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Identification of Role of Feeder, Collecting and Local Ports in Sulawesi Corridor in Supporting the National Connectivity

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ABSTRACT

Support of seaports in central areas is needed to support the development of the region. In the hierarchy of ports, seaports act as feeder port, collector port, and local port. Sulawesi Economic Corridor has a high potential in economic and social fields as well as a competitive advantage in the plantation sector, marine fisheries, food crops, and marine transportation is very important to support the trading activities. The main objective of this research is to analyze the level of connectivity in the marine transportation system connecting the centers of major growth in Sulawesi corridor and identify the role of ports in the corridor of Sulawesi to support such connectivity. Results of the study are; 1) The role of the main port in Sulawesi Corridor is to support centers of national activity which is a region that is fast-progressing and fast-growing. Collector port and feeder port, particularly regional feeder port has the majority to support centers territories and regions with the potential to grow rapidly which is the hinterland of the central area of primary growth in each province, 2) Hierarchy design arranged by the Port of Bitung is International Hub Port and the Port of Makassar is one link in the system of national pendulum as a port plays an important role in Sulawesi Corridor. Ports of Pantoloan, Kendari, Gorontalo, Palu, Parepare, and Belang-Belang are in the second hierarchy position and regional feeder ports and partially local feeder are in the third hierarchy position which act as ports to serve centers and local activities in a particular region., 3) Level of connectivity to the high sea transportation of container cargo only between major ports such as Makassar, Bitung, and Pantoloan while for general cargo high connectivity found in the Port of Makassar and Bitung.

Keywords: Connectivity, Ports, Sulawesi Corridor

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1. INTRODUCTION

Support for port infrastructure is vital in supporting the activities of inter-island trade intra Sulawesi corridor and with other economic corridors. In addition, the port has a role as a node (port as a transportation node) in the transport network in accordance with a hierarchy that support the industry and/or trade, as a system of spatial (port as a spatial system)in the development process, as a gateway that can encourage the growth of small ports which are located within the area of influence, as a service of the ships and activity over the mode of transportation, as a place of production, distribution and consolidation of cargo or goods that can increase income and employment (port as multiplier effects). Based on this, then in Sulawesi corridor takes a concept of order in the transport infrastructure network in this case is in the form of a hierarchical structure corresponding port function and role as well as the model of development of the

main ports on Sulawesi corridor that are tailored to regional development plans. The research objectives to be achieved are:

1. Identifying the role of ports in the corridor of Sulawesi to support connectivity between growth centers and the role of ports as nodes in the national route network.
2. The design model of a hierarchical structure that is optimal marine transportation infrastructure in support of the role of seaports in the economic development of the corridor Sulawesi.
3. The level of connectivity in the marine transportation system linking the major growth centers in the corridor of Sulawesi and the growth centers in other economic corridors.

2. LITERATUR REVIEW

A. National Connectivity

Strengthening national connectivity is one of the main strategies adopted in the acceleration and expansion of national economic development. Prerequisites in the creation of Indonesia inter-regional connectivity is conducted in the form; a) the realization of an integrated system among the national logistics system, the national transportation system, regional development, and communication and information systems, b) identification of nodes transport and distribution centers to facilitate the logistics needs of major commodities and support, c) strengthening connectivity intra and inter corridors and international connectivity, and d) an increase in communication networks and information technology to facilitate all economic activities, government activities, and the national education sector. The four components are forming a national connectivity postures that are interconnected into one unified planning [6].

B. National Transportation System

The purpose of Sistranas is the realization of effective and efficient transportation in supporting and simultaneously drive the dynamics of development, increasing mobility of people, goods and services, helping create a pattern national distribution of stable and dynamic, as well as supporting the development of the region, and further solidifying the development of social life of the nation and state in order the embodiment of the archipelago and the improvement of international relations, while the goal is to realize the implementation of effective and efficient transportation.

C. Conseptual Framework

The conceptual framework developed for completing this study is as follows:.

