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Engineering

ROAD NETWORK CONNECTIVITY AND FREIGHT TRANSPORTATION FOR SUPPORTING THE DEVELOPMENT OF THE NORTHERN ZONE OF ACEH

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Abstract
Road network connectivity significantly affects merchandise, transport, and people's lives. Freight transportation network models are utilized as frameworks of transport policy decisions to estimate the impacts of infrastructure projects on traffic. The goods supply delivery modes in Aceh, Indonesia, are dominated by road-based transportation, where up to 95% of daily needs, such as food, are carried using trucks, buses, and other vehicles. This condition emerged owing to a lack of infrastructure and facilities. Thus, the main purpose of this study is to analyze the effect of road network connectivity on goods delivery in the northern zone of Aceh. This research adopted a quantitative technique (survey questionnaire) and involved as many as 420 respondents. The data were analyzed using structural equation modeling (SEM) with Analysis of Moment Structures. The result of the study shows the value of regressions weight is 0.375 or 37.5%. It indicates the road network connectivity variable has a significant relationship with the transport of goods. Furthermore, the road network connectivity of the area has the strongest link or significantly influences the activities of regional development. Therefore, the government in the northern zone of Aceh can formulate road network policies oriented towards the development of the area's new economy and support the implementation of the Arun Lhokseumawe Special Economic Zone, which is the business area and trade laws are different from the rest of the country.
Keywords: Freight Transportation, Highway Network Connectivity, Structural Equation Modeling, Transportation Modes.

摘要: 道路网络连接显着影响商品，交通和人们的生活。货运网络模型被用作运输政策决策的框架，以估计基础设施项目对交通的影响。印度尼西亚亚齐的货物供应交付模式以公路运输为主，其中高达 95%的日常

需求（如食品）使用卡车，公共汽车和其他车辆运输。由于缺乏基础设施和设施，出现了这种情况。因此，本研究的主要目的是分析道路网络连通性对亚齐北部地区货物运输的影响。该研究采用了定量技术（调查问卷），涉及多达 420 名受访者。使用结构方程模型（SEM）和矩量结构分析来分析数据。研究结果显示回归权重值为 0.375 或 37.5%。它表明道路网络连通变量与货物运输有显着关系。此外，该地区的道路网络连通性具有最强的联系或显着影响区域发展的活动。因此，亚齐北部地区的政府可以制定面向该地区新经济发展的道路网络政策，并支持 Arun Lhokseumawe 经济特区的实施，这是商业区和贸易法的不同之处。这个国家。

关键词: 公路网连通性，货运，运输方式和结构方程模型。

I. INTRODUCTION

Transport automation has been significantly affect people's lives, merchandise, and transport and related sectors [1], [2]. Strategic multimodal freight transportation network models are often used in the framework of transport policy decisions to estimate the impacts of new, large infrastructure projects on traffic or modal splits and other purposes [3].

Aceh is economically dependent on the province of North Sumatra (Medan) because its only road access goes through the province. The dependency of Aceh on North Sumatra is indicated by the patterns of goods supply and logistics delivery, of which more than 90% are transported by road [6]. There are two vehicle weighing stations that record the goods transported between North Sumatra and Aceh, namely, Seumadam and Jontor, which are located in the northeast and west coasts, respectively.

In 2014, the traffic of goods entering East Aceh was as much as 1,566,112 tons, while 1,686,512 tons were transported to North Sumatra. By 2015, the traffic of goods entering East Aceh was 1,134,048 tons, and that exiting was 1.10935 million tons [7]. The goods that are transported to Aceh are mostly food, drink, and grocery items, whereas the items that leave Aceh are mostly agricultural products. According to this data, the quantity of goods transported to Aceh through the northeast corridor in 2015 decreased by 27.59% compared with that in 2014 [8]. This decline was mainly caused by the availability of shipments through the Malahayati and Krueng Geukeuh sea ports.

