The study of Larantuka urban infrastructure service level to accommodate the connectivity of surrounding islands

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Abstract. Infrastructure is important and as a solution to the problem of high price disparity and the inequality in the percentage of GDP product value nationally, in particular, in the western and eastern regions of Indonesia which have been a challenge that needs to be overcome. East Flores regency is one of the islands in the Eastern Indonesia, precisely in East Nusa Tenggara with Larantuka as its capital. This area is facing problems related to low quality strategic infrastructure and inadequate regional transportation infrastructure. This study aims to assess urban infrastructure service level in Larantuka to accommodate the connectivity of surrounding islands. This study used Linkage, Integrate Rural Accessibility Planning, and Importance Performance Analysis as the methods. The results showed that there is a connection between road infrastructure and the port as well as airport. In addition, there is a connection between marine infrastructure (collection ports) and local feeder ports in the surrounding islands and a connection between spoke airport infrastructure (air) and the hub airport. The condition of urban infrastructure in Larantuka is considered "good," with service level of; "less satisfactory" for land infrastructure and "somewhat satisfactory" for air and sea infrastructure.

Keywords: *infrastructure, Larantuka, planning*

Introduction

Transportation is one of the sectors which significantly affects socio-economic development and growth of standard living [1]. In recent years, the availability and affordability of goods in the global market has become important; the production is no longer just a metric. Logistics is one of the most important components in every supply chain. With the development of manufacturing industry and the rapidly growing demand for specialized supply chain management services, the logistics industry is growing with the national economy [2]. The growth of logistics industry demands logistics infrastructure improvement which means as investment in certain nodes of transport network such as ports, airports, and linear infrastructure (road and rail link) [3].

Since East Flores regency is an archipelago, an infrastructure that can connect the islands is needed to support economic activities and reduce disparities in East Flores development. At the beginning of East Flores regency establishment, it consisted of Flores Island (mainland), Adonara Island, Solor Island, and Lembata Island, however, in 1999 with the enactment of Law Number 52 of 1999 concerning the establishment of Lembata regency which was inaugurated by the Governor of East Nusa Tenggara, then

East Flores regency only consists of Flores Island (the eastern part of the mainland), Adonara Island, and Solor Island.

Larantuka City, besides being the capital of Larantuka sub-district, is also the capital of East Flores regency. Judging from the direction and development trends of the city, Larantuka is a transit city, especially from the mainland (Flores Island) to the surrounding islands, and vice versa. In addition, Larantuka is also a center of functional activities oriented to regional service scale in which its development is along the coast including port area, trading, and airport. While the area oriented to the regional road covers part of the settlement area (Bappeda NTT).

The problems existing in East Florest regency, especially in Larantuka city related to regional development, in terms of the Regional Government Work Plan (*Rencana Kerja Pemerintah Daerah--RKPD)* 2016 are as follows: (1) The quality of strategic infrastructure is still low, (2) Regional transportation infrastructure is inadequate. Based on those problems, a research entitled "The Study of Larantuka Urban Infrastructure Service Level to Accommodate the Connectivity of Surrounding Islands" is needed.

2. Literature Review

2.1. Regional development

In this globalization era, a correlation between infrastructure development and regional development acceleration is needed. However, there are some issues related to the development, one of them is regional disparity. This disparity can be seen from the GDP number, per capita income, and the number of poor people per island which shows regional economic growth and infrastructure gap between regions. Infrastructure disparity in Indonesia is shown by infrastructure development concentrated in Java and Bali, while Kalimantan, Sumatera, Nusa Tenggara, Maluku, and Papua are still facing infrastructure limitation. Related facts also show that high national economic growth in 2010, around 6.1%, was not followed by equitable regional economic growth. This disparity occurs mainly between Java and outside Java, between urban and rural areas, as well as between fast-growing regions and underdeveloped areas including border areas. Due to the unfulfilled infrastructure in a region, it may cause expensive transportation fares resulting in inefficient production and distribution. The availability of infrastructure is divided into competitiveness (economy) and basic needs (equity). Furthermore, that infrastructure availability must be developed continuously along with regional development based on sovereign local wisdom that is rich in traditions [4].

