SOCIAL ACTIVITY AND ADAPTIVE URBAN NETWORK IN STRATEGIC AREAS IN INDONESIA

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Abstract
Indonesia has endorsed spatial planning law and introduced “strategic areas” to promote development in lagging region. One of the regency that has strategic values (areas) is Sambas regency. This paper attempts to explore the “overlap” interaction in the perspective of the network between strategic areas. As a part of an ongoing study, we explore the resident social activity movement and the medium to support it (road) by applying urban network analysis. From findings, there are two different main orientations on each strategic area. Based on the orientation, it is necessary to improve "the potency" of interaction among strategic areas by increasing their interaction and create multiple choices (plans) and allowing partial transfer to other areas. A direct interaction between strategic areas is the best solutions. However, as one of the considerations, the connection to other areas (in-between the strategic areas) can be also applied to provide and share benefits to certain areas.
Keywords: Social, Adaptive, Urban, Network, Sambas.

1. INTRODUCTION

Strategic Areas in West Kalimantan, Indonesia

In response to the more increasing urban problems, Indonesia has attempted to develop the spatial planning framework. The strategy and policy within the national spatial plan are divided into two “forms” of plans: (1) spatial structure and (2) spatial pattern. Inside a spatial structure, recognize strategic areas. Strategic areas are assigned based upon the national importance and priorities (e.g. security, economic development, etc.). Besides, the term of strategic areas is also used in urban hierarchy system, river basin, and national strategic areas. As for the urban hierarchy system, several areas are promoted to be “national strategic activity center”; defined as an urban area assigned to foster the development in a number of national border areas. So far, there are 26 national strategic activity centers (borderlands)

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distributed across Indonesia, and 5 of them located in West Kalimantan. Another "translation" plan to promote the border areas is national tourism strategic area, organized under national tourism plan. To execute the development plan of the tourism sector in Indonesia, the Ministry of Culture and Tourism has set 88 National Tourism Strategic Areas as the development priorities, and two of them located in West Kalimantan. What is interesting from both regencies is that each of regencies (Kapuas Hulu and Sambas) is the border regency bounded directly with Sarawak-Malaysia. If seen from these conditions; the closeness of location and the attraction of national tourism strategic areas actually can be a "magnet" for the tourists/visitors from Malaysia and Brunei Darussalam (in particular), if all the infrastructures and facilities are well prepared.

Problems, Issues, and Network Logic

In view of its location and consideration in the past development that are more concerns in "security" matters, it leads to the untouched welfare development within the border areas. Today, most of the borders areas in Indonesia have still becoming the lagging areas with the limited social facilities and economic infrastructure if compared to a number of opposite countries. For this, border areas often have a low accessibility and isolated, so the residents prefer to interact with their neighboring country (Malaysia) rather than the city nearby from Indonesia side. One of the strategic regency in West Kalimantan is Sambas regency, which have a tourism strategic area in Sambas district and national strategic activity center (borderland) in Paloh district. General speaking, as a strategic region, infrastructure condition and accessibility in Sambas regency are still oriented to the areas along the main corridor that connects the main economic attractiveness (province capital city). These areas become the areas with high connectivity as well as its economic potential (e.g. Selakau, Pemangkat, Tebas, and Sambas). However, most of the "advance-connected" areas are still unable to push surrounding areas (e.g. border areas) to be more advance, if seen from the "profile" gap on the regency (e.g. population density, facilities, infrastructure, business units, etc.)

Seeing by its current condition, the interaction between the two strategic areas seems to be unbalanced. As a "growth machine" for the surrounding, these two areas should be able to interact with both, balanced, and has an equal distribution in accordance with the specifications of each area. Therefore, one of the concepts that can be used to analyze is by seeing the interaction. Due to its interaction, the approach that can be used is network approach. The network concept is based upon relationships between entities such as organization or people (Scott, et al. 2008). This approach is based on the relationship between entities and searches for the structure of the relationship. Related to urban development/planning, the principles of network analysis applied in the form of urban network.

Urban network describes the networks of a city, and it has three principle criteria, including (1) topological, (2) kinetic criterion, and (3) adaptive criterion (inside Wandl et al., 2012), as well the types of it such as (1) technical, (2) transactional, and (3) socio-socio technical (Heydebrand, 1999).

