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Readiness of the Batam City Government in implementing sustainable transportation

Kesiapan Pemerintah Kota Batam dalam menerapkan transportasi berkelanjutan

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Abstract
Batam City transportation has several problems that are influenced by the conditions of the public transportation system. The purpose of this study will be to examine the application of Smart Mobility by the Batam City Government as an effort to realize sustainable transportation in Batam City so that, through this study, an overview of the Batam City Government's readiness to apply the concept of sustainable (Smart City) will be obtained. This study uses a qualitative analysis research method that begins with a literature review process followed by data collection. The analysis technique used is triangulation supported by data analysis tools, namely VOSviewer and NVivo 12 Plus. The study results show that intelligent mobility in Batam City has not been implemented optimally and has not taken a sustainable approach. This is evidenced by the conclusions of the study which show that there is no balance in applying for development policies/programs in sustainability (economic, social, environmental) and the absence of legal products that focus on the concept of sustainable transportation, as well as the lack of use of information, communication, technology in transportation.

Keywords: implementation policy; smart mobility; sustainable transportation

Abstrak
Transportasi Kota Batam memiliki beberapa permasalahan yang dipengaruhi oleh kondisi sistem transportasi umum. Tujuan dari penelitian ini adalah untuk mengkaji penerapan Smart Mobility oleh Pemerintah Kota Batam sebagai upaya mewujudkan transportasi berkelanjutan di Kota Batam sehingga melalui penelitian ini dapat dilihat gambaran kesiapan Pemerintah Kota Batam dalam menerapkan konsep sustainable (Smart City) akan diperoleh. Studi ini menggunakan metode penelitian analisis kualitatif yang diawali dengan proses kajian pustaka yang dilanjutkan dengan pengumpulan data. Teknik analisis yang digunakan adalah triangulasi yang didukung oleh alat analisis data yaitu VOSviewer dan NVivo 12 Plus. Hasil studi menunjukkan bahwa mobilitas cerdas di Kota Batam belum dilaksanakan secara optimal dan belum mengambil pendekatan yang berkelanjutan. Hal ini dibuktikan dengan kesimpulan studi yang menunjukkan belum adanya keseimbangan dalam penerapan kebijakan/ program pembangunan yang berkelanjutan (ekonomi, sosial, lingkungan) dan belum adanya produk hukum yang menitikberatkan pada konsep transportasi berkelanjutan, serta minimnya penggunaan informasi, komunikasi, teknologi dalam transportasi.

Kata Kunci: *penerapan kebijakan; smart mobility; transportasi berkelanjutan*

Introduction

The concept of sustainability is one of the globally agreed alternatives to achieve a balance in development and the lives of future generations (Sharifi 2019). A critical aspect of development is to balance the process of change while preserving the environment to protect the earth and the lives of future generations (Ahvenniemi et al. 2017). This research focuses on the application of Sustainable Transportation in Batam City. It refers to the complex existing conditions of the city of Batam, so it is necessary to find solutions and solutions that can be applied, such as in cities in developed countries, namely the application of sustainable transportation. This study aims to examine the application of

Smart Mobility by the Batam City Government to realize sustainable transportation. This study will also provide an overview of the readiness of the Batam City Government to implement the concept of sustainability (smart mobility) which can be seen through the application of the concept of sustainability in every aspect of transportation development.

Batam City is a city of industry, services, tourism and is becoming one of the tourist icons visited by local and foreign tourists; therefore, the demand for better transportation services is something that cannot be ignored. According to Bamwesigye & Hlavackova (2019) sustainable transportation policies must be based on the Intelligent Transport System (ITS) as the basis for future multimodal network information spaces. Transportation policies in developed countries have been based on the development and advancement of Intelligent Transport System (ITS) technology, which is the basis for the information space for future multimodal networks.

The importance of the concept of sustainability stems from the problems that occur in urban life, one of which is in the field of transportation. Cities are centers of change that are rapidly experiencing innovation and economic growth (Pawłowska 2018). The high population in urban areas is one of the natural and urban challenges (Lopez-Arboleda et al. 2019, Pujiati et al. 2020, Surya et al. 2020a, 2020b). Various studies and research show that the transportation system so far does not show the concept of sustainability in it. According to Sultana et al. (2019), the unsustainability of the urban transportation system can be understood from three fundamental aspects, namely environmental, social, and economic quality. Regional issues associated with transportation problems include traffic congestion, increasing personal use, high accident rates (Lopez-Arboleda et al. 2019) and less efficient fuel consumption. The decrease in air quality is caused by the increase in CO2 emissions produced by transportation, affecting public health and the environment (Arroub et al. 2016).