2.2. Infrastructure and regional connectivity

Transportation infrastructure is an integral part of the city or country transportation system. In relation to community development and international relation intensification due to globalization process, the importance of transportation as a factor for economic and social development has been increased [5]. Transportation infrastructure is often used as a means of achieving political goal which is to promote strong and sustainable regions. Implicit mechanism between infrastructure and population growth is that infrastructure investment enlarges the area as to improve all aspects [6].

The transportation system framework is very complicated, it consists of various infrastructure such as terminal facilities, travel methods, transportation vehicles, and information system. Transportation has become one of critical infrastructure sectors in most countries in the world. Transportation is considered as one of the most important infrastructure sectors at the national and international level.

Transportation must be open and accessible (high level of user access), broad and ubiquitous (large number of physical infrastructure and assets; most infrastructure are protected and unattended; millions of vehicles and containers are distributed through the network), effective and adaptable. Critical transportation infrastructure is important for the national economy, security, and state function. This is important for:

- national priorities,
- providing basic services, reliability and availability,

- ensuring trade flows,
- supporting economic growth.

Transportation infrastructure has many critical points including elements, objects and nets, as well as vastly geographically distributed assets [1]. While connectivity infrastructure is an infrastructure connecting and facilitating people and goods from one place to another which includes road, bridge, port, and airport [7].

3. Methodology

This research used descriptive analysis method with a quantitative approach. Descriptive research is a research that attempts to describe a phenomenon or event occurred at the present time. Descriptive research obtains data based on the factors supporting the object of research, then these factors are analyzed to determine their roles [8]. Quantitative approach is an approach used in research by measuring indicators of research variables to obtain an overview between these variables in the form of research results in numbers with certain meanings.

3.1. Linkage

Linkage is a false line connecting one element to another, one node to another, or one district to another [9]. This line is usually in the form of road network, pedestrian path, and open space in various forms. Linkage theory involves organizing lines connecting parts of the city and "spatial datum" design from the building line to space. Spatial datum can be the site line, movement direction, axis, and building edge which together form a linkage system in a spatial environment. An urban linkage can be observed in different ways and approaches, there are three urban linkage approaches:

- Visual linkage,
- Structural linkage,
- Collective linkage.

3.2. IRAP (Integrated Rural Accessibility Planning)

Accessibility is the ease or difficulty in reaching social, economic, transportation, or other types of facilities and services. IRAP is a multi-sector integrated method including human, transportation system, and existing travel pattern. This is used in identifying priority design process in developing rurality due to villager capacity in achieving the easiest access to basic demands and other economic service facilities [10]. In addition, IRAP can support the development of local infrastructure planning process to improve the accessibility in rural area in Indonesia. Parameters believed to influence community needs in rural area demanding accessibility include: mobility, water, energy/electricity, education, health care, agriculture, basic need production, fishery production, small industry, market, and transportation [11].

There are three steps in IRAP analysis, namely determining accessibility indicators, determining indicator quality, and calculating indicator value.

- Determine accessibility indicators
  The first step in determining priority area and sector is determining accessibility indicators that will be reviewed. Then, assessment and category of those accessibility indicators are made. Giving score to each indicator based on the accessibility condition. The lowest score shows that the indicator is in the best condition, while the highest score means that the indicator condition is very bad. Indicator score is determined based on survey results and existing condition.
- Determine indicator value.
- Indicator value is obtained from respondents' assessment result based on the importance of each indicator.
- Calculate accessibility value which is obtained by multiplying indicator score and average indicator value.

3.3. IPA (Importance Performance Analysis)

Originally, IPA was developed to support a synchronous analysis of two components with different customer satisfaction service importance, and provider performance toward them. Instead, it was proposed to have IPA feature of "importance" axis displaying customer analysis result, and "performance" axis displaying expected value for the provider [12].