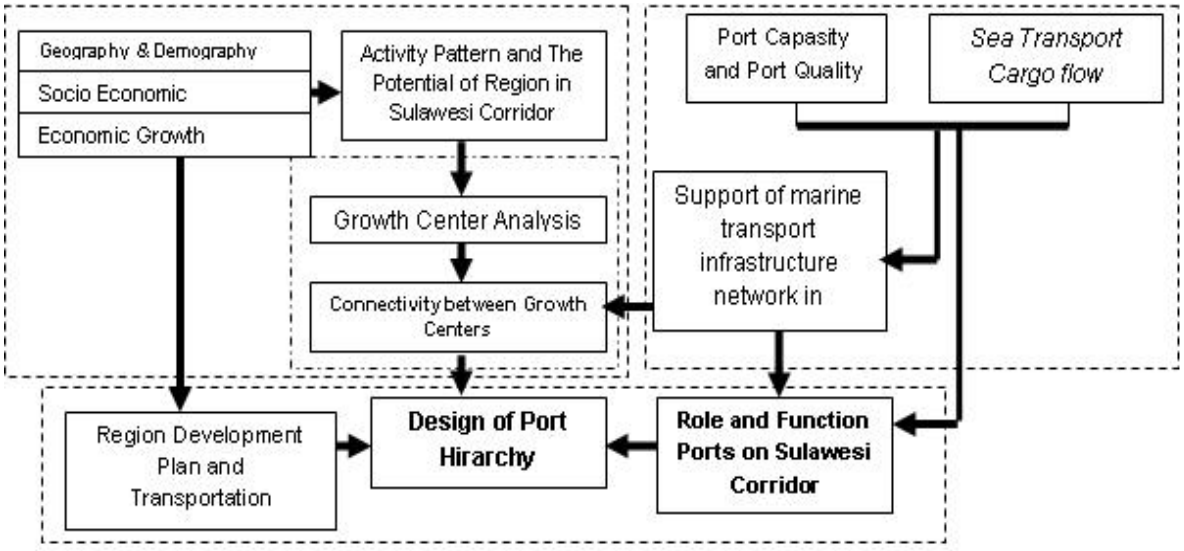

Figure 1. Conceptual Frameworks of The Study

3. ANALYSIS METHOD

A. Hinterland Analysis

Some of the variables to be used as an indicator to determine whether an area has the potential to be a port hinterland are the ease of accessibility to reach the port locations measured from a distance, travel time, the condition of road network, as well as leading commodities contained in a region. Based on the hinterland analysis, it can be seen the areas that are hinterland of ports studies so as to obtain the magnitude of the demand movement from a port of origin to port of destination can be determined by modeling the generation and the pull of the movement as well as modeling the spread of the movement in the study area with using socio-economic characteristics data of the port hinterland regions as described before.

B. Klassen Typology Analysis

Klassen Typology analytical tool is used to determine an overview of the structure and pattern of economic growth in each region. Klassen Typology basically divided areas based on two main indicators, namely regional economic growth and per capita income of the region. By determining the average growth of the economy as the vertical axis and the average income per capita as the horizontal axis, the area observed can be divided into four classifications, namely: local fast forward and fast growth (high growth and high income), developed regions but depressed (high income but low growth), rapidly developing areas (high growth but low income), and the relatively underdeveloped regions (low growth and low income).

C. Connectivity Analysis

UNCTAD set five components that can be used in determining the index value of connectivity cruise liner as an indicator of the connectivity areas, namely: 1) the number of shipping companies that serve from/to the ports in the region, 2) the size of the fleet of sea transport with the largest capacity serving of/to the port in an area that is an indicator of economies of scale and indicators of infrastructure capacity, 3) the amount of shipping networks that connect between one region to another which shows the magnitude of the opportunity to reach an area destination without intermediate transport modes, 4) total number of fleet sea transport connecting the region with other regions where the greater number of fleet shows the level of connectivity is getting better, and 5) a total payload capacity serviced from/to the port in an area where it shows the capacity of load space available [16].