The comparison of road area to city area (Density), which is not followed by the development of the Intelligent Transportation System (ITS) in the use of technology, is still minimal (Zawieska & Pieriegud 2018), a problem that arises in these aspects being a mixture of alienation, isolation and inequality, crime, and environmental problems such as pollution and congestion and ineffective and inefficient services (Khansari et al. 2014). According to Purnomo et al. (2020), the transportation sector is the most significant contributor to energy use and is constantly increasing. Estimates of energy use for transportation are dominated by road transport (88%) consisting of passenger cars 34%, freight transport 32%, motorcycles 13% and buses 1%.

Table 1.
Population of Batam City in 2010 and 2020

Subdistrict	2010	2020
Belakang Padang	18508	22439
Bulang	9531	10707
Galang	14983	16989
Sungai Beduk	80349	96193
Sagulung	149727	209386
Nongsa	49828	81451
Batam Kota	162238	198617
Sekupang	100108	156283
Batu Aji	127455	139512
Lubuk Baja	80780	84533
Batu Ampar	58745	60450
Bengkong	92033	119836
Total	**944285**	**1196396**

Source: Badan Pusat Statistik Kota Batam (BPS Batam City 2022)

Various reasons cause the transportation challenges in Batam City, the most significant of which are rapid population growth and increased car ownership, both of which impact increasing traffic congestion (Petrović et al. 2020). Driver discipline is lacking due to increased mobility of people, products, services,

and tourism. In addition, the physical condition of transportation is a concern regarding fares and routes. Poor traffic management and the lack of integration in the administration of the transportation system, as well as urban development that does not follow the formation of harmonious land use (not including spatial planning) are problems. The increasing number of people living in Batam City is one element that contributes to the development of sustainable transportation infrastructure (Abnur 2019). As the population grows, the need for transportation increases. The total population of Batam City based on the results of the population census by district and gender can be seen in Table 1.

Based on the data in Table 1, it can be seen that population growth per 10 years from 2010 amounted to 944285 to 2020 amounted to 1196396. In 10 years there has been an increase of 252,111 inhabitants. The increase in population is also followed by the high number of vehicles in Batam City. Based on the latest 2022 data (rc.korlantas.polri.go.id) which was updated on the Electronic Registration Identification (ERI) website of the Riau Islands Police, it shows that the city of Batam ranks first with the highest number of vehicles. This statement can be seen in Table 2.

Table 2.
Number of Riau Islands vehicles in 2022

No	City resort police	Number of vihecles
1	Batam City	782.066
2	Tanjungpinang City	128.976
3	Karimun	90.497
4	Bintan	69.945
5	Lingga	12.432
6	Natuna	11.431
7	Kepulauan Anambas	2.664

Source: Korlantas Polri (2022)

Based on Table 2, it can be seen that the City of Batam is ranked first in the Riau Islands Province with a high number of vehicles of 782,066. This high number is not balanced with the volume of roads, causing congestion, and congestion is one of the urban problems that can be solved with sustainable agreements.

The high growth of vehicles is not balanced with the development of environmentally friendly technology (Nugroho et al. 2020). Based on the data above, the number of vehicles in Batam is 782,066, around 71.23%. According to Nugraha et al. (2020), the high number of vehicles that are not balanced with the road volume will result in congestion (Koh & Chin 2022). This assertion is consistent with the situation of heavy traffic congestion in Batam City. In addition, the high number of automobiles in Batam City would undoubtedly contribute to air pollution, resulting in a reduction in air quality, which will negatively impact the residents' health. For this reason, the development of sustainable transportation requires definite initiatives. The fact that Batam is an industrial city is another argument in favor of the island's need to develop intelligent solutions. Because of Batam's status as an industrial city, the island is obligated to adopt Smart Mobility, which is an intelligent and sustainable mode of transportation that will have a positive impact on the local economy, society, and environment for future generations (Zawieska & Pieriegud 2018).

