

Container Transport Network Analysis of Investment Region and Port Transshipment for Sulawesi Economic Corridor

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Abstract:- Sulawesi Island is an area of land that is coherent with the sea area, flanked by Indonesian Archipelagic Sea Lanes (IASL) 2 and 3. The existence of means and a reliable infrastructure are to accelerate economic development. Connectivity between transshipment ports are relatively good and economic node. The integration of international and intermodal are still low. It's required network development across the western and eastern cross-node connectivity and the development of sea ports. Multimodal transport between the port transshipment and node of Attention Investment Region (AIR) as regional seizure of goods to be transported by container needs to be supported with improved facilities at the port of loading and unloading containers and trailers adequacy and maintain the level of service as the current road infrastructure, so that the efficiency and effectiveness connectivity can be achieved.

Keywords: Connectivity, integration, network system, Containers.

I. INTRODUCTION

The island of Sulawesi is a land area that is coherent and has the longest coastline, there are many small islands around it, for example North Sulawesi consists of about 180 small islands flanked by IASL 2 and 3 of about 17.371 million people [1], thus showing sectoral activities broader and make the transport sector plays an important role towards the development and growth of other sectors. This suggests that the stretch of road network and shipping (international and national), efficient inter-connectivity and integration of operational performance requires efficient and effective as well as a fairly broad range. For that, the existence of infrastructure and a reliable means of transportation has become an expectation in order to support the expansion and acceleration of economic development, especially in the Sulawesi Economic Corridor.

The general problem is the lack of financing the construction of transportation, lack of accessibility of transport infrastructure development in various areas. Similarly to the road network and transportation between the islands are integrated [2]. The problem of integrated transport in Sulawesi Island is not the formulation of the transport system of regions/provinces in an integrated form, so as not maximum support to the transport sector Acceleration, Economic Development and Expansion of Sulawesi Island. Transport policy at the level of provincial/district requires compliance with national transport policy.

II. SULAWESI ECONOMIC CORRIDOR

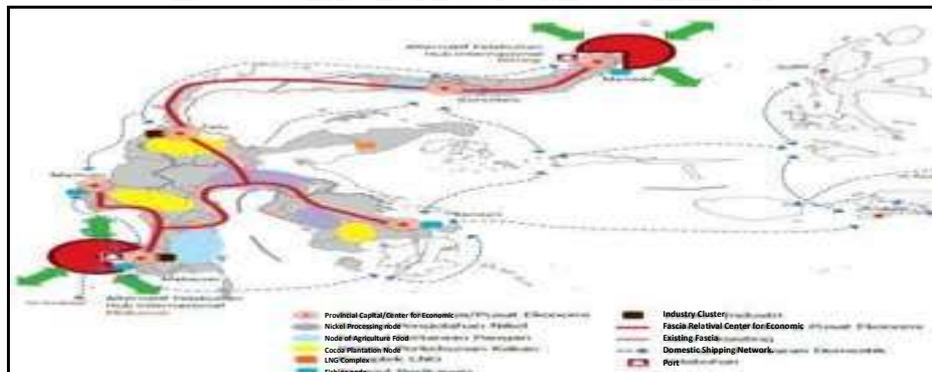


Figure1. Sulawesi Corridor Economic

Sulawesi Economic Corridor has theme as centre of Production and Processing of Agricultural Products, Agriculture, Fisheries, and the National Mining Nickel and is expected to be the prime mover of the national economy to the East Asian markets, Australia, and America [3]. Sulawesi Economic Corridor has a high potential in the field of economic and social with superior activities. In general, there are several things that must be developed in the Sulawesi Economic Corridor:

- a. The low value of GDP per capita in comparison to the other island of Sulawesi in Indonesia;
- b. The main economic activities of agriculture, as the largest contributor to GDP (30 percent), where as the slow-growing major economic activity is absorbing about 50 percent of the workforce;
- c. Investing in Sulawesi originated from within and outside the country is relatively underdeveloped compared to other regions;
- d. Economic and social infrastructure such as roads, electricity, water, and a lack of available health and inadequate.