II. RESEARCH OBJECTIVE

Given the issues discussed in the previous section regarding the freight transportation network of Aceh, this study aims to analyze and examine the effect of road network connectivity on goods delivery in the northern zone of Aceh.

III. LITERATURE REVIEW

In general, freight transportation refers to the aggregated movement of goods from one location to another. Today, most goods worldwide are transported on multimodal networks involving waterways, railways, highways, airways, and intermodal facilities [4]. Truck transportation plays a key role in serving freight transportation needs and supporting the economy, but it also contributes to urban congestion and pollution. However, comprehensive modeling of truck trips is still limited due to the complexity of freight movements and the unavailability of detailed truck trip data [5].

Basically, three road corridors link Banda Aceh (the capital of Aceh Province) and North Sumatra. The northeast coastal road network is considered the main corridor. The west coast southern and central road corridors are the two other links. Almost all districts and cities in the province of Aceh lie along these three corridors, which extend from Banda Aceh to the border of North Sumatra.

The central government and the government of Aceh have exerted effort to improve the road network linking the northern coast corridor, which includes the cities of Lhokseumawe, Aceh Utara, Bireuen, and Banda Aceh. The central corridor consists of four districts in the highlands, namely, Central Aceh, Bener Meriah, Gayo Lues, and Southeast Aceh. Construction of this road network facilitates transport in the central part of the corridor of North Aceh and open inland.

Therefore, based on findings of previous studies, the present work attempts to investigate the relationship of road network connectivity, goods transport, and regional development activities.

IV. RESEARCH METHODS

This research was performed by analyzing the existing road network connectivity in the northern zone of Aceh, including that of

Lhokseumawe [8]. Several indicators were considered, namely, pavement structural performance, geometric design of highways, highway maintenance, traffic volume, supporting facilities, demand, and supply [9].

The impact of road network connectivity on the acceleration of the delivery of goods was observed from several indicators, namely regulation, redistribution, freight transportation, truck bin sizes, punctuality, and loading and unloading systems [10]. The approach model shown in Figure 1 is proposed to observe the relationship between road network connectivity and the transport of goods.

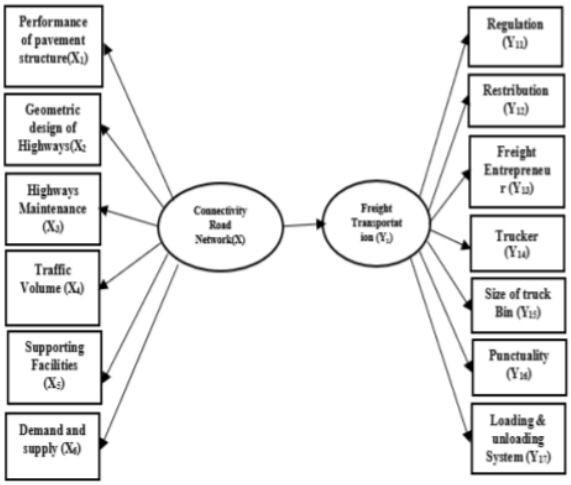

Figure 1. Conceptual framework

A. Research variables and indicators

Road network connectivity (X) and the transportation of goods (Y) were the main variables in this study. Road network connectivity was not measured directly (exogenous latent variable), while transportation of goods was considered an endogenous latent variable [11]. These two variables were divided into several sub-variables that are each linked to their own indicators.

B. Road network connectivity variable (X)

Chourmain [12] defines a conceptual variable is a variable that withdrawal limits research, such as brief, clear and unequivocal. A road network is a major infrastructure system that is part of a land transportation network. It is also deemed a main factor of economic growth in a region because it helps increases economic growth and reduces disparities between regions. The existence of a well-managed road network will create inter-regional connectivity. The term connectivity is used to describe the relationship and density of roads in a network.