Sustainability has become a global concept, so one of the driving forces in development is transportation (Golub 2010, Leuenberger et al. 2014, Bamwesigye & Hlavackova 2019). Transportation is an essential means in people's lives as a liaison to all aspects of life. The transportation system is directly related to the welfare of the community, the natural environment, and even the development of the world economy also depends on the transportation system (Warlina & Hermawan 2020). In essence, transportation is related to the dynamics of movement and the mobility or movement of people and goods from one location to another, of course, with the existing modes of transportation (Bamwesigye & Hlavackova 2019). Humans need this movement to maintain life and life on an ongoing basis. Transportation also needs to be seen as an effort to help urban planning (Saif et al. 2019).

Therefore, transportation is closely related to economic, social, and environmental aspects. This is in line with the global agreement on the concept of sustainable development itself, namely paying attention to economic, social, and environmental aspects for future generations. The transportation system is directly related to the welfare of society, the natural environment, and even the development of the world economy also depends on the transportation system. The management of a sustainable transportation system is a challenge for policymakers (Khairina et al. 2022). In line with the rapid and rapid development of technology and information in urban areas, it allows the government as a policymaker to be innovative in managing sustainable transportation.

Sustainable Transportation is one of the dimensions of a smart city. According to Rodríguez-Bolívar (2015), assuming what is known as a smart city is a strategy to get cities to improve and adapt to socioeconomic changes through information and communication technology features. Then this is supported by the statement (Pereira et al. 2018) that smart cities are the next step of E-Government which is used as the basis for development, then smart cities can be reached by bigger and wider smart governments for urban development.

According to Khansari et al. (2014), the Intelligent Information Technology (IT)-based movement in handling problems related to transportation will encourage the realization of sustainability. Smart mobility is part of the application of the concept of sustainable transportation. Sustainable transportation is also a component of a smart city, and its role is crucial in implementing the concept of sustainability (Pawłowska 2018, Bamwesigye & Hlavackova 2019). Sustainable transportation protects people's health and helps reduce accidents and traffic congestion. It can meet the financial needs of transportation while increasing social justice and health levels (Anthopoulos & Reddick 2016).

Indicators of sustainable transportation are in three aspects, namely, environment, transportation that does not harm public health and ecosystems, puts forward an innovative approach to developing SDGs (Sustainable Development Indicators) for decision-making processes in cities and transportation that can ensure the fulfillment of transportation costs through the imposition of affordable costs. It must be appropriate for people who use transportation facilities and can realize justice in the transportation system; and social transportation that can minimize noise levels, accidents, and congestion, increase social justice and health levels in healthy communities that are feasible to live in, and rich in social capital (Dwihastadi et al. 2020).

Meanwhile, according to Cohen (2019), readiness in sustainable transportation/smart mobility needs to look at five aspects, including local accessibility, multi-modal access, international accessibility, information & communication technology infrastructure supporting mobility, and sustainable & safe transportation. Another thing was conveyed (Leuenberger et al. 2014, Bamwesigye & Hlavackova 2019) is that sustainable transportation indicators include enabling safe access for communities and ecosystems to ensure future stability; sustainable transportation must be efficient in providing alternative means of alternative transportation to be chosen as highway and cycling routes, public buses, and rail and ICT Utilization. From the information on the Sustainable Transportation Indicators, the characteristics used to see sustainable transportation in Batam City can be seen in Table 3.

To achieve sustainability, the relationship of every aspect must be balanced without neglecting any (Hiremath et al. 2013). To meet sustainable development needs, policymakers must identify and provide appropriate information that will assist in policy planning by underlining the notion of sustainability. Many parts must be met before sustainable development can be implemented effectively, including institutional preparedness, regulatory considerations, socio-cultural readiness, preparedness of human resources, and an integrated approach (Sachs et al. 2019). The findings show that, in terms of transportation development, long-term sustainability is very important to consider. Other keywords, such as policymaking, transportation systems, and modes of transportation, are related to the term sustainable development, indicating that the linkages of sustainable transportation development are quite close to each other. To offer transportation services that are in line with the ideals of sustainable development and smart cities, transportation development must be carried out in an environmentally friendly manner. In addition, the notion of sustainable development examines three components.