The development Sulawesi Economic Corridor focuses on the main economic activities of agri-food, cocoa, fisheries and nickel. In addition, the main economic activities are oil and gas can be developed with the potential to be the prime mover of economic growth in this corridor. Connectivity of Transportation infrastructure requires for improvement and development to support of the agri-food primary economic activities as follow:

- a) Access road between the farms and trading center, to facilitate the farmers in selling and reduce dependence on intermediaries or agency. Access roads better than the location of the plantation to the processing industry, the port and the center of regional trade and export;
- b) The capacity of the port in Makassar, Mamuju, and Manado; Produksi and addition of storage facilities and capacity building in trade centers and ports. The construction and development of fishing ports and better road access from the site to the fishing port and a regional trade center;
- c) Infrastructure sea port to serve the delivery of equipment and raw materials from other areas. Improvement and development of access to areas of new exploration and exploitation, both onshore and offshore;

Development of space structures for Sulawesi Economic Corridor will evolve in line with the development and existence of the Trans Sulawesi highway linking the south to the northern part of Sulawesi. The structure of the corridor space is experiencing high dynamics due to the acceleration of the movement of goods and people from intra and inters growth centers in the Sulawesi Economic Corridor and between Sulawesi Economic Corridor with other economic corridors in Indonesia. Besides, given that this corridor is on the Pacific Ocean and international shipping lanes, it is very important to be able to determine the location that will serve as an international hub. Port of Bitung in North Sulawesi or Port of Makassar in South Sulawesi is an alternative port that can be developed into an international hub. Determination international hub in East Indonesia is expected to accelerate development in Eastern Indonesia more dominated by the islands.

III. TRANSPORT NETWORK CONNECTIVITY

Geographically, Indonesia's national territory can be grouped into three categories, namely region developed regions, is growing and relatively less developed category. The Sulawesi is including the emerging area as the island of Kalimantan and NTB. The road network in the region, relatively still in development, such as Sulawesi highway west, central and east, and the road development plans in the framework of regional cooperation in BIMP-EAGA. Picture of the condition of road along the East Sulawesi technically can not support the smooth operation of traffic, although its function as the primary arterial access of *PKW Kolonodale*/Poso, Central Sulawesi, Southeast Sulawesi with PKN of Kendari. Economically [4], the implementation of road construction has not potential to involve the public/private is pure, it is necessary to finance some government involvement, in order to be financially viable, so it can attract private investors.

The development of the road network needs to be adjusted and aligned with the functions carried and in accordance with the level of service required [4], namely i) for pathways need to be developed economically strategic road network with a primary arterial road classification freeway can be a toll road corridor to support the development of existing areas, ii) while for strategic pathways aimed to strike a balance between regions can be developed according to the needs of the road network such as highways or roads being; iii) for the road network that is intended as a consolidation of the territorial Homeland, because it does not need an excessively high level of service, type of road can be developed enough to begin the road was down.