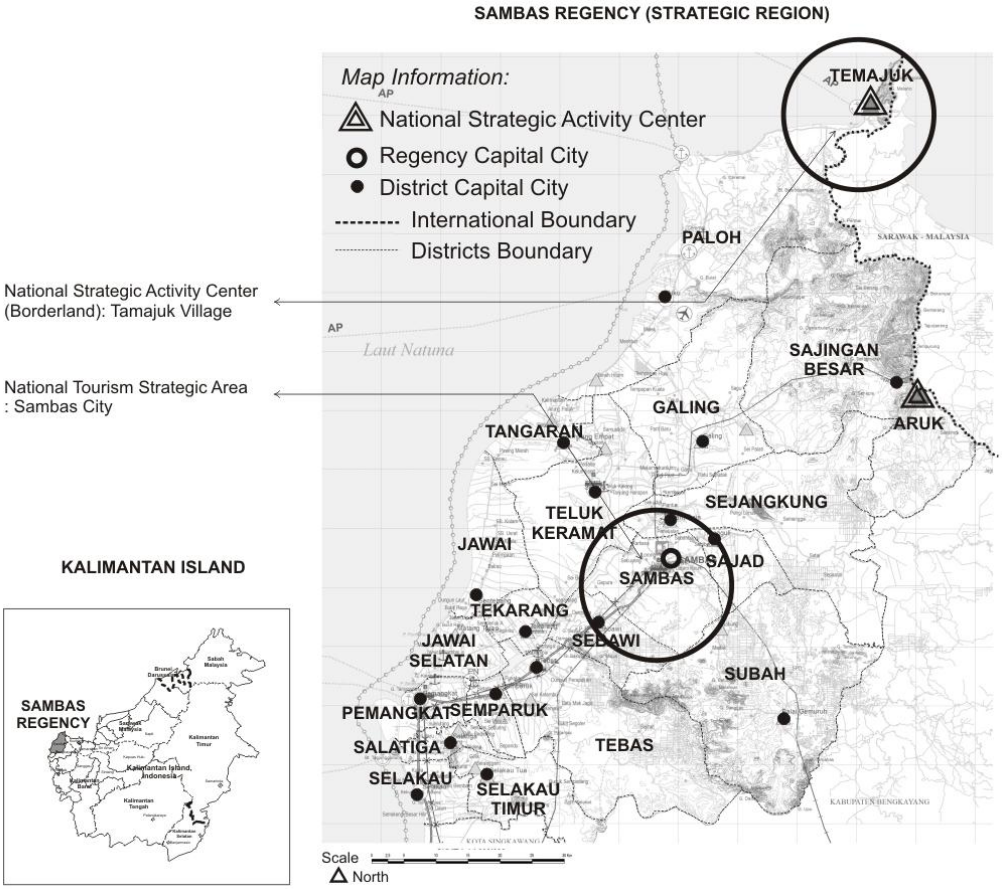

FIGURE 1 - SAMBAS REGENCY AND STRATEGIC AREAS
Source: Map modified from Draft of Sambas Spatial Plan, 2012

This study attempts to explore the condition and character of the existing (urban) network. As a part of an ongoing study, we only focus on the resident "social" network (resident activity movement) and one the channel/medium to support it (road). Both indicators are included as urban network types. Then afterwards, based on the existing condition and the movement trend, we try to identify the new links configuration (adaptive criterion) in "technical" aspect (road) so that each strategic area (tourism strategic area and borderland) has a better "social and technical" interaction and has a new configuration without undermining the previous networks.

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2. SNAPSHOTS OF CONCEPT

Urban Network Analysis

Theoretically, a network primarily goes back to the 1950s when Social Network Analysis (SNA) was developed (Rutherford, 2007). Then, since the technological revolution in the 1970s, the network as a metaphor has become popular (Clarke, 2009). Generally, the network concept is based on a relationship between entities such as organization or people (Scott, et al. 2008). The properties of the network studied by researchers are related to the structure of these relationships. According to Knoke & Yang (2008), the underlying assumption of network is the perspective emphasized on structure relations, while Scott (2013) said it is about relation. The central idea in (social) network analyses is the development of the branch of mathematics, called graph theory (Carrington & Scott, 2012). Compiled from Scott et al. (2008) and Pavlovich (2003), network analysis is characterized into several contents, such as transactional, direction, structural, centrality, density, degree, and structural optimization. For the analysis concept or method, taken from Borgatti et al. (2013), social network can be analysed through centrality, subgroups, equivalence, two mode, large network and ego networks.

The central idea in social network (analysis) according to Knoke & Yang (2008) is the methodology to identifying, measuring, and testing the hypothesis about the structural forms and substantive contents of relation among actors. According to Takashi & Sakamoto (2000), most traditional assessment of social relationship has been mainly concerned with a person's single relationship such as a mother, friend, spouse, or with a person's social competence in general. Besides, they also propose another type of relationship such as intimate relationship (trust, love, and close-relationship), "rating" of relationship, and psychological functional (proximity, emotional, etc.). Social relationship is characterized at least by the mutual orientation of the action of each to that of the others (Mucha, 2003). Besides, it is also the concept of individual social action. Relation can occur between individual and individual, group and group, or between an individual and a group.

Network analysis is not a discipline confined to only one branch of academia or industry (Phillips & Diaz, 1981). Described as "metaphor", sometimes, network comes in, goes out of sociological fashion and is employed in some "incompatible ways" (Erickson, 2012), the use of metaphors in network is probably inevitable and enhances an understanding of social experience. Furthermore, Heydebrand (1999) described three different types of network in getting more understanding about network metaphor, those are (1) technical network (telephone, internet), (2) transactional networks (transportation, trade), and (3) social and socio-technical networks.

Associated with (urban) planning, adopting from Castell, Beaureagrd (in Albrechts & Mandelbaum, 2005) mentioned that a network consists of a set of components in the city (urban space), linked to each other to achieve one or more common purposes. The story of network (in planning) can begin back in the late of nine-tenth and early twentieth century's when urban professional began to conceive of the city analytically rather than holistically. An urban space may consist of several series of (network) system (e.g. water supply, sewage disposal, housing, transportation, or telecommunication). Noted by Beaureagrd, in doing so, they disaggregate the city into a series of system: waters supply, sewage disposal, housing, or transportation. Then, it is continued by the contemporary version of this "perspective" turned into networks; about the system of city, and linked externally to other city/system. Cited from several Authors (Dupuy, Caso, Drewe), Wandl et al. (2012) put forward that in its modern meaning, urban network is characterized by three principle criteria, such as (1) topological, (2) kinetic, and (3) adaptive. Topological criterion refers to the geometrical or physical configuration of a network, the way in which nodes of a network are physically connected. Kinetic criterion refers to the movement and communication between nodes, translated in speed and relationship between space and time. Adaptive criterion, meanwhile, is the capacity of the network to evolve over time and space. The network should be able to modify its own structure of nodes and links. It should be adapted to various changes and changing needs and desire of it users.