IPA Steps are:

- Sum the score of each item of all respondents
- Calculate the average of each item by dividing the score result by the number of respondents
- Sum the average of each item then divide them by the number of items
- Make Importance Performance Analysis (IPA) diagram to determine each item category

Before making importance performance analysis cartesian diagram, first find the intersection for the X axis (interest) and Y axis (satisfaction) using the following equations:

$$\overline{\overline{X}} = \frac{\sum_{i}^{n}{}_{=1}Xi}{k} \quad (1)$$

$$\overline{\overline{Y}} = \frac{\sum_{i}^{n}{}_{=1}Yi}{k} \quad (2)$$

Then, make IPA (importance performance analysis) diagram:

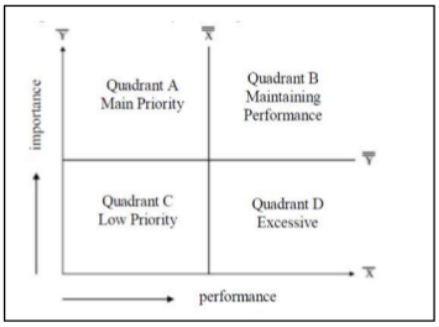


Figure 1. IPA diagram

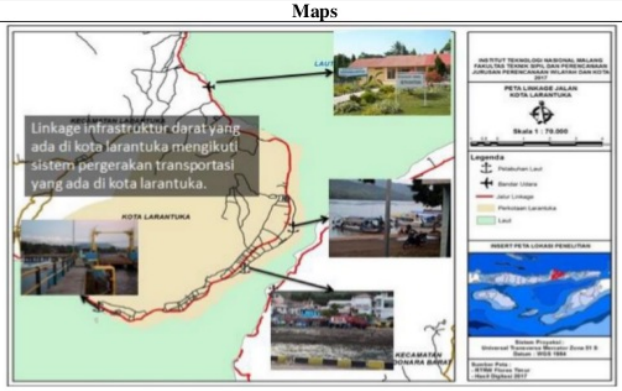
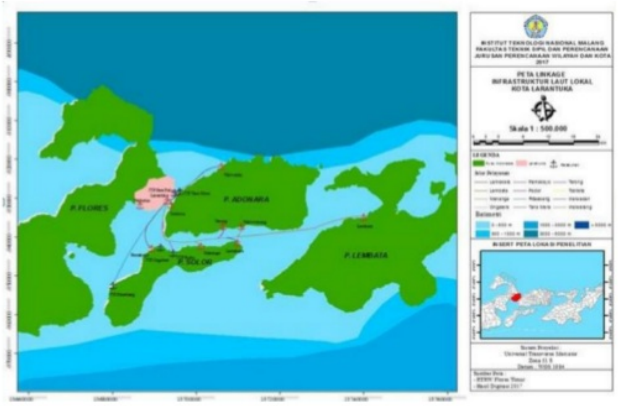
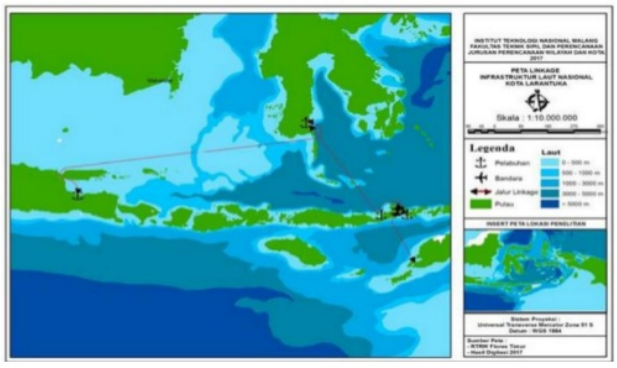
4. Result and discussion

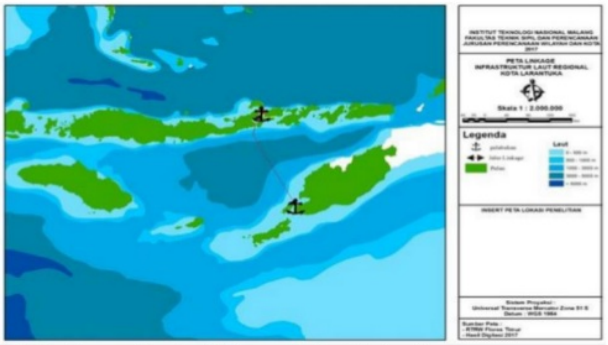
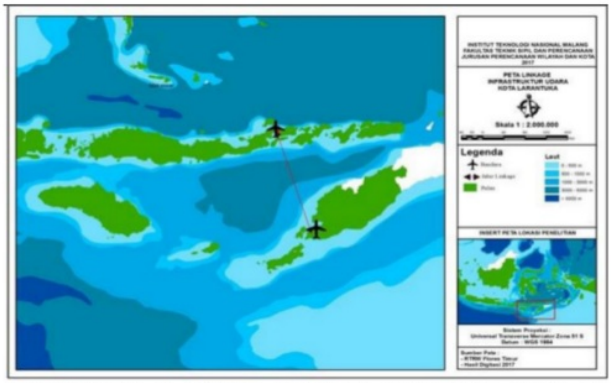
Result and discussion consist of the analysis results of connecting infrastructure, infrastructure condition, and urban infrastructure service level in Larantuka city to accommodate surrounding islands. The analysis of connecting infrastructure in Larantuka city was conducted to determine the connectivity between land infrastructure and other area around Larantuka city, as well as connecting Waibalun ferry port, the sea port, JPT pallo beach, and airport/ Style and Spacing airport.