Table 3.
Characteristics/principles of sustainable transport

Aspect	Criteria	Indicator
Environment	Minimizing environmental pollution due to the impact of transportation	1. Improving public safety and health. 2. Availability of services for pedestrians (pedestrian) 3. Provide a Mode of Transportation
Economy	Transport activity efficiency	1. Good accessibility 2. Transportation Services with Affordable Prices and High Capacity 3. Setting up Transportation Development Options
Social	There are institutions that support transportation	1. Public Transportation Services for All Levels of Society/Community Equality 2. Can Reduce Accident Rates 3. Creating an Efficient Transportation System

Source: Author modification (Hiremath et al. 2013, Bamwesigye & Hlavackova 2019, Cohen 2019)

If the research that is used as a reference in this paper focuses more on the concept of sustainability, this research will focus on the readiness of the Batam City Government in implementing sustainable transportation, which is also one of the dimensions of the smart city. The selection of sustainable transportation and government readiness are used as theoretical indicators in this paper. Indicators of the selection of the respective characteristics were obtained with the help of the VOSviewer software, by collecting the relevant study results. The application of sustainable transportation here will be seen and measured from the characteristics of sustainable transportation in the economic, social, and environmental sectors, which then is the readiness of the Batam City Government in terms of institutional readiness. Here are the results of the analysis from VOSviewer.

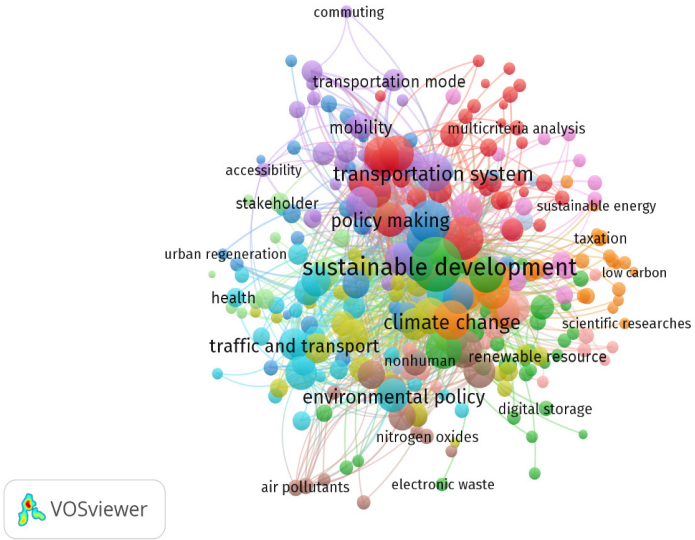

Figure 1.
VOSviewer analysis results
Source: Processed by author (VOSviewer)

The results of the VOSviewer data review above were collected from the Scopus-indexed journal literature from 623 documents with three keywords, namely sustainable development, transportation, and policy, shown in Figure 1, the keywords used to generate many indicators, which are distinguished

by several colors; the color with the largest circle (Green) will show the dominant indicator which means the color shows information from three keywords leading to sustainable development, then related to the transportation system (Red) Then related to climate change that affects the environment (Orange) and also policymaking (Blue). The most dominant circle and color show the relationship of the most influential keywords; therefore, the author chose the keywords which became the basis for the development of this paper.

Urban sustainability is also defined in various ways, especially by Rodríguez-Bolívar (2015), whose fundamental characteristics include economic, social, and environmental pillars, each of which has different dimensions. Each aspect can be interpreted as shown in the table above. Many parts must be met before sustainable development can be implemented effectively, including Institutional readiness, regulatory considerations, sociocultural readiness, human resource readiness, and an integrated approach (Sachs et al. 2019). Although many dimensions affect transportation, the environment has the highest importance. Therefore, sustainable development focuses on environmental issues (Lane & Beeler 2010, Purnomo et al. 2020). When looking at the many things people do to make an impact on the environment, it's important to look at all of the actions, not just a few.

Research Method

This study focuses on transportation in Batam City. This study is classified as a Literary Review starting from digesting literature in the form of writing study results, print, and online mass media, and relevant books, then, after understanding the concept, conducting field observations to see phenomena and problems in the transportation sector in Batam City. After placing the concepts and phenomena in the field, the identification problem is assisted by the VOSviewer software tool by entering all relevant study results to see the differences with other writings and helping to see the indicators used in this paper. This is used so that this paper is more comprehensive and focuses on the purpose. The identification of problems, namely, the application of the concept of sustainable transportation in the city of Batam is still different from other big cities that lead and apply the concept of sustainability at several service points such as Jakarta, Surabaya, Bandung, Yogyakarta. The method used is qualitative, an approach used to explore and understand a central phenomenon (Peterson 2019). In Figure 2 it is explained about the data search process to draw conclusions from this study.