3. METHOD

To explore urban networks in strategic areas, we performed network analysis which based on urban network types and criterions. To classify data types and develop it into a research guide (e.g. interview guide, questionnaires questions, etc.), we use definition about "network" data in accordance with Knoke & Yang (2008); Scott (2013); and Borgatti, Everett, & Johnson (2013). Compiled from them, data collection in network analysis always comprises about (1) connection/connectivity, (2) relation/relationship, and (3) flow. To explore social activity movement; we develop some information regarding resident relationship to their social activity movement with family and friends as well as their daily and frequent movement or travelling. The social activity movement comprises of resident daily activities location, family visits, work, travelling to city/border area, and frequent daily routes. To obtain the data, we performed survey method by exploring the resident social activity movement. To determine the sample size, this study adopted Krejcie & Morgan (1970) method in determining the sample based on the population distribution in both strategic areas. In the exploration of social activity movement in Sambas district, 381 respondents had returned the questionnaires. From all the responses on "movement" indicators and questions, it formed 1,721 units of relationship connection. In Temajuk/Paloh

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district, 316 questionnaires were filled out with a total connection of "movement" indicators as 2,578 connections.

In relation to the network analysis, the urban types (e.g. technical, transactional, and social) are attempted to conform to the basic network analysis tools. The adjustment has been made by identifying the basic network analysis and their development (Table 1). There are several types of network analysis (tools) can be used in accordance with different Authors/Researchers specialties (e. g. Scott, 2013; Borgatti, Everett & Johnson, 2013; Hanneman & Riddle in Scott & Carrington, 2012; Knoke & Yang, 2008; Carrington, Scott, & Wasserman, 2005; and Wasserman & Faust, 1994). However, this study uses the general principles contained inside each of the network analysis approaches, such as degree, centrality, sub-graph/clique, and role-position (structural equivalence/block modeling and holes).

TABLE 1 - URBAN NETWORK CRITERION, TYPES AND ANALYSIS

Urban Criterion & Definition		Urban Types	Basic Analysis Tools
Topological	The geometrical or physical configuration of a network, the way in which nodes of a network are physically connected	1. Technical/infrastructure: road, public transportation, airport, seaports, water supply, energy, telecommunication, etc. 2. Transactional/business activity: main transaction, cooperation, branches, customer, etc. 3. Social activity: distribution, movement, social contact, etc.	1. Centrality 2. Subgroup 3. Equivalence
Kinetic	Referring to movement and communication between nodes, which translated in speed, relationship between space and time		
Adaptive	The capacity of a network to evolve, network should be able to modify its own structure of nodes and links based on needs and desires		

Source: Compiled from Several Sources

This study will use two stages/steps of network analyses. In the first stage, the social activity movement was analyzed. For social activity movement, it will only be focused only on the analysis of out/in degree and distribution (initiated/received ties). This is because there are only two main areas (Sambas and Temajuk/Paloh) which became the data sources. On this matter, if the analysis carried out by the principle of another measurement (e.g. centrality, sub-graph, etc.) then the result is likely to be centered on those two main areas, because of its dominance. However, this is does not apply to the (technical) infrastructure network, because the data of infrastructure network used covers all areas, so there is no domination of the data source. The results obtained in stage 1 are the findings of existing social activity movement and infrastructure network (road) in strategic areas. From the results in stage 1, the analysis of adaptive criteria made through the development of (new) alternative networks (multiple choice), scenarios, and modifications or re-calculate. The "modifications" are based on the existing network

conditions (available nodes), issues, needs, and desires (e.g. border area development and the increase connection between strategic areas), applied in infrastructure network. Adaptive criterion is applied only to the infrastructure network, in this case we use road network as the medium of movement. This is because the infrastructure network is a physical element and become a medium for social activities. Besides, the infrastructures or utilities play a key role in promoting the increasing polarized, fragmentary, and undemocratic cities, which are managed to service the needs (Marvin & Graham, 1993). For the measurements (indicators), we used 9 measurements for the nodes exploration, such as (1) outdegree; (2) indegree; (3) farness; (4) closeness; (5) betweenness; (6) eigenvector; (7) level of hierarchy in clique; (8) effective; (9) efficient, and 1 measurement for the groups/blocks exploration by performed blockmodelling (CONCOR). From the results obtained in stage 2, each of network alternatives (new networks) is compared respectively to see the changes and impacts. For the measurement and calculation, we use UCINET version 6.587. Calculation method and references can be found at http://www.analytictech.com/ucinet/help/webhelp.html.