D. Gravity Model

Production and attraction movement between zones with regard to some of the parameters contained in each zone of origin and destination, for example, population and level of accessibility between the zones that are a function of distance, time or cost.

$$F_{id} = G\frac{m_i m_d}{d_{id}^2}$$ with G as gravity (1)

For the transportation purpose, GR model stated as:

$$T_{id} = k\frac{O_i O_d}{d_{id}^2}$$ with **k** as constant (2)

The movement between zones of origin***i*** and destination zone ***d*** is directly proportional to O_i and D_d and inversely proportional to the quadratic distance between the two zones. So GR model can be expressed as:

$$T_{id} = O_i \cdot D_d \cdot f(C_{id}) \quad (3)$$

In Tamin (2002) explains that there are four types of models of GR i.e. without constraints (UCGR), with constraints-production (PCGR), with constraints-attraction (ACGR), and with constraints-production-attraction (PACGR).

The study uses the PCG, which in this model, total global movement trip attraction results should be the same as the total movement generated by modeling; as well, the resulting production trip model should be the same as the desired production tripresults. There are three Barrierfunctions which are commonly used in the GR model [15], namely:

$f(C_{id}) = C_{id}^{-\alpha}$ (exponential func.) (4)

$f(C_{id}) = e^{-\beta C_{id}}$ (negative exp. Func.) (5)

$f(C_{id}) = C_{id}^{\alpha} \cdot e^{-\beta C_{id}}$ (Tanner func.) (6)

5. RESULT AND DISCUSSION

A. Sulawesi Corridor Sea Transportation System

Seaports located on Sulawesi corridor consist of main ports, collector

ports, regional feeder ports, and local feeder ports.

Marine transportation network in question is sea transportation route network that serves both intra Sulawesi corridors and Sulawes corridors with other economic corridors in Indonesia. Sea transport network in this case distinguished on the domestic sea freight and pioneer ocean freight.

B. Growth Centers in Sulawesi Corridor

Center of national activities and the center of regional activities contained in Sulawesi corridor which are centers of growth including Urban Area of Manado and Bitung; andcenter of regional activities of Tomohon, Tondano, and Kotamobagu in North Sulawesi; and center of national activities of Gorontalo; and center of regional activities of Isimu, Kuandang, and Tilamuta in Gorontalo province. In Central Sulawesi there are center of national activiteis of Palu; and center of regional activities of Poso, Luwuk, Buol, Kolonedale, Tolitoli, and Donggala. In the province of South Sulawesi are urban area of Sungguminasa-Takalar Makassar-Maros (Mamminasata) as center of national activities and districts of Jeneponto, Palopo, Watampone, Bulukumba, Barru, and Pare Pare as center of regional activities. In the province of West Sulawesi Mamuju contained center of regional activites; and in Southeast Sulawesi province are center of national activities of Kendari; and center of regional activities of Unaaha, Lasolo, smell the smell, Raha, and Kolaka.

Based on Klassen Typology analysis, the classification of the area carried out in four categories: rapidly advancing region and rapidly growing region as a primary growth center, rapidly developing region as a secondary growth centers and developed region but oppressed as a center of tertiary growth.

C. Sea Transport Infrastructure Network Support (Ports)

Ports support on each regional growth center located on Sulawesi corridor is as presented in Table 4

D. Sulawesi Corridor Ports Hierarchy

Based on the identification of the role of the ports of the hierarchy port design on Sulawesi corridor can be described as follows:

E. Primary Growth Center Inter-Regional Connectivity

Connectivity between the central regionsin this study viewed from sea transportation connectivity among national/international ports namely Manado, Bitung, Gorontalo, Palu, Kendari, Donggala, Tolitoli, Mamuju, Parepareand

Makassar. Variables used insea transport connectivity is shipping distances, the amount of stretch liner serves, the capacity of the largest fleets, fleet, as well as the number of shipping companies. Based on connectivity index value above, hence the classification is conducted as follows:

Table 1. Sulawesi Corridor Sea Ports Infrastructure Network in 2010

Provinces	Main Port	Collector Port	Reg/ Feeder Port	Local Feeder Port
North Sulawesi	1	7	9	29
Central Sulawesi	-	4	-	7
South Sulawesi	1	14	6	73
Sulawesi Southeast	-	9	6	26
Gorontalo	-	3	1	15
West Sulawesi	1	16	10	34
Sulawesi	3	53	32	184

Table 2. Sulawesi Corridor Sea Transport Route Network in 2012.