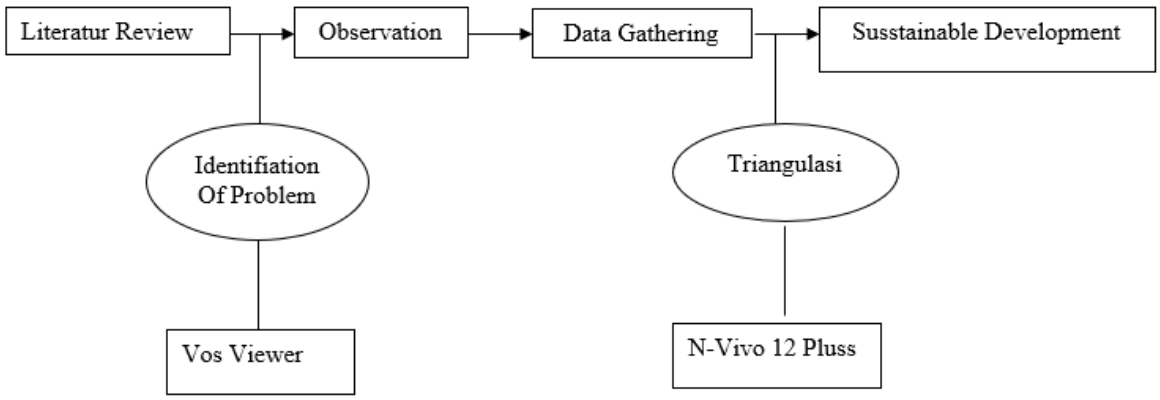

Figure 2.
Research method
Source: Processed by author

Furthermore, after conducting literature review and observation, then data collection is performed. The data used to see the implementation of sustainable transportation in Batam City are secondary data, which are data collected from other sources and which can be in the form of reading or literature and various other data sources (Peterson 2019). Secondary data in this research can be in the form of relevant study results, online/print mass media in Batam City, documents in the form of attachments from official bodies such as government, ministries and the Batam City Government official website or from related organizations or institutions.

The data collection technique in this research is the observation and documentation technique. Documentation is part of the secondary data needed by researchers. Then secondary data are obtained from several journals, documents, and online mass media in Batam, and websites that will be supported by N-Capture in the NVivo 12 Plus software.

The data analysis technique in this paper is a triangulation technique. First, is data reduction, at this stage the selection/classification of information that can be used as data information in this paper is performed, selecting relevant study results, choosing from the results of documentation from social media and observation results. Second, is the display/presentation of data when the selected data, and the relevant results are then compiled in detail and systematically to facilitate and obtain in-depth analysis. The relevant data reduction results will also be assisted by the existing N-Capture software in the NVivo 12 Plus. The way the NVivo 12 Plus software works is by importing the data resulting from the documentation data from secondary data.

Then all the data will be coded on the software to then be read and the sentences analyzed which are then presented in the form of descriptions and tables, graphs/charts which make it easier and strengthens the analytical evidence. After systematically arranging the results in an analysis, the final conclusion is drawn, which one refers to the results of the reduction as fixed data which then looks for relationships, and equations, which refer to the initial goals set to draw conclusions. An overview of research methods can be seen in the chart below.

Results and Discussion

Sustainable transportation can be viewed from a variety of perspectives, including economic, environmental, and social, whereas the sustainability instrument to realize a smart city in the dimensions of sustainable transportation (Sustainable Development) can be viewed through the innovations made, the use of Information and Communication Technology (ICT), and the application of Information Technical Services (ITS). In accordance with the delivery (Pawłowska 2018), the principle of the intelligent mobility component of the transportation system in the smart city idea is where its application is linked by information and communication technology between transportation modes.