4. RESULT AND DISCUSSION

Social Activity Movement in Strategic Areas

The type of data analyzed focuses on the "movement" from residents in Sambas district and Temajuk/Paloh district. The distribution covers their regular/frequent daily activity, family visit, work location, travelling to other areas outside Sambas, travelling to border area, and their frequent route of travelling. In Sambas, based on the distribution of the data (Table 2), the southern part of Sambas (oriented in Pontianak; province capital city) seems to be the main orientation to residents' social activity movement (in-degree). Meanwhile inside Sambas regency, there are Tebas and Pemangkat which have a significant score compared to other areas. Interestingly, Sarawak-Malaysia also becomes one of the main orientations as the score is high enough. For Temajuk/Paloh, the "movement" part in Temajuk/Paloh also covers resident regular/frequent daily activity, family visit, work location, travelling to other areas outside Temajuk/Paloh, travelling to neighboring country, and their frequent route of travelling. Based on the distribution data (Table 2), Sarawak as their nearest neighbor becomes the main orientation (in-degree) from resident in borderland (Paloh district). This can happen because the closeness between areas, compare to other areas in Sambas regency. Other area with a significant score is Jawai. Jawai is the main location where family and friend are distributed. Other nearest areas such as Teluk Keramat and Sambas also have a higher score compared to other areas.

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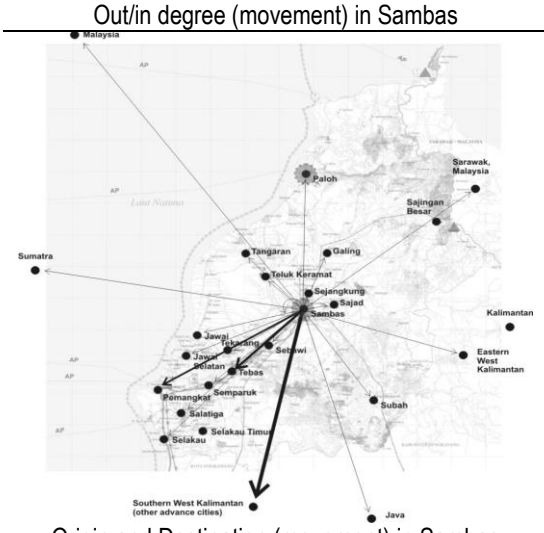
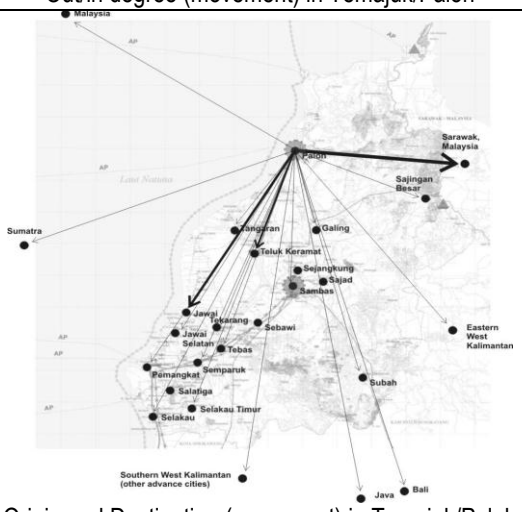
TABLE 2 - MOVEMENT AND ORIENTATION IN STRATEGIC AREAS

Tourism Strategic Area (Sambas)			National Strategic Activity Center/ Borderland (Temajuk/Paloh)		
	1 OutDegree	2 InDegree		1 OutDegree	2 InDegree
12 Sambas	961.000	0.000	8 Paloh	993.000	0.000
1 Eastern West Kalimantan	0.000	25.000	2 Eastern West Kalimantan	0.000	8.000
2 Galing	0.000	15.000	1 Bali	0.000	1.000
4 Jawai	0.000	21.000	4 Java	0.000	4.000
5 Jawai Selatan	0.000	1.000	5 Jawai	0.000	117.000
3 Java	0.000	3.000	6 Jawai Selatan	0.000	1.000
7 Paloh	0.000	31.000	7 Malaysia	0.000	4.000
8 Pemangkat	0.000	97.000	3 Galing	0.000	3.000
9 Sajad	0.000	8.000	9 Pemangkat	0.000	11.000
10 Sajingan Besar	0.000	8.000	10 Sajingan Besar	0.000	1.000
11 Salatiga	0.000	1.000	11 Sambas	0.000	81.000
6 Malaysia	0.000	6.000	12 Sarawak	0.000	584.000
13 Sarawak	0.000	47.000	13 Selakau	0.000	3.000
14 Sebawi	0.000	18.000	14 Selakau Timur	0.000	5.000
15 Sejangkung	0.000	31.000	15 Semparuk	0.000	2.000
16 Selakau	0.000	8.000	16 Southern West Kalimantan	0.000	36.000
17 Semparuk	0.000	5.000	17 Subah	0.000	4.000
18 Southern West Kalimantan	0.000	465.000	18 Sumatra	0.000	22.000
19 Subah	0.000	23.000	19 Tangaran	0.000	8.000
20 Sumatra	0.000	1.000	20 Tebas	0.000	12.000
21 Tangaran	0.000	10.000	21 Tekarang	0.000	4.000
22 Tebas	0.000	98.000	22 Teluk Keramat	0.000	82.000
23 Tekarang	0.000	4.000			
24 Teluk Keramat	0.000	35.000			
Out/in degree (movement) in Sambas			Out/in degree (movement) in Temajuk/Paloh		



