International Journal of Scientific Engineering and Science
Volume 8, Issue 1, pp. 23-26, 2024. ISSN (Online): 2456-7361

Decision Support Systems used in Transportation Feasibility: Literature Review

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***Abstract*—** *Approximately 1.3 million people die in accidents worldwide each year and between 20 million and 50 million sustain non-fatal injuries. Whether it's an accident on land, sea, or air. In addition to human error, the main factor in traffic accidents is vehicle feasibility. This happens with both private and public vehicles. Brake, steering systems, engines that are not working, and the vehicle's performance on the road that is not regularly checked for condition can be the cause of accidents. According to international road transport laws, every vehicle, especially conventional mass transport vehicles, must undergo a fitness test every six months. Therefore, it is necessary to adopt an approach aimed at reducing the number of accidents in the transport sector. By using sundry decision support system approaches more accurately and effectively, measuring transportation feasibility will be easier. Based on the literature review analysis performed, the use of AHP and Fuzzy as decision support systems in the transportation sector is the most widely used.*

***Keywords*—** *Decision Support System, Transportation, Feasibility*.

I. INTRODUCTION

According to data from the Global Road Safety Report, each year around the world about 1.3 million people die due to accidents and between 20 million and 50 million sustain non-fatal injuries[1]. There are 3 main causes of transportation accidents: human error as the driver or user, vehicle malfunction, and factors related to infrastructure roads. According to international road transport laws, proficiency tests must be taken every six months[2]. However, many bus companies and transport drivers are reluctant to inspect vehicles because this process takes a long time, up to 1-2 days. Thus, many researchers use decision-making system applications to predict the feasibility of transportation easily and quickly.

There are many uncertain risk factors and many criteria, so sometimes difficult for experts to predict eligibility. There are many factors that must be explained in determining the feasibility of the transportation sector and deciding on this requires quite a long time. So in this research, a literature review analysis was carried out regarding Decision Support Systems (DSS) for the feasibility of transportation land, sea, and air.

II. MATERIAL AND METHOD

Google Scholar search engine is used to obtain relevant articles published in peer-reviewed journals. Only published articles were included and dated from 2005 to the present. Older articles are used as historical references and general information about the documents discussed in the article, either due to the paucity of recent literature on a particular topic or to demonstrate consistency in results between earlier and newer test results. The references of the included studies were also checked to minimize the possibility of missing relevant studies.

The following keywords were used: DSS Transport; Feasibility or eligibility Transport; land transport; maritime transport; air or aviation transport.

III. LITERATURE REVIEW

A. Land Transportation

Several researchers on land transportation have applied DSS to carry out feasibility tests before implementing it in the field. Parts of land transportation that have implemented DSS in terms of feasibility tests include fuel feasibility, transportation route feasibility, transportation service system feasibility, and underground route feasibility. There are 11 articles discussing the use of DSS for Land Transportation. In Land Transportation feasibility research, the authors predominantly use the DSS approach with multi-criteria to assess or evaluate feasibility. There are also criteria based on objectives, computational techniques, and the origin of the data as shown in Table 1.

B. Maritime Transportation

The shipping industry has also deployed DSS to check feasibility including port feasibility, port facility feasibility, LNG fuel feasibility for ships, and port feasibility to implement the concept of Maritime Highway. Articles related to the use of DSS in transportation are few, most of them use NPV, IRR, and BVC calculations, so there are only 9 articles. The criteria used are diverse, even if environmental and economic aspects prevail over others. The article is divided by objectives, computational techniques, and the origin of the data as shown in Table 2.

C. Air Transportation

The aviation industry has implemented the use of DSS for the feasibility of airport relocation, the feasibility of alternative fuels, the feasibility of flight simulator pilots, and airline services. The survey generated 10 articles discussing the use of DSS for feasibility in the aviation industry.

Evaluation criteria are examined differently. The article is divided by objectives, computational techniques, and the origin of the data as shown in Table 3.

TABLE I. DSS used in The Field of Land Transportation.

No.	Authors	Criteria		
		Objective	Computational Technique	Origin Data
1	Lu,M et.al[3]	Advanced Driver Assistance System (ADAS) to get the shortest and safest route	Analytical Hierarchy Process (AHP)	Maps database
2	Tangari et.al[4]	Feasibility of a transport network connecting the Balkans and European Union for shipping goods	Fuzzy Multicriteria	Data on freight transport in Balkan cities
3	Liu, K et.al [5]	Testing the feasibility of taxi dispatch system via satellite in real-time	AHP	Data comes from Tsubame Taxi Company in Nagoya
4	Shiyu, D et.al[6]	Feasibility of Electrical Fuel in vehicles	AHP	Data from 5 countries using electric cars
5	Mishra, S, et. al [7]	Choosing transportation infrastructure worthy of investment	Multi-Objective Optimization (MOO) & AHP	Data comes from stakeholders
6	Barfod, M & Salling [8]	Assessing the feasibility of sustainable transportation	Multi-Criteria Decision Analysis (MCDA)	Data from the UNITE project database (UPD)
7	Albert. G, et.al[9]	Feasibility of smartphone applications for road safety	AHP	Data from Experts
8	Jumadi, J, et.al[10]	Feasibility of railway operations with Fuzzy	Fuzzy Tsukamoto	Data were obtained from the Indonesian Railway Company
9	Lee, D[11]	Feasibility of public transportation in Korean urban areas	Multi-Criteria Decision Analysis (MCDA) & AHP	The data comes from a survey of experts
10	Winter,K, et.al [12]	Feasibility of urban public transport service system	Automated Demand Responsive Transport 30 Service (ADRTS)	The data comes from public transport users
11	Riyadiani, R & Fairusabadi[13]	Feasibility of public transportation in Yogyakarta	Fuzzy Tsukamoto	The data comes from the Yogyakarta City Department of Transportation.