The role of transportation in supporting the progress of a region is vital. For this reason, the development of transportation should be a particular concern for decision-makers to support the economy, welfare, and a good urban environment. The concept of sustainability is a concept designed to overcome environmental crisis conditions, growth in economic activity and population, declining natural resources, and ecosystem damage (Khairina et al. 2022). These conditions become the conditions of life that occur today. Therefore, sustainable design seeks to reduce negative impacts on the environment, economy, and society. Sustainability is also a solution for a city to be able to meet current needs without ignoring the needs of future generations (Serrano et al. 2019). To offer transportation services, according to the ideals of sustainable development and intelligent mobility, transportation development must be carried out in an environmentally friendly way. In addition, the notion of sustainable development examines three components, as follows:

Economic aspect

Sustainable transportation basically has a goal of supporting regional economic development. In the transportation sector, the economic aspect is taken into consideration. In the economic aspect, transportation must be developed to facilitate and reduce public costs. According to Brotodewo (2010), sustainable transportation in the economic aspect is transportation that is affordable, operates efficiently, is able to provide various alternative modes of transportation, increases accessibility and supports the pace of economic growth.

The mode of transportation launched by the government aims to assist the community in providing affordable, high-capacity transportation services and preparing transportation development options. By doing so, it is hoped that it can help the people of Batam in traveling. Transportation services at affordable

prices can encourage mobility and community economic activities, namely production, distribution, and consumption. Therefore, the price of transportation will affect the activities in the community. Batam City has several choices of public vehicles such as public transportation (Angkot) or commonly called Metro Trans, motorcycle taxis, and Bus Rapid Transit (BRT), known as Trans Batam and Taxy.

Seeing the number of bus vehicles in Batam City in 2022, amounting to 1522, shows that the facilities are pretty affordable. Then, for the price of public transportation, the government facilitates the community with Trans Batam services. Based on the Mayor of Batam Regulation No 21 of 2021 concerning Adjustment of Fares for Trans Batam Bus Public Passenger Transportation at the Technical Service Unit of the Regional Public Service Agency for Transportation Service Transportation Services, the price given for one trip is IDR 6000.00/person with cash or non-cash payment system. As for the price of the Trans metro, the price is determined by the price range/kilometers, which is Rp. 5000.00/kilometers. Although the price of public transportation facilities is affordable, what makes the economic aspect not in favor of the community is the limited reach of the intended area. Metro Trans and Trans Batam only reach the Batam Center, Nagoya, Nongsa, Bengkong areas. Meanwhile, to reach other areas, people have to make transit trips so that the time it takes to get to the destination location will be longer. It can be a factor in hampering community economic activities.

The simplest economic aspect of the concept of sustainability is seeking services from the transportation system so that it can support urban activities that can increase the accessibility of areas that are efficient and productive one of which can be seen from the aspect of good accessibility. Accessibility is often used to measure how easy or difficult a location is to be reached by transportation. Good regional accessibility in Batam City will be supported by well-maintained public roads. According Batam City Transportation Department Strategic Plan, based on these regulations, the length of the Batam City National Road section is 1,089.08 kilometers. In fact, many road points in Batam City are still damaged One of them is in the Legenda Point area, Batam Center, the conditions are hollow and uneven. Even the asphalt is no longer visible.

Social aspect

The social aspect means that sustainable transportation, according to Cohen (2019) is a transportation system that is able to create equality horizontally and vertically toward the use of transportation with a high level of safety, and can be an institutional system that is able to support the creation of a sustainable transportation system. The social aspect in the development of sustainable transportation is one of the aspects that must be considered.

Overall, social sustainability is expressed in social justice, human dignity, and improving the community's quality of life (Khairina et al. 2022). In the social aspect, sustainability can be seen in public transportation services for all levels of society/community equality, reducing accident rates and creating an efficient transportation system. The whole community must enjoy public transportation without exception for persons with disabilities (Saif et al. 2019). In Indonesia, persons with disabilities are protected by Law No. 8 of 2016 concerning disability. Namely, persons with disabilities have the right to life, free from stigma, privacy, justice, and legal protection, employment, education, health, entrepreneurship, education, politics, sports, religion, tourism and culture, accessibility, social welfare, and public services.

From the social aspect, public transportation services for all levels of society/community equality in Batam City have not been fulfilled properly. This can be seen from the availability of bus stops/ terminal/shelter/terminal services which are part of the transportation system. Its function is to raise and lower passengers. The convenience of service or the speed of movement of passengers will determine the capacity of the terminal. Several terminals in Batam City are still functioning today. However, the availability of terminals is inadequate, with limited passenger and vehicle capacity. Based on observations, it can be proven that several bus stops or terminals have not provided extraordinary services for persons with disabilities so they do not get the same rights as people who do not have special needs; thus, persons with disabilities cannot wait for the Trans Bus comfortably. This can be seen in Figure 3 of the Trans Batam Bus Stop service.