Origin and Destination (movement) in Sambas



Origin and Destination (movement) in Temajuk/Paloh

Source: Analysis, 2016

A Medium of Movement (Road) in Strategic Areas

Totally, the road in Sambas is 696,633 km in length (in 2013). Furthermore, the management and control of road are divided into several responsibilities, such as national, province, regency, village, and national strategic. Most of the responsibilities are under villages and regency level (38% and 39%) while the other includes national strategic, national, and province. As a strategic areas (designated as national strategic activity center), the road status in border districts in Sambas (Paloh and Sajingan Besar) is mostly included as national strategic (e.g. Sambas-Temajuk) where the financing can be supported by several levels of government (national, province, regency), particularly central government. However, recorded in 2013, as much as 49% of road condition was still categorized as damage condition. In general, the road network that connects other cities/regencies to Sambas will end/centralize in Sambas district (as the regency's capital city). By its location in the middle of the

region, Sambas district is expected to have a role as the center of distribution of movement and activities to other districts and villages. Moreover, with its position as a regional activity center (in spatial plan) that serves and connects activities between regencies, Sambas district becomes the focal point of the region with several connections (Figure 2)

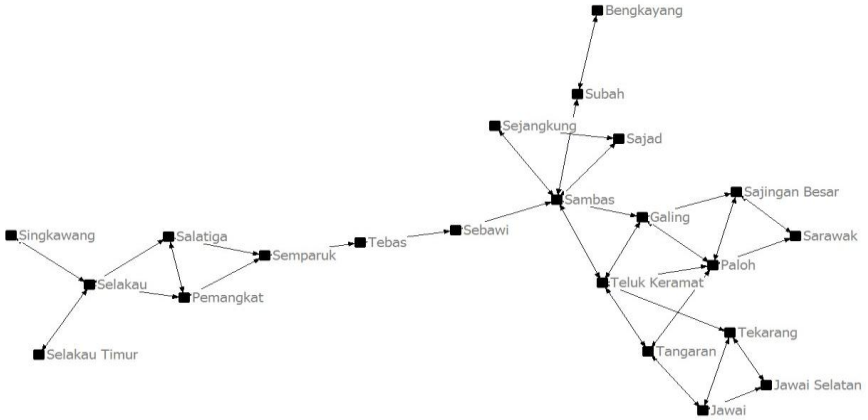


FIGURE 2 - ROAD NETWORK (GRAPH) IN SAMBAS REGENCY
Source: Analysis, 2016

By several network measurements/indicators (e.g. in/out degree, centrality, clique, etc.) that have been done, network characteristic in the movement medium (road) can be described as follows:

TABLE 3 - NETWORK MEASUREMENT

Area	Existing Road Network								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Selakau	4	4	107	19.	18.	0	1	3.5	0.8
Selakau Timur	1	1	127	16.	0	0.	0	1	1
Pemangkat	3	3	92	22.	12.	0.	2	1.6	0.5
Semparuk	3	3	79	26.	38.	1.	0.4	2.3	0.7
Salatiga	3	3	92	22.	12.	0.	2	1.6	0.5
Tebas	2	2	69	30.	42.	4.	0	2	1
Tekarang	3	3	77	27.	11.	26.	1	2.3	0.7
Sambas	**6**	**6**	**55**	**38.**	**68.**	**50.**	**1**	**5.3**	**0.8**
Subah	2	2	73	28.	9.	14.	0	2	1
Sebawi	2	2	61	34.	46.	14.	0	2	1
Sajad	2	2	74	28.	0	18.	1	1	0.5
Jawai	3	3	91	23.	1.	21.	1	2.3	0.7
Jawai Selatan	2	2	95	22.	0	12.	1	1	0.5
Teluk Keramat	5	5	61	34.	33.	63.	2	3.8	0.7
Galing	4	4	64	32.	14.	57.	2	2.5	0.3
Tangaran	3	3	75	28.	5.	39.	0.8	2.3	0.7
Sejangkung	2	2	74	28.	0	18.	1	1	0.5
Sajingan Besar	3	3	79	26.	2.	39.	1	1.6	0.5
Paloh	**5**	**5**	**74**	**28.**	**8.**	**61.**	**2**	**3.4**	**0.6**
Bengkayang	1	1	93	22.	0	3.	0	1	1
Singkawang	1	1	127	16.	0	0.	0	1	1
Sarawak	2	2	93	22.	0	27.	1	1	0.5

Note: (1) OutDegree; (2) InDegree; (3) Farness; (4) Closeness; (5) Betweenness; (6) Eigenvector; (7) Level of hierarchy in clique; (8) Effective; (9): Efficient

Source: Analysis, 2016

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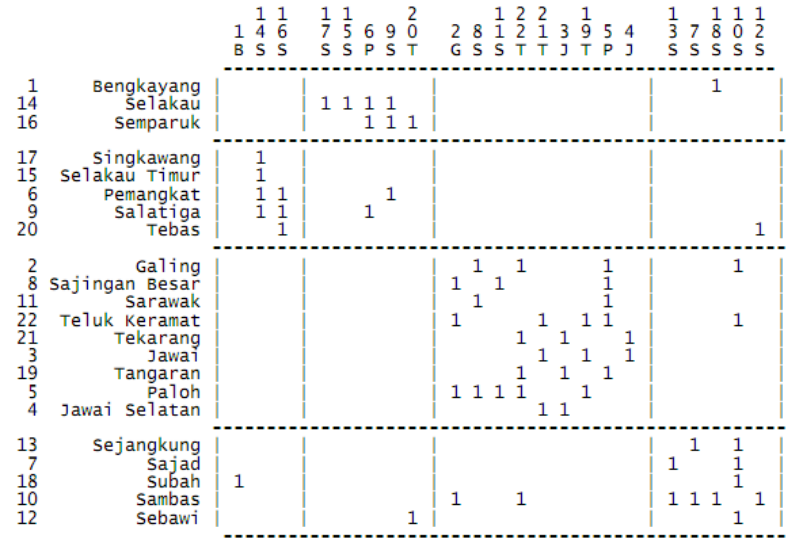