C. Freight transportation variable (Y)

National development policies in the transportation sector operationally are created to improve the mobility of people, especially in remote areas. The smooth flow of such development will accelerate the achievement of developmental goals. Smooth transportation will positively impact development aspects, both nationally and regionally. The development of the transportation sector will directly facilitate relationships between regions, improve producer and consumer relationships, improve the relationship between developed and underdeveloped regions, and facilitate new relationships between the locations of production processes and those of resources as production factors (input). In a regional development process, the transportation system is a particularly important factor. A well-managed transportation system allows for a smooth exchange of goods and services, which is required for a city's development in becoming the center of growth in the region.

In addition, transportation development will expand marketing and services in order to support growth in various sectors of socio-economic activity, in every zone. In other words, the role of the transportation system (infrastructure) is to become an element that can connect separate points in space with different mechanisms of activity that are interdependent on one another [13].

V. RESULT

A. Test of validity

This test was done by correlating each variable with a score, where the total score is the sum of all variables. Where there is a significant correlation between the variables and the total score, it indicates that the variable in question is able to provide support to explain the aspect that one wishes to capture. Below in Table 1 and Table 2 the validity of the test results of road network connectivity variable (X) and freight transportation variable (Y1) are shown.

Table 1.
Validity of test results road network connectivity (X_1)

Indicator	$R_{Analysis}$	Threshold	Decision
Performance of pavement structure	0.562	> 0.30	Valid
Geometric design of highways	0.342	> 0.30	Valid
Highway maintenance	0.503	> 0.30	Valid
Traffic volume	0.314	> 0.30	Valid
Supporting facilities	0.364	> 0.30	Valid
Demand and supply	0.461	> 0.30	Valid

Table 2.
Validity of test results freight transportation (Y1)

Indicator	$R_{Analysis}$	Threshold	Decision
Regulation	0.382	> 0.30	Valid
Redistribution	0.580	> 0.30	Valid
Freight entrepreneur	0.411	> 0.30	Valid
Trucker	0.615	> 0.30	Valid
Size of truck bin	0.509	> 0.30	Valid
Punctuality	0.671	> 0.30	Valid
Loading and unloading systems	0.326	> 0.30	Valid

B. Test of reliability

Reliability tests are used to determine the consistency of measurement tools in order to gain confidence in the results. Reliability implies consistency of results when tested against different samples of the population. A common method used for reliability testing is the Cronbach Alpha method, available in the SPSS program. The questionnaire is considered reliable if the Cronbach Alpha values are greater than 0.60. The reliability of the test results for road network connectivity variable (X) and goods transport variable (Y1) are shown in Table 3 and Table 4.

Table 3.
Reliability test results of network connectivity road (X)

Indicator	α (alpha)	Threshold	Decision
Performance of pavement structure	0.710	> 0.60	Valid
Geometric design of highways	0.709	> 0.60	Valid
Highway maintenance	0.715	> 0.60	Valid
Traffic volume	0.708	> 0.60	Valid
Supporting facilities	0.713	> 0.60	Valid
Demand and supply	0.714	> 0.60	Valid

Table 4.
Reliability test results of goods transport (Y)

Indicator	α (alpha)	Threshold	Decision
Regulation	0.714	> 0.60	Valid
Redistribution	0.725	> 0.60	Valid
Freight entrepreneur	0.699	> 0.60	Valid
Trucker	0.720	> 0.60	Valid
Size of truck bin	0.711	> 0.60	Valid
Punctuality	0.722	> 0.60	Valid
Loading and unloading systems	0.720	> 0.60	Valid

The data in Table 3 and Table 4 show that all indicators measuring or forming the road network connectivity variable (X) and goods transport variable (Y1) are reliable or trusted in measuring each of the represented indicators.

C. CFA of road network connectivity variables

The confirmatory factor analysis (CFA) of the latent variable road network connectivity was used in order to confirm all of the indicators that make up the latent construct road network connectivity. Figure 2 shows the result of data processing for road network connectivity confirmatory analysis [10].