Figure 3.
Condition of the Batam City bus stop
Source: Dodo (2022)

Based on Figure 3, it can be seen that some shelters will be complex for people with disabilities to use. Furthermore, in addition to the condition of the different shelters/shelters, the radius of which is far from one shelter to another is an obstacle for the community in using these public transportation services. Based on the observation that the radius of the stop/shelter is not the same, sometimes, in a radius of one kilometer, two shelters can be found. Then in the next kilometer, it is difficult to find a shelter. The location of the radius of the bus stop is different from the results of the documentation archives. In Batam.go.id it is stated that Corridor I: Sekupang-Batam Center, with a distance of 22.5 kilometers is served by ten buses and has 24 bus stops. Corridor II: Batu Aji-Batam Center with a distance of 22 kilometers is served by eight buses with 20 stops. The need for transportation from all walks of life in Batam City has not been fulfilled, so it can be said that the transportation system is not efficient in Batam City. The portrait of a Trans Bus Stop that can be accessed by disabled should be like the image below, which is implemented in developed cities that provide disability rights. Meanwhile, bus stops in Batam do not have images and services like in Figure 4.

Figure 4.
Disability rights conditions
Source: Kumparan (2022)

Furthermore, creating an efficient transportation system can also be done by conceptualizing the Transport Demand Management (TDM) strategy. According to Ma et al. (2020), Transport Demand Management is an attempt to influence the behavior of travelers to reduce or limit travel demand. TMD can also increase people's motivation to use public transportation more. However, in Batam City, transportation management still uses the old approach, namely, predict and provide.

Environmental aspect

The environment is an aspect that needs to be considered and a prerequisite in every development. Indicators that can support the environment are the availability of services for pedestrians and providing a mode of transportation. Improving public safety and health can be done by reducing the number of private, transportation in Batam City and can encourage people to use public transportation. The number of vehicles in the city of Batam in 2022 is increasing, not only coming from the city but also immigrants who come from outside the city who buy new vehicles. Until March 2022, based on data from the Korlantas, the number of private vehicles in the city of Batam is 632,625. The increase in the number of private vehicles will certainly increase emissions and pollution to decrease air quality.

Furthermore, the pedestrian path can move from one place to another. Pedestrian lanes are usually on the right and left sides of the road corridor. According to its function, the Batam City pedestrianization is not yet optimal in some points or areas difficult for pedestrians to access. Based on observations, the pedestrian path that is separated from the public vehicle path (sidewalk/pavement), namely Jalan Jendral Soeprapto Muka Kuning Batam City, has not provided comfort for pedestrians. Phenomena are such as controlling street vendors is not carried out, facilities that interfere with comfort such as trash bins, lane lighting pedestrians, and there are no special services for persons with disabilities. Furthermore, several points in the Batu Aji area, the Sagulung sub-district, are prone to traffic jams. No special pedestrian/ pedestrian services are provided, so people find it difficult to cross the road. The lack of pedestrian path facilities in Batam City has not provided comfort. This results in the low level of interest and participation of pedestrians in Batam City. Besides that, the sidewalks for disabilities in Batam City have not been fully given the same access; this can be seen in the condition of the sidewalks for the disabled in Figure 5.

Figure 5.
Disability sidewalk
Source: Gunawan (2021)

One of the factors that influence the low level of public interest and the application of the concept of sustainability in the Batam City transportation sector is the legal product that regulates it. In the Batam City RPJDM, there is no regional/mayoral regulation that discusses in detail sustainable transportation planning. Legal products that regulate sustainable transportation in Batam are still weak, and there are no regulations, or legal products in the form of statutory regulations. This regulation becomes something essential and fundamental because regulations provide order in society. The order of the city is comfortable and future-generation oriented. This gives an understanding of other cities that are more focused and tend to improve a region's economy. The analysis of sustainability in the transportation sector uses a data analysis tool, namely NVivo-12 Plus.