Density Matrix

	1	2	3	4
1	0.000	0.467	0.000	0.067
2	0.467	0.100	0.000	0.040
3	0.000	0.000	0.389	0.044
4	0.067	0.040	0.044	0.500

FIGURE 3 - BLOCKS (USING CONCOR) IN ROAD NETWORK
Source: Analysis, 2016

From the table above (Table 3) it can be seen, that generally, Sambas district as a tourism strategic area and the capital city of the regency mostly have the highest score in all indicators (green color = the highest score; red color = the lowest score). The highest score distribution can be seen from the degree indicator (no. 1 and 2), closeness indicator (no. 3 and 4), betweenness (no. 5), as well as the effectiveness of Sambas in interacting with other areas (no. 8). While Paloh as border area, included as the central area (eigenvector) and the most active area in interacting with other areas (indicator no. 6 and 7). From the block density score (Figure 3); Sambas and Paloh are located in different blocks, Sambas in block 4 and Temajuk/Paloh in block 3. However, there is interaction between both blocks with score of 0.044 (less than the average mean) and linked weakly (density matrix mean is 0.139).

From the existing condition, the distance between Sambas with Temajuk/Paloh at least has "two-steps" which have to pass a minimum of 1 area and 2 segments of roads to reach Sambas (Figure 2) such as Paloh – Galing - Sambas; Paloh - Teluk Keramat - Sambas, etc. Moreover, the condition of network is seems to be concentrated in Sambas district and its southern part. As the social activity movement (Table 2), there are two main orientations from both strategic areas. The residents in Temajuk/Paloh (border area) tend to move to the neighboring country (Sarawak-Malaysia), while the residents in Sambas (tourism area and capital city) are more oriented to areas in the southern part of Sambas, in which several “developed areas” are located such as Singkawang, Mempawah, and Pontianak as the

province's capital city. Therefore, it seems necessary to have an effort to organize the "meeting point" between the two orientations by giving more "closeness" and increased their connectivity as well as provides multiple choice routes that are expected to facilitate more convenient access, flow, interaction, and opportunities between both "strategic" areas. In addition, the existing routes can be expanded with other alternative routes in order to allow a better movement, access, and support.

Adaptive Urban Network in Strategic Areas

As the existing condition above, the distance between Sambas (code H) with Temajuk/Paloh (code S) at least has "two-steps" which have to pass a minimum of 1 area and 2 segments of roads to reach Sambas. For that, by providing more "closeness" options; with the assumption that can provide a better alternative flow and direction, the network modification and multiple choices can be done by calculating the new direction/options and compare it with each other.