TABLE III. DSS of used in The Field of Maritime Transportation.

No.	Authors	Criteria		
		Objective	Computational Technique	Origin Data
1	Lam,J et.al[14]	Evaluate the feasibility of getting the best port	AHP	The data comes from shipping company reviews
2	Yang, Z, et.al[15]	Feasibility of port infrastructure and security	Fuzzy & PFSA	Data from member reviews
3	Ahmadi, N, et. al[16]	Greenport Test Port Eligibility	AHP	Cigading port data
4	Putri, GA, et. al[17]	Analyze the feasibility of the shipyard	Linear Regression	Laksana Abadi's CV data
5	Arisusanty, DJ, et. al[18]	Determining a suitable Sea Highway feeder port	AHP	Data from questionnaires and internal interviews
6	Djunarsyah, E, et.al[19]	Assessment of the feasibility of Makassar Port to support the maritime highway concept	Comparison of Fuzzy and AHP method	Makassar port data
7	Wan, C, et.al[20]	Test the suitability of LNG fuel on board	AHP	Data from expert
8	Tseng, P, et.al[21]	Assessing the feasibility and policy of Greenport in Taiwan	Fuzzy & AHP	Data from expert
9	Hsu, W, et.al[22]	Evaluate the feasibility of Carrier Port	Multiple Criteria Decision Making (MCDM) Hybrid	Data from questionnaires completed by port staff

TABLE IIIII. DSS of used in The Field of Air Transportation.

No.	Authors	Criteria		
		Objective	Computational Technique	Origin Data
1	Yoo, K, et.al[23]	Feasibility of commercial flight service between South Korea and North Korea	Fuzzy & AHP	Korean Air's database
2	Santoso,M & Suryono, W[24]	Feasibility of relocation of Rahadi Oesman Airport	AHP	Data came from questionnaires and interviews with investigators
3	Usada, E[25]	Eligibility of simulator pilots in air traffic	Fuzzy Reasoning	Data comes from STPI Tangerang
4	Hileman, J & Stratton, R.[26]	Feasibility of alternative fuel for jet aircraft	AHP	Data from Stratton et al.,
5	Gillen, D., & Morrison, W.[27]	Assessment of Aviation Security Eligibility	Fuzzy Logic	Data from airlines in Canada, the United States and Europe
6	Huang, S,et.al[28]	Feasibility of air service quality for cargo transportation	Fuzzy & AHP	Data from respondents from freight companies
7	Cacchiani, V.,et.al[29]	Feasibility of optimal transport routes for aircraft carrying transplantation organs	Fuzzy & ILP	Data from the Italian Transplant Database
8	Shirazi, F., & Mohammadi, E[30]	Assessment of the feasibility of airlines in Iran	Fuzzy & Stochastic	Data from private, military, and government airlines in Iran
9	Zhang, J. et.al[31]	Feasibility and optimization of aircraft landing	Imperialist Competitive Algorithm (ICA)	Data from expert
10	Haddad, M. et.al[32]	Boeing's rankings reached the top 4 in the	Multi-Criteria Decision	Data from expert review

		world	Making (MCDM)	

IV. DISCUSSION

Decision Support System (DSS) is a very popular use for decision-making in land transportation. Some of the techniques used for feasibility in the road transport sector are AHP, Fuzzy, TOPSIS, and MCMD. At the same time, the DSS approach clearly shows that the AHP technique is very popular in maritime transport in this research. This confirms that determining the feasibility of maritime transportation is done based on many different criteria. The data used come mainly from the ports whose suitability will be assessed, being useful for developing a DSS on the feasibility of maritime transport. Furthermore, the use of DSS in ground transportation shows that AHP and Fuzzy techniques are very popular for their computational techniques have implemented the use of DSS for feasibility, including airport relocation feasibility, alternative fuel feasibility, flight simulation pilot feasibility flights and air services to transport goods.

V. CONCLUSION

Based on the Literature Review that has been carried out, the use of DSS in Feasibility in the Transportation sector has been widely used. The field where DSS is most widely applied is the feasibility of land transportation. In general, the DSS approach techniques that are often used for feasibility testing are AHP and Fuzzy method. The data used also varies, ranging from questionnaire data to using data that is already available from experts. Time constraints lead the author to suggest that further research could discuss this issue DSS Trends in more depth. Next Research may can to see whether DSS technique is actually decreasing.

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