4.1. The analysis of connecting infrastructure in Larantuka City

There are three connecting infrastructure in Larantuka city, namely land, marine, and air infrastructure. The following is the analysis of the connecting infrastructure in Larantuka city.

Table 1. Connecting infrastructure analysis

No	Linkage	Description	Maps
1	**Land infrastructure linkage**	The basis of land connecting infrastructure in Larantuka city is seen from transportation movement system connecting Waibalun ferry port to Larantuka sea port, JTP pallo beach, and Gewayantana airport Larantuka.	
2	**Marine infrastructure linkage**	**Local Service Marine Infrastructure Linkage**	
			In Larantuka city, there are two types of port, namely Larantuka sea port and Waibalun ferry port. In Larantuka sea port, the linkage used is seen from the hierarchy and port location, in which the hierarchy and Larantuka sea port status is as collection port, while the ports in surrounding islands (Adonara island and Solor island) are local feeder ports.
		National Service Marine Infrastructure Linkage	For national service infrastructure linkage, seen from national transportation 

No	Linkage	Description	Maps
			system, Larantuka sea port is in national shipping system with service route of Surabaya-Makasar- Maumere-Larantuka-Lembata-Kupang (round trip).
		Regional Service Marine Infrastructure Linkage	 Waibalun ferry port is class III ferry port of which functions are: 1. Port that functions as moving bridge (crossing) 2. Serves as a bridge connecting primer 2 collector road, primer 3 collector road, primer 4 collector road, and roads are not in port criteria for class I and class II crossing transport. 3. The location is not at the conception of the national crossing belt. 4. Port that has not been commercially operated. The linkage of this ferry port connects between Waibalun ferry port Larantuka (class III port) with Bolok port (class I port) in Kupang district as an access to Kupang city.
3	**Air infrastructure linkage**		 Air infrastructure in Larantuka, in this case Gewayanatana airport, only serves Kupang – Larantuka – Larantuka – Kupang flight route. It was caused by the hierarchy of Gewayantana airport Larantuka as spoke airport to serve hub airport that is El Tari airport kupang (Transportation Minister Regulation Number: PM 69 of 2013 concerning Airport). Spoke airports are: a. Airports with service coverage and affect local economy. b. Destination airport or supporting airport from the collecting airport. c. Airport as one of the supporting infrastructure service for local activities. Gewayantana airport larantuka has a runway of 1.400 m length and 30 m width that is only able to serve aircraft with short/medium distance flight. Operators that manage the flights from Kupang to Larantuka are Trans Nusa and Wings Air operators. The aircraft serving Gewayantana airport Larantuka is Fokker 50 for Trans Nusa operators, while Atr 72 for Wings Air.

Source : Analysis Result, 2017

4.2. Analysis of infrastructure condition in Larantuka City

The analysis of infrastructure condition in Larantuka city used IRAP (Integrated Rural Analysis Planning) analysis method. The results can be seen as follows:

a. Land Infrastructure

Accessibility value was obtained by multiplying each indicator score by each value score then the result was divided by the number of questionnaire to get the average score. Each result then summed and the total average score can be obtained. Last, the total average score was divided by the number of respondents to obtain the accessibility value.

Table 2. Land Infrastructure Accessibility

Infrastructure Type	Total Average I x V	Accessibility Value
Land Infrastructure	1390,75	21,40

Source: Analysis, 2017

With accessibility value of 21,40, it can be said that land infrastructure in Larantuka is in good condition.