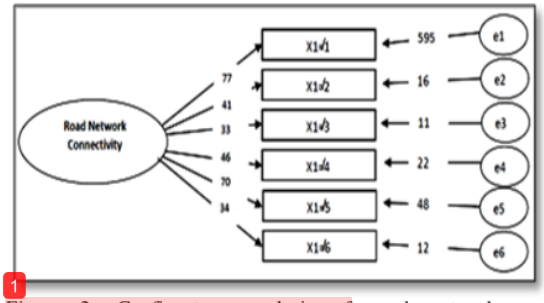

Figure 2. Confirmatory analysis of road network connectivity

Analysis of the CFA results confirmed that the CFA models for road network connectivity fit well. All indicators were valid and reliable to measure road network connectivity variables. The performance of the pavement structure indicator had the highest loading factor followed by the supporting facilities indicator. The results of CFA variable output analysis of road network connectivity are shown in Table 5.

Table 5.
CFA variable output analysis of road network connectivity

Standardized Regression Weights: (Group number 1-default model)			Estimate
X ≠ 1	◄- - - -	Road network connectivity	0.768
X ≠ 2	◄- - - -	Road network connectivity	0.406
X ≠ 3	◄- - - -	Road network connectivity	0.334
X ≠ 4	◄- - - -	Road network connectivity	0.465
X ≠ 5	◄- - - -	Road network connectivity	0.696
X ≠ 6	◄- - - -	Road network connectivity	0.344

D. CFA of freight transportation variables

The indicators that are suggested to form the latent constructs of freight transportation were verified via CFA. The data processing for the CFA of freight transportation [14] is shown in Figure 3.

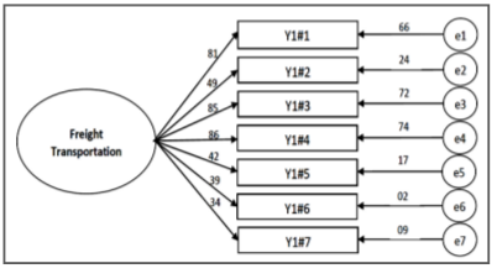

Figure 3. Confirmatory analysis transport of goods

Analysis of the CFA results confirmed that the CFA models for freight transportation fit well. All indicators were confirmed valid and reliable for measuring the freight transportation variables. The trucker indicator had the highest loading factor, and the freight transportation entrepreneurs had the second highest loading factor. The results of the CFA analysis of the freight transportation variables are shown in Table 6.

Table 6.
Variable output analysis CFA freight transportation

Standardized Regression Weights: (Group number 1-default model)			Estimate
X ≠ 1	◄- - - -	Freight Transportation	0.809
X ≠ 2	◄- - - -	Freight Transportation	0.494
X ≠ 3	◄- - - -	Freight Transportation	0.851
X ≠ 4	◄- - - -	Freight Transportation	0.858
X ≠ 5	◄- - - -	Freight Transportation	0.418
X ≠ 6	◄- - - -	Freight Transportation	0.385
X ≠ 7	◄- - - -	Freight Transportation	0.341

All the indicators suggested for forming the freight transportation variables were declared valid and trusted, given that all of them had loading factors greater than 0.30. The influence coefficient was calculated using regression weights and utilized as baseline to answer the research hypothesis. The data processing results are shown in Table 7.

Table 7.
Regression weight

Relationships			Estimate	P
Road network connectivity	⟶	Freight transportation	0.375	0.028

The regression weight results indicated the influence significance of each variable that impacts the freight transportation in the north zone of Aceh. Road network connectivity also showed a significant effect on the smooth freight transportation flow in the area. Table 7 indicates that the obtained value was significant; the p value was (0.014), which fulfills the standard criterion of $p < 0.05$. This finding illustrates that road network connectivity has a strong relationship with, and is significantly affected by, freight transportation activity and success in the northern zone of Aceh.

Road network connectivity has significantly contributed to the success of freight transportation activities and has amounted to 37.5%. It can be concluded that road network connectivity significantly impacts freight transportation based on the regulation, distribution, transportation manager, trucker, truck bin size, punctuality, and loading and unloading systems.