Provinces	ALDN Tramper		ALDN Liner		Pioneer Liner		
	Inter-Corridor	Internal Corridor	Inter-Corridor	Internal Corridor	Stretch	Stretch Code	Call
North Sulawesi	51	25	3	0	6	R16, R17, R18, R19, R35, R37	121
Gorontalo	8	11	0	0	1	R23	13
Central Sulawesi	15	66	0	0	4	R19, R20, R23, R36	58
Southeast Sulawesi	23	41	1	1	6	R19, R20, R21, R22, R36, R38	102
West Sulawesi	2	0	0	0	0		0
South Sulawesi	127	49	3	1	9	R19, R20, R21, R22, R23, R24, R30, R36, R38	150
Jumlah	226	192	7	2	26		444

Source: Indonesia Statistics, 2010

Table 3. Regional Classification Based on Klassen Typology Analysis

Region Classification	Provinces	District / City
High growth and high income	North Sulawesi	Manado, Bitung, Mihasa Utara
	Gorontalo	Gorontalo City
	Central Sulawesi	Palu
	Southeast Sulawesi	Kendari, Kolaka
	West Sulawesi	-
	South Sulawesi	Makassar, Pare-pare, Palopo, Pangkep, Sidrap, Pinrang
Region Classification	**Provinces**	**District / City**
High growth but low income	North Sulawesi	Kep. Sangihe, Kep.Sitaro, Kotamobagu
	Gorontalo	District Gorontalo, Gorontalo Utara, Boalemo
	Central Sulawesi	Poso, Donggala, Morowali, Tolotoli, Buol
	Southeast Sulawesi	Baubau, Konawe, Konawe Selatan, Bombana, Wakatobi, Muna
	West Sulawesi	Polewali Mandar, Majene, Mamuju
	South Sulawesi	Bulukumba, Bantaeng, Gowa, Bone, Luwu Utara, Luwu Timur, Barru, Jeneponto, Takalar, Maros
Region Classification	**Provinces**	**District / City**
High income but low growth	North Sulawesi	Minahasa, Tomohon
	Gorontalo	Pohuwato
	Central Sulawesi	Banggai, Tojo Una una, Sigi
	Southeast Sulawesi	Konawe Utara, Buton Utara, Kolaka Utara
	West Sulawesi	Mamuju Utara
	South Sulawesi	Toraja Utara, Wajo

Region Classification	**Provinces**	**District / City**
Low growth and low income	North Sulawesi	Bolaang Mongondow, Bolmong Utara, Bolmong Selatan, Bolmong Timur, Kep. Talaud, Minahasa Utara, Minahasa Selatan
	Gorontalo	Bone Bolango
	Central Sulawesi	Banggai Kepulauan, Parigi Moutong
	Southeast Sulawesi	Buton, Kolaka Timur, Konawe Kepulauan
	West Sulawesi	Mamasa, Mamuju Tengah
	South Sulawesi	Sinjai, Soppeng, Enrekang, Luwu, Tana Toraja, Kep. Selayar

Table 4. Seaport Support in the Primary Growth Centre Region.