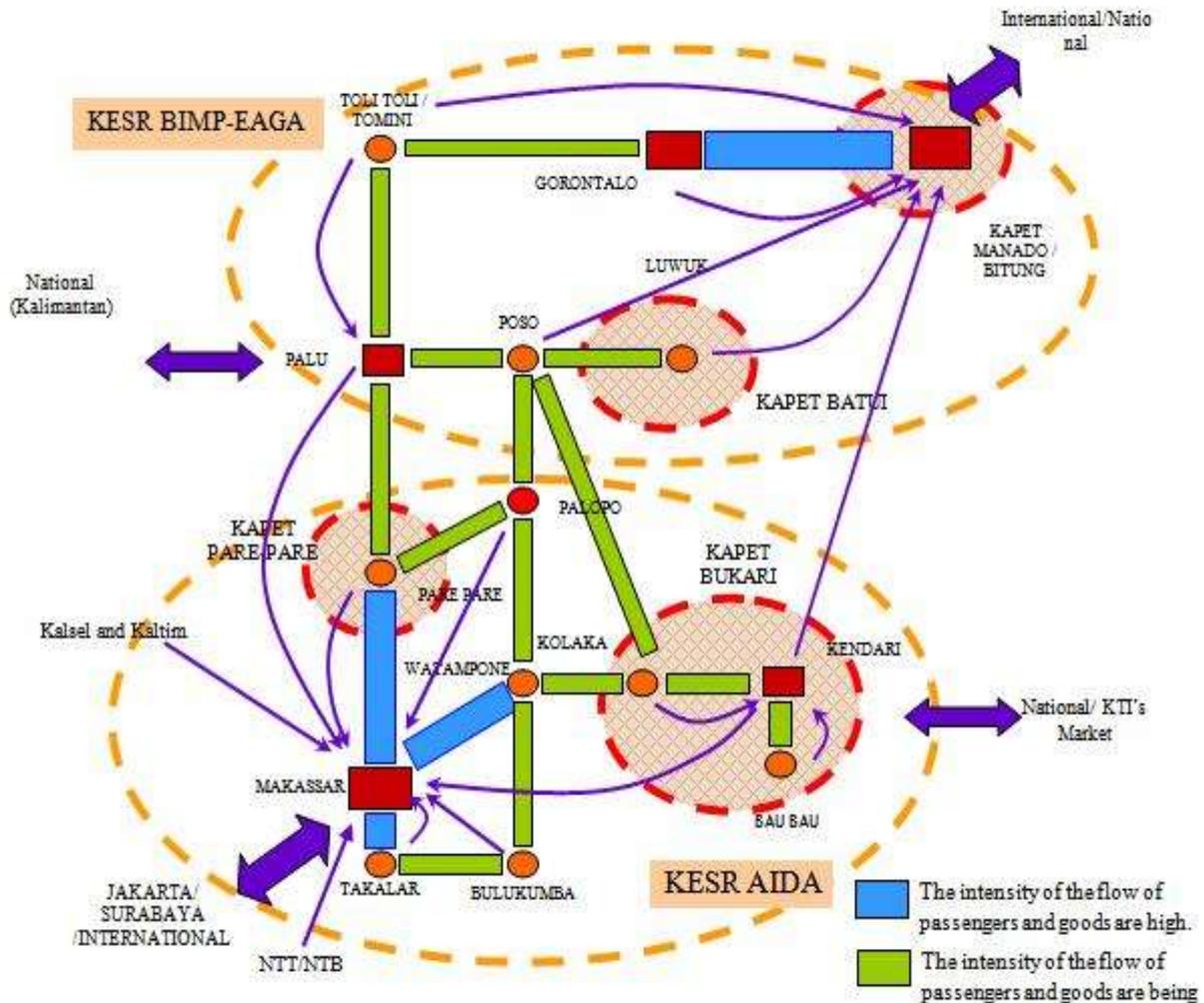


Figure 2. Linkage Cities (National and Regional Activity Center) and Passenger Flow Patterns and Goods

Activities to serve the region's economy and public mobility in Sulawesi Island, the strategy to set up in the Space Plan of Sulawesi Island to the development of land transport network system, consisting of the development of the road network, railway network, river and Ferry transport:

- Development of road network Trans-Sulawesi, both across East, West and Central and *Collector's Roads*.
- Development of Sulawesi integration transport systems with national and sub-regional ASEAN (BIMP-EAGA), as well as KESR AIDA.
- Development of railway Sulawesi Island and station nodes in the cities of National and Regional activity Center.

Marine transport network development strategy [4,7,8] is to optimize the utilization of IASL II lines that cross the Sulawesi Sea and the Makassar Strait, and IASL III across the Pacific Ocean, the Maluku Sea, Seram Sea and the Banda Sea to the Indian Ocean, to develop inter-island sea transport networks and inter-countries through the port in Makassar, Bitung, Pantoloan, Kendari, Bau-Bau and Anggrek.