VI. DISCUSSIONS

High road network connectivity among transportation modes and warehousing and distribution network settings have improved supply chains. The development of transportation infrastructure will facilitate the mobility of goods and open up new areas for trade. Good transportation infrastructure such as road will increase the competitiveness of northern Aceh [15]. The development of road network connectivity in the northern zone of Aceh is still not optimal due to the non-structuring and non-development in the road connectivity with this area. Because of this, many production areas do not have access to high-capacity vehicles. Similarly, there is limited use of the Krueng Geukueh seaport for loading and unloading goods. It is because the Krueng Geukueh seaport cannot cover all trade caused by limited area and supported infrastructure. Hence, freight

transportation still greatly depends on trucking modes.

The economic growth in the north zone of Aceh continues to increase. This growth is supposed to be accompanied by adequate infrastructural development to avoid stagnation. Inadequate infrastructure may block investments. Infrastructural development will facilitate better connectivity among areas in Aceh and accelerate the flow of goods and people, therefore increasing economic activity in this area. Due to its location, Lhokseumawe is considered a center of activity in several fields—such as industrial, trade, and services—whereas other districts serve as centers for agricultural and fishery activities. Therefore, the functionality of the Krueng Geukueh seaport must be improved for it to play its role in freight loading and unloading for exports and imports.

Developing road network connectivity in the northern zone of Aceh will have many positive impacts, including improved accessibility for people living in the Bener Meriah and Aceh Tengah districts. The distance between these districts and Lhokseumawe will become shorter, thus reducing cost and time. All districts in the northern zone of Aceh require interrelation and cooperation. The Bener Meriah district, for instance, as a center of horticulture, needs a market to sell its products. Lhokseumawe, as a center of trade and services, requires goods to sell. Good road networks are indispensable [17].

Therefore, an effective and efficient freight transportation system must be established to provide freight transportation among cities, regions, and islands in a smooth, fast, safe, and inexpensive way. The transportation system in the northern zone of Aceh is unique because most Aceh regions are surrounded by sea with primary land transportation access only through the North Sumatra province. Thus, freight transportation that utilizes and integrates all possible modes should be developed. The existing condition of the road network in the northern zone of Aceh is shown in Figure 4.

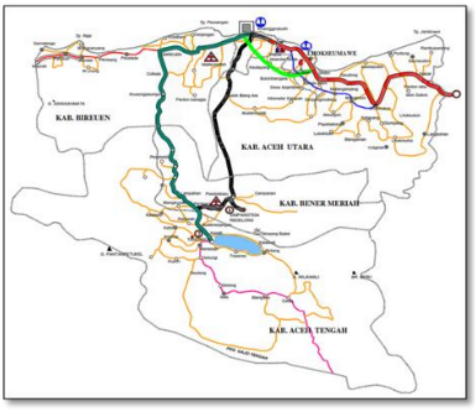

Figure 4. Road network of Aceh in 2017

Currently, the northern zone of Aceh is unable to improve its logistic competitiveness because no commitment has been established among its governments regarding the leading commodities. The volume of goods exported and imported through the Krueng Geukueh sea ports remains very limited, as its infrastructure is not sufficient to establish it as a "hub port," which is an important pragmatic indicator in the logistics sector. Strong regulations to stimulate multimodal transportation systems have not been enacted.

Logistic infrastructure in the northern zone of Aceh is not currently managed in an integrated way, and intermodal transportation of freight is poorly established. The lack of synchronization between port infrastructure, warehousing, and transportation further contributes to this problem. This shortcoming is expected to be resolved with the passage of regulation that establishes the Arun Lhokseumawe Special Economic Zone [16]. The road network development plan extends to the year 2045 to support exports and imports in this zone, as presented in Figure 5.