Table 3. Land Infrastructure Condition in Larantuka City

Land Infrastructure	Condition			Remarks
	Good	M	B	
Road	√			

Source: Analysis, 2017

b. Marine Infrastructure

Accessibility value was obtained by multiplying each indicator score by each value score then the result was divided by the number of questionnaire to get the average score. Each result then summed and the total average score can be obtained. Last, the total average score was divided by the number of respondents to obtain the accessibility value.

Table 4. Marine Infrastructure Accessibility

Infrastructure Type	Total Average I x V	Accessibility Value
Marine Infrastructure	1539,00	23,68

Source: Analysis, 2017

With accessibility value of 23,68, it can be said that marine infrastructure in Larantuka is in good condition.

Table 5. Marine Infrastructure Condition in Larantuka City

Marine Infrastructure	Condition			Remarks
	Good	M	B	
Ports	√			

Source: Analysis, 2017

c. Air Infrastructure

Accessibility value was obtained by multiplying each indicator score by each value score then the result was divided by the number of questionnaire to get the average score. Each result then summed and the total average score can be obtained. Last, the total average score was divided by the number of respondents to obtain the accessibility value.

Table 6. Air Infrastructure Accessibility

Infrastructure Type	Total Average I x V	Accessibility Value
Air Infrastructure	726,75	11,18

Source: Analysis, 2017

With accessibility value of 11.18, it can be said that air infrastructure in Larantuka is in good condition.

Table 7. Air Infrastructure Condition in Larantuka City

Marine Infrastructure	Condition			Remarks
	Good	M	B	
Airport	√			

Source: Analysis, 2017

4.3. Analysis of infrastructure service level in Larantuka City

This analysis used IPA (Importance Performance Analysis) analysis method. This analysis aimed to determine infrastructure (land, marine, and air infrastructure) user satisfaction level in Larantuka city.

a. Land Infrastructure Service Level

Service level in this analysis was user satisfaction level in using land infrastructure. Cartesian diagram was made by inputting average score of each item of interest level (X) and satisfaction level (Y). The detail can be seen in the following table and diagram:

Table 8. Average Score of Interest Level (X) and Satisfaction Level (Y)

Item	Interest Level	Satisfaction Level
1	1.68	3.32
2	1.48	3.52
3	1.40	3.58
4	1.57	3.43
5	1.40	3.60
6	1.40	3.60
7	1.40	3.60
8	1.57	3.43
9	1.42	3.58
10	1.40	3.60
11	1.62	3.38
12	1.60	3.40
Total Average	**1.49**	**3.51**

Source: Analysis Result, 2017

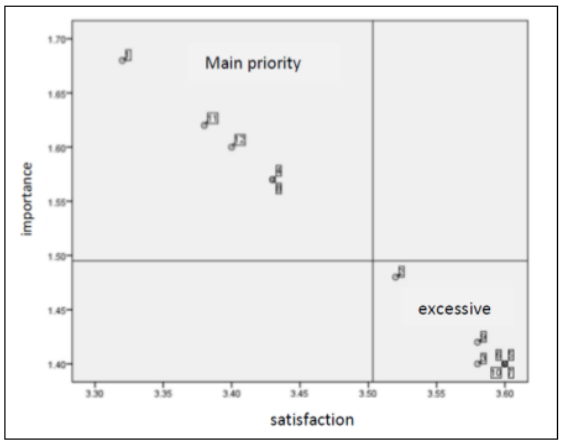


Figure 2. Importance performance analysis of land infrastructure
Source: Analysis Result, 2017

Based on the the result of cartesian diagram, two quadrants were obtained, namely main priority quadrant and excessive quadrant. Main priority quadrant is the quadrant containing items considered important by the community but still lacking in user satisfaction, while excessive quadrant contains items with relatively low interest but relatively high satisfaction. Items in main priority quadrant include: item 1, item 4, item 6, item 8, item 11, and item 12. While items in excessive quadrant include: item 2, item 3, item 5, item 6, item 7, item 9, and item 10. In general, land infrastructure users in Larantuka felt **"less satisfied"** with the existed service level. It can be seen from the total value which reached **42.61%.**

b. Marine Infrastructure Service Level

Service level in this analysis is marine infrastructure user satisfaction. Cartesian diagram was made by inputting average score of each item of interest level (X) and satisfaction level (Y). The detail can be seen in the following table and diagram:

Table 9. Average Score of interest level (X) and satisfaction level (Y)

Item	Interest Level	Satisfaction Level
1	1.80	3.20
2	1.82	3.18
3	2.08	2.86
4	2.18	2.82
5	1.66	3.34
6	1.83	3.17
7	1.91	3.09
8	1.83	3.17
9	2.00	2.98
10	1.49	3.51
11	1.69	3.29
12	1.92	3.06
Total Average	**1.85**	**3.14**

Source: Analysis Result, 2017

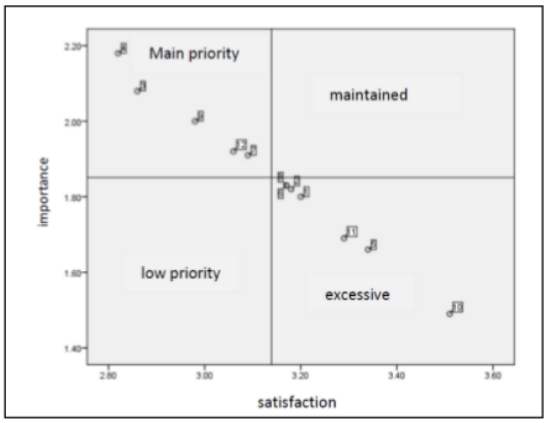


Figure 3. Importance Performance Analysis of marine infrastructure
Source: Analysis Result, 2017

Based on the the result of cartesian diagram, two quadrants were obtained, namely main priority quadrant and excessive quadrant. Main priority quadrant is the quadrant containing items considered important by the community but still lacking in user satisfaction, while excessive quadrant contains items with relatively low interest but relatively high satisfaction. Items in main priority quadrant include: item 3, item 4, item 7, item 9 and item 12. While items in excessive quadrant include: item 1, item 2, item 5, item 6, item 8, item 10, and item 11. In general, marine infrastructure users in Larantuka felt "**quite satisfied**" with the existed service level. It can be seen from the total value which reached **58.96**%.

c. Air Infrastructure Service Level

Service level in this analysis is air infrastructure user satisfaction. Cartesian diagram was made by inputting average score of each item of interest level (X) and satisfaction level (Y). The detail can be

seen in the following table and diagram:

Table 10. Average score of interest level (X) and satisfaction level (Y)

Item	Interest Level	Satisfaction Level
1	1.80	3.20
2	1.80	3.20
3	1.40	3.60
4	2.00	3.00
5	1.80	3.20
6	1.83	3.20
7	1.63	3.40
8	2.40	2.60
9	1.60	3.40
10	1.40	3.60
11	1.40	3.60
12	1.80	3.20
Total Average	**1.74**	**3.27**

Source: Analysis Result, 2017

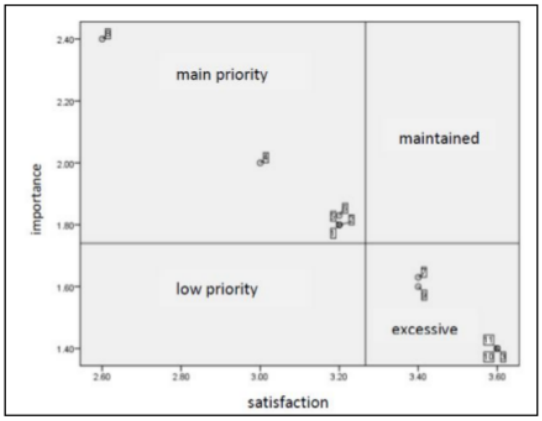


Figure 4. Importance Performance Analysis of Air Infrastructure
Source: Analysis Result, 2017

Based on the the result of cartesian diagram, two quadrants were obtained, namely main priority quadrant and excessive quadrant. Main priority quadrant is the quadrant containing items considered important by the community but still lacking in user satisfaction, while excessive quadrant contains items with relatively low interest but relatively high satisfaction. Items in main priority quadrant include: item 1, item2, item 4, item 5, item 6, and item 8. While items in excessive quadrant include: item 3, item 7, item 9, item 10, item 11. In general, marine infrastructure users in Larantuka felt "**quite satisfied**" with the existed service level. It can be seen from the total value which reached **52.23 %.**