Based on the data flow of container over a period of last five 5 for container transshipment ports in each province are as follows:

a. South Sulawesi and West Sulawesi Province

The flow of goods in the economic activity in the Area of Attention Investment (AoAI) of Makassar, Maros and Gowa are economically or lower costs when transshipment in Makassar port in comparison to Pare-pare port because of the distance and a faster time. Similarly, the flow of goods in the economic activity in the Area of Attention Investment of Pare-pare, Wajo and economically Luwu is lower when the port of transshipment in Pare-pare port. The flow of goods in the economic activity in Attention Investment of Mamuju, Mamasa and Palipi that use containers can be transshipped through ports in the port of Pare-Pare in South Sulawesi, because the port of Mamuju is not yet available for container unloading.

b. Southeast Sulawesi and Central

The flow of goods in the economic activity in Area of Attention Investment of Kendari, Kolaka and North Konawe through transshipment ports in Kendari port. The Area of Attention Investment Economic of Toli-toli and Buol are more economical when through transshipment in Toli-toli port and for economic activities in the Area of Attention Investment, Palu, Morowali, Parigi, Tojo Una-Una, Banggai, Sigi, Donggala and Poso more economical when through transshipment port Pantoloan in Palu.

c. Gorontalo and North Province

The flow of goods in the economic activity in the Area of Attention Investment (AoAI) of Pahuwato, North Gorontalo, Boalemo and Gorontalo will be economical when through transshipment port of Gorontalo in the city of Gorontalo, and the economic activity in the Area of Attention Investment of Manado, Bitung and North Minahasa would be more economical if through transshipment port in the city of Bitung.

IV. RESULT AND DISCUSSION

1. Road Network for the Area of Attention Investments (AoAI) to Port

a. South Sulawesi and West Province

Traffic level of service on area roads for AoAI of Maros to Makassar port will decrease level C to D from 2015 to 2019 and to F in 2025 and 2030. To maintain the level of service at a rate of up to 2025 C to 2030, the road capacity needs to be increased from the current capacity of 2402 into 3782 and 5307. While on the road Attention Investment of Region Gowa to the port of Makassar service levels decreased from C to F in 2015 to 2030. To maintain the level of service in 2015 and 2030 the capacity of the road needs to be improved in a row into 2148; 2817; 4217 and 5930. Unlike the Attention Investment Region roads Luwu, and Pare - Pare Wajo through transshipment port in Pare - pare the level of service in 2015 and in 2019 the level of A and B levels in 2025 and 2030, so do not need an increase in road capacity.

b. North Sulawesi and Gorontalo Province

Traffic on roads connecting the AoAI of Region Manado, Bitung and North Minahasa to the port of Bitung to have this level of service will decline from the 2015 level D, to F in 2020, and 2030. To maintain the level of service at the level of D, and 2030 is needed road capacity respectively 3,383; 5222, and 6398. Connecting traffic of the AoAI of Region Pahuwato, North Gorontalo and Boalemo to port, will decrease the level of service of the rod C at 2015 to 2025 level D and level E in 2030. To maintain the level of service C is needed road capacity improvement respectively in 1277; 1392 and 1462.

c. Central Sulawesi and South East Province

The results of the calculation of traffic on the roads that connect the area Toli-Toli's AoAI and Buol Toli-toli harbor indicate the level of service at a rate of up to 2015 2030 so do not need the addition of road capacity. Similarly, traffic on roads that connect Attention Investment Region Palu, Morowali, Parigi, Tojo Una-Una, Banggai, Sigi, Donggala and Poso, Palu Pantoloan port to the level of service (LOS) between B and C from 2015 to the year 2030 so it is not necessary capacity expansion. The results of the calculation of traffic on the roads that connect the Attention Investment Region Kendari, Kolaka and North Konawe Kendari port to indicate the level of service at the level of B and C from 2015 till 2030 so that at this period, yet it need the increase in road capacity.

1. Connectivity and integration

The nodes of connectivity that connects to the Attention Investment Region (AIR) in each province on Sulawesi economic corridors with transshipment port in the province.