Primary Growth Center	Focus Sector	Port Support
PKN/KEK Bitung	Sentral processing industry fishery product export-oriented	Port of Bitung
PKN Manado	Sentral processing industry fishery product	Port of Manado
Minahasa Utara	Regional marine and fisheries	Port of Munte
PKN Gorontalo	Leading areas in the leading sectors of agriculture, plantation, fishery and mining	Port of Gorontalo
PKN/KEK Palu	Integrated regional economic development of Betui Certain leading area	Port of Pantoloan Port of Palu
PKN Kendari	Marine industry development center and an export-oriented fisheries	Port of Kendari
PKN Maminasata	Industrial clusters, node food agriculture and oil and gas processing Sentral processing industry fishery product export-oriented	Port of Makassar / TPM

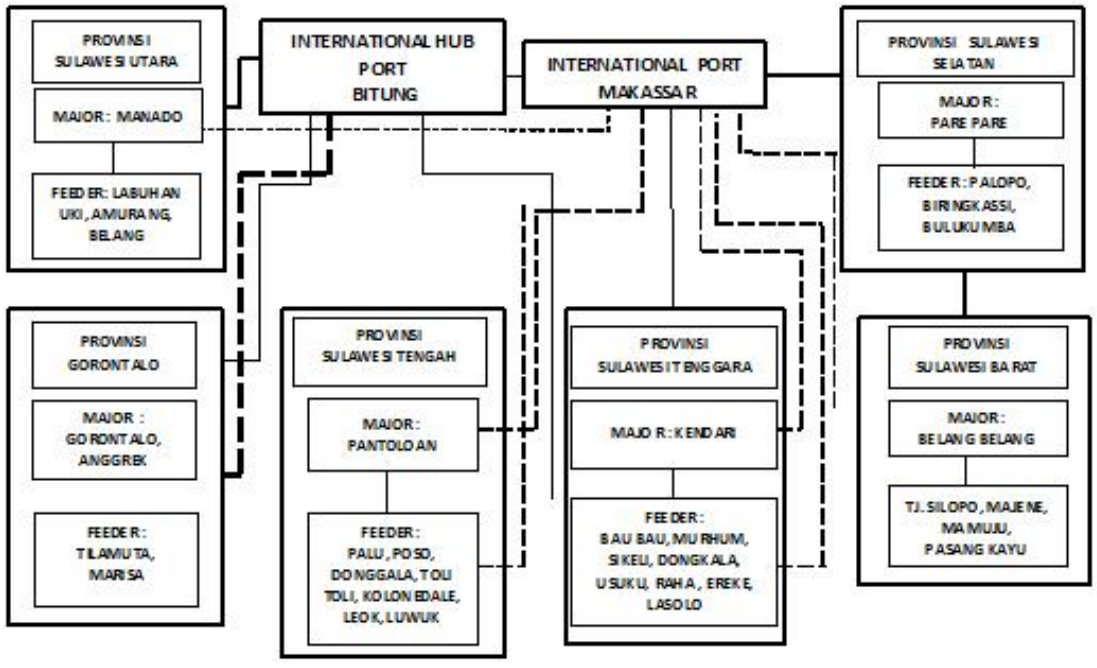

Figure 2. Sulawesi Corridor Ports Hierarchy.

Table 6. Sea Transportation Connectivity Index Value for The Container Load

	Makassar	Parepare	Bitung	Manado	Gorontalo	Pantoloan	Tolitoli	Kendari	Donggala	Mamuju
Makassar		0,0168	0,6273	0,0017	0,2975	0,0069	0,0154	0,0215	0,0115	0,0013
Pare pare	0,5668		0,2644	0,0014	0,1235	0,0026	0,0131	0,0183	0,0198	0,0011
Bitung	0,8532	0,0108		0,0011	0,0948	0,0080	0,0100	0,0139	0,0074	0,0008
Manado	0,5504	0,0141	0,2675		0,1235	0,0025	0,0131	0,0181	0,0097	0,0111
Gorontalo	0,6289	0,0161	0,3027	0,0017		0,0029	0,0148	0,0207	0,0110	0,0012
Pantoloan	0,6417	0,0049	0,2813	0,0005	0,0427		0,0188	0,0063	0,0034	0,0004
Toli toli	0,5559	0,0142	0,2663	0,0015	0,1235	0,0105		0,0182	0,0098	0,0011
Kendari	0,5639	0,0144	0,2684	0,0015	0,1252	0,0026	0,0132		0,0098	0,0011
Donggala	0,5995	0,0143	0,2657	0,0015	0,1237	0,0026	0,0132	0,0183		0,0011
Mamuju	0,5564	0,0142	0,2619	0,0014	0,1226	0,0025	0,0130	0,0181	0,0097	

Table 7. Sea Transportation Connectivity Index Value for The General Cargo Load.