Figure 5. Images of road network plan until 2045

VII. CONCLUSIONS

Based on the data analysis, results, and discussion presented in previous sections, the following points are highlighted. The road network connectivity variable (X) is constructed from six different indicators: pavement structure performance (X1), highway geometric design (X2), highway maintenance (X3), traffic volume (X4), support facilities (X5), and demand and supply (X6). The analysis results demonstrate that these indicators are valid and reliable in measuring the freight transportation.

Further, the freight transportation variable (Y1) is formed from the following indicators: regulation (Y11), redistribution (Y12), transportation entrepreneur (Y13), trucker (Y14), truck bin size (Y15), punctuality (Y16) and loading and unloading systems (Y17). These indicators are also valid and reliable in measuring the freight transportation. In addition, road network connectivity has a significant impact on freight transportation among regions.

VIII. Recommendations

From the results and discussion, the following suggestions are highlighted:

1. Further research is required to determine the infrastructure readiness of Krueng Geukueh to operate as the main import/export gate in the northern zone of Aceh and to develop the Arun Lhokseumawe Special Economic Zone.
2. The government of Aceh and the northern zone of Aceh should exhibit political will by supporting policies that optimize road network connectivity.
3. As some indicators were not included in the analysis, further research is needed to consider broader indicators and to obtain more reliable results.

REFERENCES

[1] GUDMUNDSSON, H, and HÖJER, M. (1996) Sustainable development principles and their implications for transport. *Ecological Economics,* 19(3), pp. 269-282.

[2] GWILLIAM, K.M., STUBBS, P.C., TYSON, W.J., and DALVI, M.Q. (1980) Transport economics. *The Economic Journal,* 90(359), pp. 677–678.

[3] JOURQUIN, B. (2016) Calibration and validation of strategic freight transportation planning models with limited information. *Journal of Transportation Technologies,* 6(5), 70840.

[4] SHEN, G., and WANG, J.A. (2019) Freight mode choice analysis using a binary logit model and GIS: The case of cereal grains transportation in the United States. *Journal of Transportation Technologies,* 2, pp. 175-188.

[5] DOUSTMOHAMMADI, E, SISIOPIKU, V.P., and SULLIVAN, A. (2016) Modeling freight truck trips in Birmingham using tour-based approach. *Journal of Transportation Technologies,* 6(5), 71356.

[6] FITHRA, H., SIROJUZILAM, SALEH, S.M., ERLINA (2018) Effect of freight transportation for regional development in the North Zone of Aceh. In: *Proceedings of MICoMS 2017, Vol. 1, Bingley, May 2018.* Bingley: Emerald Publishing Limited, pp. 35-42.

[7] DEPARTMENT OF TRANSPORTATION COMMUNICATIONS INFORMATION AND TELEMANIKA GOVERNMENT OF ACEH (2011) *Re-review study tetrawl Aceh in supporting acceleration and expansion of economic development corridor I Sumatera, Banda Aceh.*

[8] THE CENTRAL STATISTICS AGENCY (BPS) OF ACEH PROVINCE (2016) *Province in figures, Banda Aceh.*

[9] MISHRA, S., Welch, T.F, and JHA, M.K. (2012) Performance indicators for public transit connectivity in multi-modal transportation networks. *Transportation Research Part A: Policy and Practice,* 46(7), pp. 1066-1085.

[10] BEHDANI, B., FAN, Y., WIEGMANS, B., and ZUIDWIJK, R. (2016) Multimodal schedule design for synchromodal freight transport systems. *European Journal of Transport & Infrastructure Research,* 16(3), pp. 424–444.

[11] BAGOZZI, R.P., and YI, Y. (2006) On

the use of structural equation models in experimental designs. *Journal of Marketing Research,* 26(3), pp. 271-284.

[12] CHOURMAIN, I. (2008) *Normative research for writing theses and dissertations*. Jakarta: Al-Haramain Publishing House.

[13] BAGOZZI, R.P., and YI, Y. (2012) Specification, evaluation, and interpretation of structural equation models. *Journal of the Academy of Marketing Science,* 40(1), pp. 8–34.