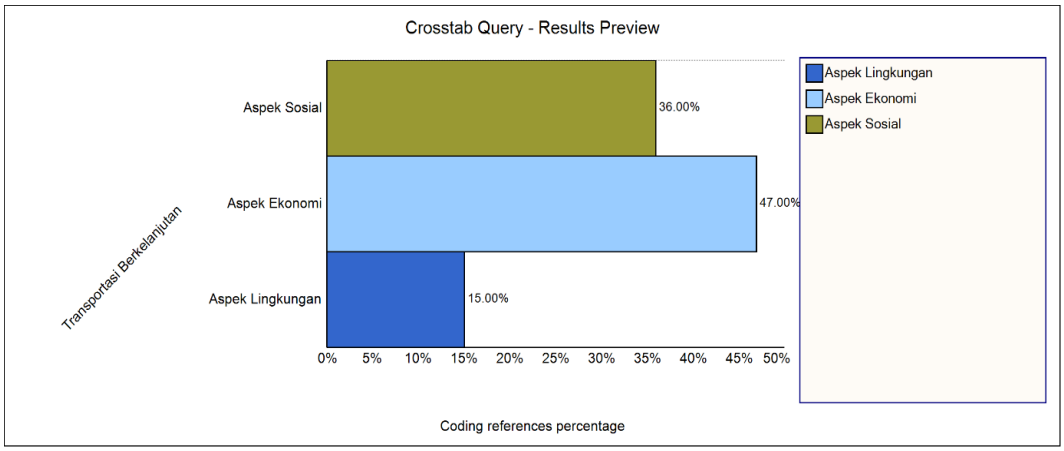

Figure 6.
Aspects in sustainable transport
Source: Processed by author (NVivo 12 Plus)

Figure 6 shows the analysis results carried out with the NVivo 12 Plus tool, which uses secondary data from several studies, online media, and government documents, and shows that the economic aspect of sustainable transportation has the highest value. This means that the economic aspect has a value of 47% and has a significant effect on the development of sustainable transportation, especially in the city of Batam. This is an exciting study, and it can be said that Batam is trying to build more environmentally friendly transportation to boost the economy. For example, on the other hand, sustainable transportation development is a process that looks at how to apply the concept of sustainable development with predetermined indicators (Khairina et al. 2022). That way, people can get transportation services to improve their economic welfare. Figure 4 shows the values declared by the government as essential for transportation development. These values have a significant impact on how transportation grows.

Three things will be used as benchmarks for sustainable development in the transportation sector, with specific indicators. However, the environmental aspect has the lowest value, meaning that the process of reducing pollution from transportation has not been maximized. This means that transportation users are safe, but pedestrians do not get the best service. However, the social aspect shows an effective transportation system with a value of 36%. This shows that there is attention to social aspects.

This proves that, in the transportation aspect, the Batam City Government has not yet led to the concept of sustainability, this is also evidenced by the limited public transportation facilities and transportation infrastructure such as intermodal terminals and bus stops, public transport stops (bus stops), transfer points, sidewalks for pedestrians and bicycles as well as the readiness of the institution is also weak, as is evidenced by the absence of Special Regulations concerning Transportation Arrangements toward Sustainability, so that the smart city concept can still be realized from the transportation sector.

Conclusion

The conclusions obtained when comparing benchmark comparisons between certain indicator standards in the local context or global context standards (according to the concept of sustainability) related to the concept of sustainable transportation in Batam City have not fully demonstrated sustainability. Based on the identification of the characteristics of the sustainability aspects of transportation in Batam, it indicates that the concept of sustainability emphasizes more on the economic aspects. From the indicators assessed from the conditions and implementation in Batam City, it is seen that most meet the indicators of transportation sustainability in the economic aspect. Meanwhile, from the social aspect, the characteristics of sustainability in DIY have not met the sustainability requirements. The non-fulfillment of sustainability requirements in the social aspect can be seen from the implementation of the program that has not supported sustainability.

The Batam City Government is considered not yet ready to implement smart mobility to realize sustainable development in the transportation sector. The Batam City Government still needs many breakthroughs, both in the form of development concepts and policies that support the realization of transportation as it should be in a sustainable concept which is not stated in the Regional Medium-Term Development Plan (RPJMD), Transport Demand Management (TDM) and the push and pull strategy, which could increase public interest in using public transportation, convenient drop point facilities, as well as the use of ICT to support integrated transportation and provide transportation modes that can be used anytime and anywhere by the community. This effort is carried out by the Department of Transportation, as the agency responsible for planning, building and managing road network transportation services and vehicle regulation.

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