Connectivity performance depends on the capacity of the transport network facilities and other supporting infrastructure, the travel time between nodes AIR with the port as a transshipment node, indicator of connectivity can be approached connectivity between nodes as follows:

Province	Transshipment Port	Location of AIR	Travel Time Between Nodes
South Sulawesi	Makassar	Makassar	Excellent
		Maros	
		Gowa	
	Pare-pare	Pare-pare	Good
		Wajo	
Luwu			
North Sulawesi	Bitung	Bitung	Good
		Manado	
		Minahasa Utara	

Gorontalo	Gorontalo	Gorontalo	Good
		Pahuwato	
		Gorbet	
		Boalemo	
Central Sulawesi	Pantoloan	Palu	Good/Fair
		Morowali	
		Tojo Una-Una	
		Banggai	
		Sigi	
		Donggala	
	Toli-Toli	Toli-Toli	Good/Fair
		Buol	
South East Sulawesi	Kendari	Kendari	Fair
		Kolaka	
		Konawe Utara	
West Sulawesi	Belang-belang	Mamuju	Fair
		Mamasa	
		Majene	

The integration of network services and transport infrastructure in Sulawesi Island are already manifested, among others, at the terminal nodes, ports and airports. The overall, the value integration to network infrastructure and services is still poor, still need improvement in order to achieve a good category to support the development of other sectors.

The value of the transport network indicates that the island of Sulawesi, South Sulawesi Province, North West and showed relatively good value, following the Central Sulawesi, South East Sulawesi, and Gorontalo has a low value (minimum adequacy). These reflections show that the required increase in the level of integration to achieve better integration of transport.

The integration between the network infrastructure of roads and air transport has the highest value very well. This is due to the road network; especially the airport serves as the center spread of the primary arteries. For network service shows that the integration of goods between modes with the highest score is the mode of transportation and road crossings, road and sea following is considered good. This condition is possible, because some of the ports served by the system of loading and unloading containers.

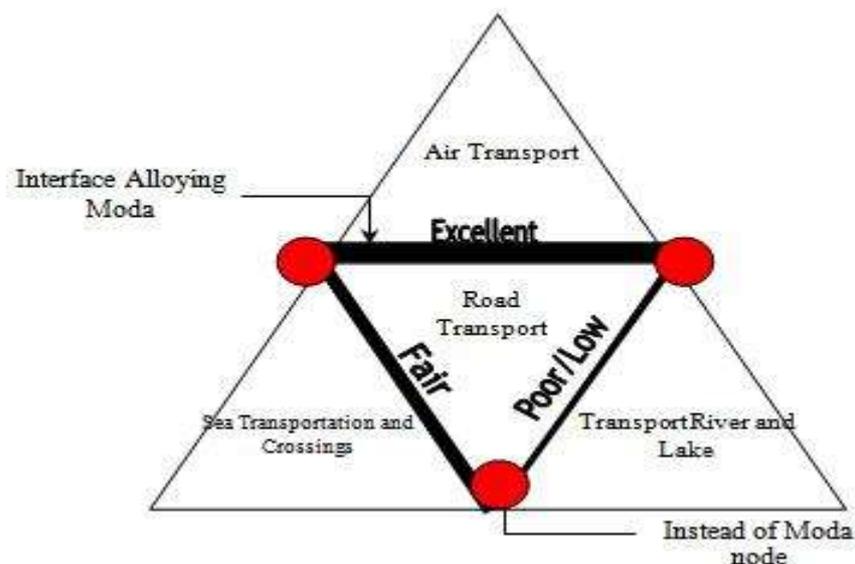


Figure 3. The integration of "Interface" Transport Modes Road with Other Modes [6,7,8]

The other ports are already developing technology to reduce the cost of container shed and yard with a system that is losing truck. The development of transport infrastructure and multi-modal container, integrated or integrated with technology development of container transport is influenced by several factors including: i)

change the spatial/space planning assesibilitas effect on sea transportation networks and land, development of transport demand in the hinterland, as well as system load over the network and terminals, ii) organizational system affect the scheduling of multimodal, hinterland transportation, logistics systems and administrative systems as well as consolidation and intermodal transportation keterpaduannya; iii) technology affect productivity improvement tool loading/unloading, container handling facilities, terminal efficiency and implications for the computerized system and inter and intermodal facilities.