5. Conclusion

Based on the analysis that has been done, it was known that:

a) Connecting infrastructure in Larantuka city consisted of land, marine, and air infrastructure.
   - For land infrastructure (road), existing linkage seen from transportation movement system and the connectivity between Waibalun ferry port, Larantuka sea port, JTP pallo beach, and Gewayantana airport Larantuka. While marine infrastructure linkage was

divided into two namely Larantuka sea port linkage for local and national service, and Waibalun ferry port for regional service. Local service of marine infrastructure linkage is seen from the hierarchy and port location in which Larantuka sea port is the collection port while the ports in surrounding islands (Adonara island and Solor island) are local feeder ports. National service of marine linkage infrastructure is seen from national transportation system in which Larantuka sea port is in national transportation system with service of Surabaya-Makasar-Maumere-Larantuka- Lembata-Kupang.

- Waibalun ferry port is seen from the port status in which this port is class III port that is not in national service belt and has not been commercialized.

b) Infrastructure condition in Larantuka city
   - Based on the analysis results, it was known that infrastructure in Larantuka city (land, marine, and air infrastructure) are in "good" condition.

c) Infrastructure service level in Larantuka city
   - Based on the analysis result, it was known that the users of land infrastructure in Larantuka city are "less satisfied" while for marine and air infrastructure they are "quite satisfied."

6. References

[1] Janušová, Lucia, and Silvia Čičmancová. 2016. Improving Safety of Transportation by Using Intelligent Transport Systems. 9th International Scientific Conference Transbaltica 2015. University of Zilina, 1. mája 32, 01001 Zilina, Slovakia.

[2] Acar, A. Z., and Yurdakul, H. (2015). *Evaluation of competitive power of logistics industry in Turkey*. Journal of Caspian Affairs , 1 (1), 1-22.

[3] Acar, A. Z., Bentyn, Z., and Kocaoglu, B. (2015). *Turkey as a Regional Logistics Hub in Promotion of Revivaling Ancient Silk Route Between Europe and Asia*. Journal of Management, Marketing and Logistics , 2 (2), 94-109.

[4] Putri,Andina Oktavia Sulistya. 2012. *Peran Infrastruktur dalam Percepatan Pembangunan Wilayah Sesi II*. Seminar Nasional Kota Untuk Rakyat.

[5] Skorobogatova, Oksana and Irina Kuzmina-Merlino*. 2017. *Transport Infrastructure Development Performance*. 16th Conference on Reliability and Statistics in Transportation and Communication,RelStat'2016, 19-22 October, 2016, Riga, Latvia. Procedia Engineering 178 (2017) 319 – 329

[6] Aarhaug, Jørgen and Frants Gundersen. 2016. *Infrastructure investments to promote sustainable regions*. 44th European Transport Conference 2016, ETC 2016, 5-7 October 2016, Barcelona, Spain. Transportation Research Procedia 26 (2017) 187–195

[7] Anonim. 2014. *Kementerian PPN Bappenas - Konektivitas Infrastruktur Wilayah dan Antar Wilayah*. Tarakan

[8] Arikunto, Suharsimi. 2010. *Prosedur Penelitian: Suatu Pendekatan Praktik*. Jakarta : Rineka Cipta

[9] Markus Zahnd. 2006. *Perancangan Kota Secara Terpadu*. Yogyakarta: Kanisius

[10] Oktaviana, Maria Goretti.2011. *Development Strategy For Rural Transportation Case Study Province Of West Papua*. *J. Basic. Appl. Sci. Res*., 2(1)179-184, 2011. ISSN 2090-4304 Journal of Basic and Applied Scientific Research

[11] Bakri ,M. Djaya, Harnen Sulistio, Achmad Wicaksono, Ludfi Djakfar. 2015. *Infrastructure Development Program in Rural Areas using the Integrated Rural Accessibility Planning (IRAP.)* Australian Journal of Basic and Applied Sciences, 9(23) July 2015, Pages: 456-463.

[12] Rondinia. Alice, Marco Bertonib, Giuditta Pezzottaa. 2017. *An IPA based method for PSS design concept assessment*. The 9th CIRP IPSS Conference: Circular Perspectives on Product/Service-Systems. Procedia CIRP 64 (2017) 277 – 282

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