[14] ANDERSON, J.C., and GERBING, D.W. (1988) Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin,* 103(3), pp. 411-423.

[15] FITHRA, H., and SALEH, S.M. (2017) Readiness of freight transportation system at special economic zone of Lhokseumawe. *AIP Conference Proceedings,* 1903, 060012.

[16] *Indonesian Government Regulation No. 5 "On special economic zones Arun Lhokseumawe"* (2017) Indonesia.

[17] LIU, Z., ZHAO, K, and MAO, J. (2017) Transportation model and simulation of chloride in concrete under electric field. *Journal of Southwest Jiaotong University,* 52(4), pp. 725-730.

参考文:

[1] GUDMUNDSSON，H 和 HÖJER，M。（1996）可持续发展原则及其对运输的影响。生态经济学，19（3），第 269-282 页。

[2] GWILLIAM，K.M.，STUBBS，P.C.，TYSON，W.J。和 DALVI，M.Q。（1980）运输经济学。The Economic Journal，90（359），pp.677-678。

[3] JOURQUIN，B。（2016）有限信息的战略货运规划模型的校准和验证。Journal of Transportation Technologies，6（5），70840。

[4] SHEN，G。和 Wang，J.A。（2019）使用二元 logit 模型和 GIS 的货运模式选择分析：美国谷物运输的情况。Journal of Transportation Technologies，2，pp.175-188。

[5] DOUSTMOHAMMADI，E，SISIOPIKU，V.P。和 SULLIVAN，A。（2016）使用基于旅行的方法对伯明翰的货运卡车旅行进行建模。交通技术杂志，6（5），71356。

[6] FITHRA，H.，SIROJUZILAM，SALEH，S.M.，ERLINA（2018）货运对亚齐北区区域发展的影响。在：2017 年 MICoMS 会议录，第一卷。1，Bingley，2018 年 5 月.Bingley：Emerald Publishing Limited，第 35-42 页。

[7] 交通运输部信息部和 ACEH 的 TELEMANIKA 政府（2011 年）重新审查研究 tetrawl 亚齐，以支持加速和扩大经济发展走廊 I Sumatera，Banda Aceh。

[8] ACEH 省中央统计局（BPS）（2016 年）省数据，班达亚齐。

[9] MISHRA，S.，Welch，T.F 和 JHA，M.K。（2012）多式联运网络中公共交通连通性的绩效指标。交通研究 A 部分：政策与实践，46（7），第 1066-1085 页。

[10] BEHDANI，B.，FAN，Y.，WIEGMANS，B。和 ZUIDWIJK，R。（2016）用于同步货物运输系统的多模式进度设计。欧洲运输与基础设施研究杂志，16（3），第 424-444 页。

[11] BAGOZZI，R.P。和 YI，Y。（2006）关于在实验设计中使用结构方程模型。Journal of Marketing Research，26（3），pp.271-284。

[12] CHOURMAIN，I。（2008）撰写论文和论文的规范性研究。雅加达：Al-Haramain 出版社。

[13] BAGOZZI，R.P。和 YI，Y。（2012）结构方程模型的规范，评估和解释。营销科学学院期刊，40（1），pp.8-34。

[14] ANDERSON，J.C。和 GERBING，D.W。（1988）实践中的结构方程模型：回顾和推荐的两步法。心理学公报，103（3），第 411-423 页。

[15] FITHRA，H。和 SALEH，S.M。（2017）Lhokseumawe 经济特区货运系统的准备

情况。 AIP Conference Proceedings，1903,060012。

[16]印度尼西亚政府条例第 5 号“关于经济特区 Arun Lhokseumawe”（2017 年）印度尼西亚。

[17] LIU，Z.，ZHAO，K和MAO，J。（2017）电场下混凝土中氯化物的运输模型和模拟。西南交通大学学报，52（4），pp.725-730 。

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