	Makassar	Parepare	Bitung	Manado	Gorontalo	Pantoloan	Tolitoli	Kendari	Donggala	Mamuju
Makassar		0,06	0,31	0,01	0,43	0,01	0,06	0,09	0,02	0,01
Pare pare	0,52		0,38	0,00	0,05	0,00	0,02	0,01	0,01	0,00
Bitung	0,69	0,02		0,01	0,18	0,01	0,02	0,02	0,05	0,01
Manado	0,53	0,01	0,29		0,12	0,00	0,01	0,02	0,01	0,00
Gorontalo	0,88	0,01	0,03	0,00		0,00	0,01	0,04	0,02	0,00
Pantoloan	0,55	0,02	0,26	0,00	0,12		0,02	0,02	0,01	0,00
Toli toli	0,70	0,02	0,11	0,00	0,16	0,00		0,01	0,00	0,00
Kendari	0,39	0,01	0,21	0,00	0,33	0,00	0,03		0,02	0,00
Donggala	0,51	0,01	0,32	0,00	0,15	0,00	0,01	0,01		0,00
Mamuju	0,57	0,01	0,26	0,00	0,12	0,00	0,01	0,01	0,01	

Table 8. Connectivity Level Classification for The Container Load.

Level of Connectivity	Container Freight	
	Origin Port	Destination Port
Very High Connectivity (< 0,7)	Bitung	Makassar
High Connectivity (0,6 - 0,69)	Pantoloan, Gorontalo Makassar	Makassar Bitung
Moderate Connectivity (0,5 – 0,69)	Pare-pare, Manado, Toli-toli, Kendari, Donggala, Mamuju	Makassar

Table 9. Connectivity Level Classification for The General Cargo Load.

Level of Connectivity	Container Freight	
	Origin Port	Destination Port
Very High Connectivity (0,6 – 0,9)	Bitung, Gorontalo, Toli toli	Makassar
High Connectivity (0,3 - 0,59)	Makassar Pare-pare Manado, Pantoloan, Kendari Donggala, Mamuju Kendari Donggala	Bitung, Manado Makassar, Bitung Makassar Gorontalo Bitung
Moderate Connectivity (0,1 – 0,29)	Manado, Pantoloan, Toli toli, Kendari, Mamuju Bitung, Manado, Pantoloan, Toli-toli, Donggala, Mamuju	Bitung Gorontalo

6. CONCLUSION

The role of the main ports in Sulawesi Corridor as a national collector port is supporting national activity centers which are a region that is rapidly advancing and rapidly growing. Collector and feeder ports especially regional feeder ports largely support regional activity

centers and regions that have the potential to expand rapidly which are the hinterland of the central region of the primary growth in each province. While the local feeder ports as major support centers of local activity contained in each of the provinces where most of the local community center is a region that is advanced but has a slow economic development.

The hierarcchy draft prepared by the Port of Bitung as an International Hub Port and the Port of Makassar, which is one link in the system of national pendulum as a port that plays an important role in Sulawesi Corridor. Ports of Pantoloan, Kendari, Gorontalo, Palu, Parepare, Belangbelang are ports that are located on the second hierarchy and the regional feeder ports and partially local feeder ports are in the third hierarchy as most of the local ports are serving local activities on certain areas.

Highlevel of sea transportation connectivity for container load occursonly among the main ports of Makassar, Bitung, and Pantoloan while for general cargo load has high connectivity among ports on Sulawesi corridor with Makassar port and Bitung port.

Recommendation

To further complement this study, further research is needed to achieve incisive analysis in determining the hierarchy of the port on Sulawesi corridor as well as determining the analysis of connectivity among centers of growth by considering the connectivity among collector ports, feeder ports which are on Sulawesi corridor.

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