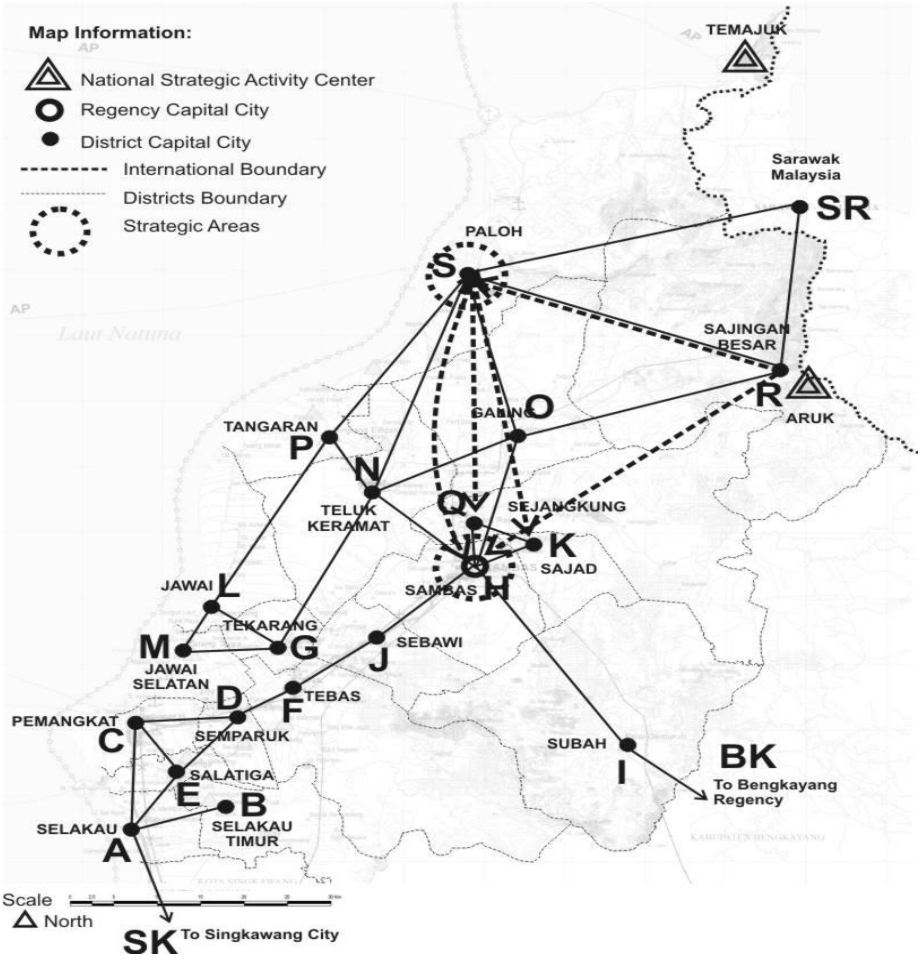

FIGURE 4 - PROPOSED/ALTERNATIVE NETWORKS AND AREA CODES FOR ROAD NETWORK
Source: Map modified from Sambas Spatial Plan, 2012

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TABLE 4. EXISTING NETWORK, CHANGES, AND IMPACT IN ROAD NETWORK

CODE	AREA GROUP	pN1 (S-H)									pN2 (S-Q-H)									pN3 (S-K-H)								
		1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
A	Main routes/ developed areas	=	=	-	+	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
C		=	=	-	+	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
F		=	=	-	+	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
H		+	+	-	+	=	+	=	+	=	=	=	=	=	-	+	=	=	=	=	=	=	=	-	-	=	=	=
N		=	=	=	=	-	-	=	-	-	=	=	=	=	-	-	=	-	=	=	=	=	=	-	-	=	=	=
I	Far-end areas	=	=	-	+	=	+	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
M		=	=	=	=	=	-	=	=	=	=	=	=	=	=	-	=	=	=	=	=	=	=	=	-	=	=	=
O	Border and surrounding	=	=	=	=	-	-	-	-	+	=	=	=	+	-	-	=	=	+	=	=	=	=	-	-	=	=	+
R		=	=	=	=	-	-	+	=	=	=	=	-	=	-	-	+	=	=	=	=	-	=	-	-	+	=	=
S		+	+	-	+	+	+	=	+	=	+	+	-	+	+	+	=	+	+	+	+	-	+	+	+	=	+	+

CODE	AREA GROUP	pN4 (S-R-H)								
		1	2	3	4	5	6	7	8	9
A	Main routes/ developed areas	=	=	-	+	=	=	=	=	=
C		=	=	-	+	=	=	=	=	=
F		=	=	-	+	=	=	=	=	=
H		+	+	-	+	+	+	+	+	=
N		=	=	=	=	-	-	=	=	=
I	Far-end areas	=	=	-	+	=	+	=	=	=
M		=	=	=	=	=	-	=	=	=
O	Border and surrounding	=	=	=	=	-	-	=	+	+
R		+	+	-	+	+	+	+	+	+
S		=	=	=	=	-	-	=	=	=

Note: (1) OutDegree; (2) InDegree; (3) Farness; (4) Closeness; (5) Betweenness; (6) Eigenvector; (7) Level of hierarchy in clique; (8) Effective; (9): Efficient; pN = Proposed Network

(+) Score increase (for farness it means the accessibility is decrease); (-) Score decrease; (=) Score constant

Source: Analysis, 2016

From this experiment, it can provide an overview of the connection options and the benefits/shortages which resulted, developed from existing conditions. From the existing network, there are at least 4 alternative (available) routes or proposed network between Paloh (S) and Sambas (H) (Figure 4). The alternative routes are: (1) Paloh directly to Sambas or S-H, (2) Paloh – Sejangkung - Sambas or S-Q-H, (3) Paloh – Sajad – Sambas or S-K-H, and (4) Paloh – Sajingan Besar – Sambas or S-R-H. The connections concept and area codes are illustrated in the following figure (Figure 4).

From the existing and 4 alternative routes, the score comparison (by nodes and by blocks) is described in the table below (Table 4 & Table 5).

After each area is compared, further analysis was performed by minimizing the areas and focusing on strategic areas; H and S. In addition, several “local activity centers”, which are areas with the major development function in Sambas regency (area A, C, F, and N) and other group, such as far-end (area I and M) and border and surrounding (area O, R, and S) were also observed (Figure 4 & Table 4). The comparison between those areas is to see the impact from the new/alternative network to other areas; in this case, several areas above are as the representation.

TABLE 5 - EXISTING BLOCK, CHANGES, AND IMPACT IN ROAD NETWORK

Existing Network & Density Matrix

Block	1	2	3	4
1	0.000	0.467	0.000	0.067
2	0.467	0.100	0.000	0.040
3	0.000	0.000	0.389	**0.044**
4	0.067	0.040	**0.044**	**0.500**

- **H** in block 4; **S** in block 3
- $\overline{X}$ = **0.139**
- H in block 4 send ties to S in block 3 and vice versa (linked weakly)

pN1 (S-H)

Block	1	2	3	4
1	=	+	=	-
2	+	=	+	-
3	=	+	-	+
4	-	-	+	+

Density Matrix

	1	2	3	4
1	0.000	0.700	0.000	0.000
2	0.700	0.100	0.018	0.000
3	0.000	0.018	0.291	0.068
4	0.000	0.000	0.068	0.667

- **H** in block 3; **S** in block 3
- $\overline{X}$ = **0.164**
- H and S inside the same block (linked strongly)

pN2 (S-Q-H)

