect the long term. Meanwhile, determining the right policy requires careful planning and integrated information delivery. Seeing this urgency, it is essential to pay attention to several aspects of policymaking based on current issues to be evaluated and used as capital in policy formation in the future. This study aims to determine the four countries' tendency to discuss sustainable transportation based on the aspects that are of concern in this study. The output generated from this research is to provide input to various countries to pay more attention to these aspects in developing sustainable transportation to realize the 11th SDGs goal.

RESULT AND DISCUSSION

Sustainable Transportation Publication Trend Analysis

The results of the analysis of 538 journal articles that discuss sustainable transportation with a range from 2012 to 2022 show quite varied data. This paper analyzes based on several classifications such as the number of articles per year, country, affiliation, author, and the dominant scientific field in the last ten years.

In the last ten years, the number of journal articles has fluctuated from year to year. The picture above shows that from 2012 to 2022, the lowest number of pieces produced in 2012 was 12 articles, then the highest number of reports was issued in 2021 with 117 articles. There was a decline from 2015 to 2016 by seven pieces. This condition shows that the discussion regarding sustainable transportation has enough dynamics from year to year.

The United States has the highest number of articles on sustainable transportation, with 166 reports. They are then followed by China with 103 pieces, Canada with 46 articles, and then South Korea with 26 articles.
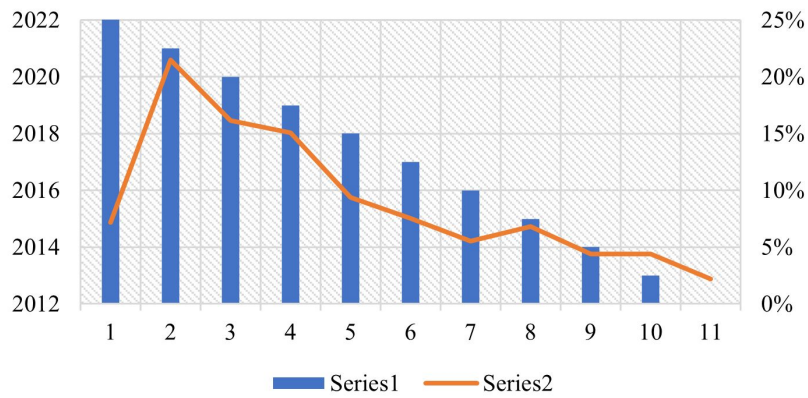
Figure 1: Graph of sustainable transportation trends 2012-2021.
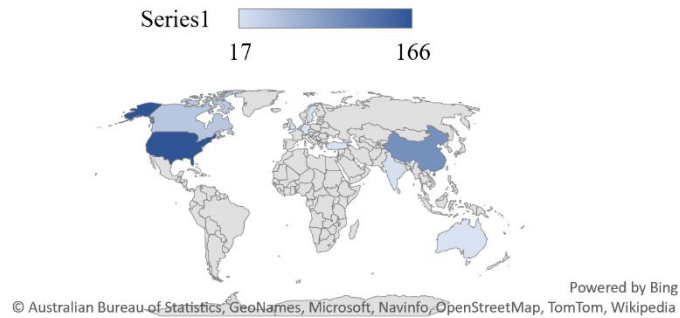**Source:** Author, 2022.

Figure 2: Sustainable transportation trends by country.
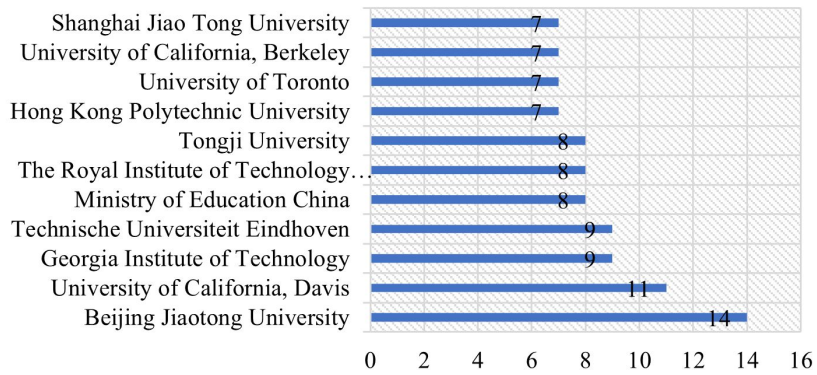**Source:** Author, 2022.

Figure 3: Sustainable transportation trends by affiliation.
Source: Author, 2022.

Several other countries are also developing research on sustainable transportation, such as the Netherlands and the United Kingdom. From these data, it can be seen that several developed countries have considered the preservation of nature when talking about transportation.

Table 1. Sustainable transportation trends by author.