1. Network Development Strategy

Conditions of service and transport infrastructure Network are varities, causing the performance of transport and the level of integration varies. Low coherence in the provision of services will transport activity correlated with the performance of transport, see Figure 4 databases must address satisfying relationships and integration of transport networks. Therefore, the integration between the transport sub-sector and inter-modal transportation between regions (Sulawesi island level, provincial, district and city) sought to be improved and expanded transportation system in realizing the island of Sulawesi effective, efficient and sustainable.

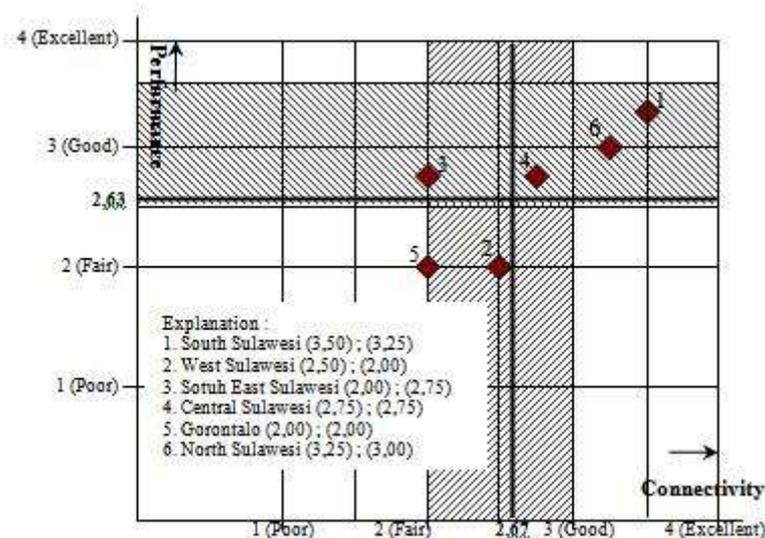


Figure 4. The relationship between performance and Transport Network Connectivity

To improve, develop transportation systems integration and implementation of a reliable transport service required criteria formulation of a comprehensive policy and strategy and dynamic. The criteria is the availability of infrastructure and transportation facilities, and operational performance that can be measured from the value above and below average performance and availability of infrastructure and transportation facilities Sulawesi.

Policy strategies related to transportation as a support function, that's open isolated and reach remote areas, can be expressed as follows:

- Opened access isolated areas, remote and disadvantaged areas to encourage increased local production and addressing regional disparities.
- Connecting relatively underdeveloped inland regions to the center of trade and government services are more advanced.
- Increasing functional linkages between production areas with the central collection and distribution, between the ports along the coast, between developing regions and less developed regions, thereby encouraging harmony between regions and reduce regional disparities, as well as transportation services that support the effective and efficient.
- Develop a priority settlements contained in the area/region lagging.

V. CONCLUSIONS

Connectivity between Port Transhipment with node Attention Investment Region (AIR) is generally excellent and good, despite an increase in traffic flow in the period ahead. The need for container terminal development of transport infrastructure is urgent because of the tendency of an increase in the loading and unloading of containers on the node/port transhipment growth is quite high. Investment and economic activity increases the demand for infrastructure development as well as the tendency of container flow diversion from the conventional transport system to system container. The integration of intermodal transport is generally still less/low, the limited number of fleet in service nodes inter/intra mode is still limited and the network

infrastructure and services between regions and connect the other so on. Necessary adjustments road network (geometric and road carrying capacity) that can be passed by a trailer/container freight to support the load reaches 15-18 ton payload with container size of 20 feet and 30 tons 40 feet from and to node Investment Region transshipment Attention.

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