Block	1	2	3	4
1	=	=	=	-
2	=	=	=	-
3	=	=	+	+
4	-	-	+	-

Density Matrix

	1	2	3	4
1	0.000	0.467	0.000	0.037
2	0.467	0.100	0.000	0.022
3	0.000	0.000	0.500	0.156
4	0.037	0.022	0.156	0.278

- **H** in block 4; **S** in block 3
- $\overline{X}$ = **0.140**
- H in block 4 send ties to S in block 3 and vice versa (linked strongly)

pN3 (S-K-H)

Block	1	2	3	4
1	=	=	=	-
2	=	=	=	-
3	=	=	+	+
4	-	-	+	-

Density Matrix

	1	2	3	4
1	0.000	0.467	0.000	0.037
2	0.467	0.100	0.000	0.022
3	0.000	0.000	0.500	0.156
4	0.037	0.022	0.156	0.278

- **H** in block 4; **S** in block 3
- $\overline{X}$ = **0.140**
- H in block 4 send ties to S in block 3 and vice versa (linked strongly)

pN4 (S-R-H)

Block	1	2	3	4
1	=	-	=	-
2	+	=	+	-
3	=	+	-	+
4	-	+	+	-

Density Matrix

	1	2	3	4
1	0.000	0.700	0.000	0.000
2	0.700	0.100	0.022	0.000
3	0.000	0.022	0.306	0.111
4	0.000	0.000	0.111	0.400

- **H** in block 3; **S** in block 4
- $\overline{X}$ = **0.154**
- H in block 3 send ties to S in block 4 (linked weakly)

Note: (+) Score increase; (-) Score decrease; (=) Score constant
Source: Analysis, 2016

From the result above (Table 4), each of the alternative networks provides diverse results. If the entire indicators are compared, pN1 have 11 score reduction, and pN2-pN3 have 9 score reduction (-), while pN4 have 7 score reduction especially in the "centrality" measurement. On the other hand, pN4 is apparently is safe with only 7 reduction scores in certain areas, compared with other. However, in pN4, the increasing score mainly occurs in R, not in S. For the increased score (+), it can be seen that pN4 has to go through a lot of increasing scores (28). However, in pN4 only R and O are mainly having an increased score, while S is constant and tend to decrease. Other than pN4, it seems pN2 have the highest increased score in S (border) and the surrounding. While in pN1, it also influences other areas at the main routes.

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Another consideration in evaluating the existing network and the modifications is the formation of blocks in each alternative plans (Table 5). From the block configuration, it can be seen that H and S mainly remain inside block 4 or block 3 both in the existing network and the modifications. Only in pN1, they included at the same block. The main score reduction in the block interaction can be seen in pN4 which has 6 score reductions in the 6 blocks, while other networks (pN1, pN2, pN3) have the same size of score reductions for their block interaction (in 5 blocks). However, pN1 also has the highest total score which increases (in 7 blocks). Seen from the increased score of interaction, H and S in their respective blocks have mainly increased score compared to the existing. However, pN1 have the "valued score" compared to the other, it have successfully makes H and S included at the same block (classes), which is means they have interact or send ties directly inside the same group or block, not separate.

TABLE 7 - SCORE RANK IN ROAD NETWORK

Options	Reduction		Increment		Block Interaction	
	Amount	Rank	Amount	Rank	Linked	Rank
pN1 (S-H)	11	**3**	24	**2**	Strongly (0.291)	**1**
pN2 (S-Q-H)	9	**2**	13	**3**	Strongly (0.156)	**2**
pN3 (S-K-H)	9	**2**	11	**4**	Strongly (0.156)	**2**
pN4 (S-R-H)	7	**1**	28	**1**	Weakly (0.111)	**3**

Source: Analysis, 2016

Judging from the overall comparison, pN4 seems to have the optimum score among the others (in score reduction/increment). However, in pN4 the "benefits" mostly distributed not to S. Other than that, pN1 with a direct connection between H and S became as the "second" grade/rank in score increment. In pN1, the benefits (score increment) also influence several areas in far-end areas and near border, as well as in pN2. In addition, in pN1, H and S have a good interaction inside the same block and linked strongly without separation. Through this indicator (blocks), it has shown that pN1 become as the most valued option; the two areas (H and S) are connected directly in one group/block amongst other groups within the overall network.

5. CONCLUSIONS

From discussions above, several notes can be concluded as follows:

1. There are two different orientations on each study areas: H (Sambas) and S (Paloh). Residents' activities in the border area (S) tend to be oriented to the neighboring countries (Sarawak-Malaysia). While in tourism strategic areas as well as regency capital city (H) tend to be oriented to the southern part where most of the advanced areas are located.

2. Based on the orientation, it is necessary to improve "the potency" of interaction among strategic areas by “adaptive approach”, which provides multiple choices (from the available nodes) and allowing partial transfer to other areas, as well as by considering the flow or transfer from other areas (developed area). By increasing the interaction, it makes the possibility of “closeness” between areas to interact and provide alternatives of activity centers which more equal in terms of the magnitude of their external linkages (adopted from Burger et al., 2013)

3. A significant score transformation (change) which provide an optimum interaction between strategic areas occurs mostly in the direct interaction between strategic areas (e.g. area H to area S). However, as one of the considerations, the connection to other areas (in-between the strategic areas) can be also applied to provide and share benefits to certain areas.

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