Authors	Article
Choi, K.	4
Kucukvar, M.	4
Rasouli, S.	4
Antoniou, C.	3
Frederick, C.	3
Fujii, S.	3
Gao, L.	3
Haghshenas, H.	3
Krizek, K.J.	3
Onat, N.C.	3
Rodriguez-Valencia, A.	3

Source: Author, 2022.
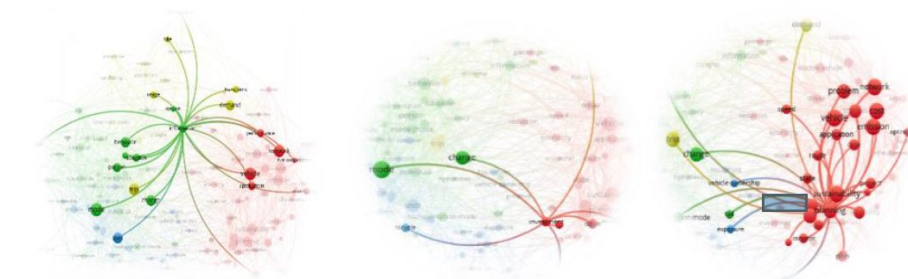
Figure 4: Visualization of sustainable transportation trends.
Source: Vosviewer Data Processing.

The picture above shows that Beijing Jiaotong University is an affiliate of the university that has conducted the most research related to sustainable transportation, namely 14 articles in the last ten years—then followed by the University of California, Davis, which showed 11 studies. Other universities conducting the same research are the Georgia Institute of Technology, Technische Universiteit Eindhoven, and the Ministry of Education of China, which are the top five in developing research on sustainable transportation.

Choi, Kucukvar, and Rasouli are the researchers with the most studies discussing sustainable transportation. Meanwhile, other researchers only have three articles that pay attention to aspects of sustainable transport in their research.

Analysis of Developed and Developing Country Publication Trends

Data mapping through the Vosviewer application helps find and discuss sustainable transportation. Based on the mapping, several aspects could be the focus of a strategy for sustainable transport. From the mapping results of previous research, it is hoped to provide an exciting picture of each country that has its focus on discussing sustainable transportation. The following is the result of displaying data from the VosViewer application:

The planning aspect is one of the strategic focuses in the discussion of sustainable transportation because careful planning is needed to get to sustainable transport. Careful planning can be measured from several indicators, namely the preparation of transportation support applications to make it easier for the public to access them, the type of transportation that supports sustainable transport, the travel routes used in which areas are essential in urban settings towards sustainable planning (Billones *et al.*, 2021) , emissions and costs incurred in implementing the transportation. In addition to the planning aspect, the information aspect is urgent because achieving sustainable transport requires adequate information about travel and performance estimates used to disseminate this information to the broader community. It was also mentioned (Bernhardt *et al.*, 2020) that information technology intervention creates a smart ecosystem by combining *Information Communication Technology* (ICT) with city infrastructure. Then another aspect that has urgency in sustainable transportation is long-term policy investment. A good policy can be a long-term investment in a better direction. Therefore, it is crucial in policymaking to pay attention to currently developing issues to be evaluated.

The US has enough attention on sustainable transportation in the planning aspect, which is indicated by several articles that discuss it. As (Balali, Fathi and Aliasgari, 2020) state, the management of transportation modes is not only related to the sophistication and effectiveness of travel time, but it is also essential to consider other aspects such as aspects of sustainability, fuel consumption, and costs incurred. The US has several articles that discuss the information aspect in the information aspect (Chaudhary *et al.*, 2019), which state that information infrastructure supports innovative city ecosystems in the intelligent transportation sector. However, in terms of long-term transportation policy, the US has not paid more attention, which seems to have no articles discussing it. In contrast to the theme from China, the planning aspect concerns a little about emissions, costs, and modes of transportation. They are more interested in discussing sustainable transport from the side of urban spatial planning as in the study (Gao *et al.*, 2021) examining industrial land use for intelligent cities. Regarding information and its relation to sustainable transportation, no article from China discusses it. Still, China has articles related to monitoring smart roads with the help of modern information technology (Liu *et al.*, 2021). Meanwhile, China has not conducted further studies based on the current situation in terms of long-term policy.

Meanwhile, Canada has several articles related to sustainable transportation, but most articles only emphasize the urgency of using bicycles as a mode of public transportation to achieve sustainable transport. Research (Larsen, Patterson and El-Geneidy, 2013), (Amiri and Sadeghpour, 2015), and (Edge, Goodfield and Dean, 2020) discuss the use of bicycles to reduce emissions expenditure and support sustainable transportation. Meanwhile, in the aspect of transportation planning, information, and long-term policy, research from Canada has not yet been found that discusses this matter. Then in South Korea, there are several focuses of research on sustainable transportation, such as research (Ban and Hyun, 2019) that bicycles can reduce

pollution rates. However, some articles from South Korea have not developed sustainable transportation in the aspects of planning, information, and long-term policies in detail.

CONCLUSION

This study found some interesting findings that each country has its focus on discussing sustainable transportation, especially when viewed from the aspect of planning, information, and long-term policy investment.US has a *Sustainable Transportation* in the planning stages focusing solely on vehicle emissions. On the other hand, the mode of travel becomes an information aspect; then, there is no attention to future policies related to current investments. In the planning element of *Sustainable Transport*, China focuses on various factors: the type of transportation used, emissions, and routes. On the other hand, China has paid less attention to this focus on information and investment aspects. Meanwhile, Canada and South Korea have not focused on planning, information, and investment.

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