



INTISARI

Dilewati 40% jalur perdagangan laut global memberikan kesempatan Indonesia untuk menjadi poros maritim dunia. Sayangnya, kesempatan tersebut tidak didukung infrastruktur pelabuhan yang memadai. Oleh karena itu, rekayasa sistem melalui perancangan kebijakan strategis perlu dilakukan guna meningkatkan kemampuan pelayanan pelabuhan. Karakterisasi jaringan pergerakan komoditas antar pelabuhan perlu dilakukan guna memberikan gambaran kondisi sistem maritim Indonesia. Pemahaman karakter jaringan merupakan langkah awal sebelum melakukan perancangan kebijakan maritim strategis terkait.

Node jaringan diwakili oleh pelabuhan, sedangkan *edges* merupakan pergerakan komoditas antar pelabuhan. Data yang digunakan merupakan pendekatan dari survei ATTN yang dilakukan Badan Penelitian dan Pengembangan Perhubungan (Balitbanghub). Komoditas yang dipertimbangkan terbatas pada beras, minyak goreng, dan gula. Pengambilan data dilakukan menggunakan teknik *data scripping* untuk memperoleh *node list* dan *edge list*.

Gephi digunakan untuk visualisasi jaringan pada komoditas beras, minyak goreng, dan gula. Identifikasi properti lokal dan global pada jaringan dilakukan menggunakan Jupyter Notebook. Properti lokal yang diidentifikasi antara lain, *node degree*, *degree centrality*, dan *betweenness centrality*. Properti global yang diperhitungkan antara lain *number of nodes*, *number of edge*, *density*, *average path length*, dan *average clustering coefficient*. Penambahan bobot dengan menyertakan atribut volume aliran komoditas dan jarak antar pelabuhan dilakukan untuk menggambarkan kompleksitas jaringan dunia nyata. Karakter jaringan *small world* diidentifikasi dengan membandingkan *average path length* dan *average clustering coefficient* terhadap jaringan *random* yang memiliki ukuran jaringan sama. Melalui perbandingan tersebut, terindikasi pergerakan komoditas memiliki karakteristik jaringan *small world*. Grafik *degree distribution* dibuat untuk mengidentifikasi fenomena *scale free*. Berdasarkan grafik tersebut tidak terdapat karakteristik jaringan *scale free* pada seluruh jaringan pergerakan komoditas.

Kata kunci : Jaringan Maritim, Pergerakan Komoditas, Sistem Kompleks, *Small-World*



ABSTRACT

Passed by 40% of global trade routes, Indonesia has the opportunity to become the world's maritime axis. Unfortunately, this opportunity is not supported with adequate port infrastructure. In order to improve the service capabilities of Indonesian ports, it is imperative to revolutionize the maritime system through strategic policy design. The characterization of inter-port networks describing the flow of commodities is needed to provide an overview of Indonesia's maritime system. Understanding the character of a network is a preliminary step before undertaking the design of strategic maritime policies.

Network nodes are represented by ports, while edges visualise the flow of commodities between ports. The data used is from the ATTN survey conducted by the Transportation Development and Research Agency (Balitbanghub). Commodities are limited to rice, cooking oil, and sugar. Data scripping techniques were used to extract node lists and edge lists from the ATTN official site.

Gephi was used for the visualization of commodity networks, while the identification of the local and global properties of the networks were performed using Jupyter Notebook. The local properties identified consisted of node degree, degree centrality, and betweenness centrality. The global properties on the other hand, are composed of the number of nodes, number of edges, density, average path length, and average clustering coefficient. The volume and distance of commodity flows were included on the local and global properties to illustrate the complexities of real-world networks. The small world network is identified by comparing the average path length and average clustering coefficient with random networks of the same size. These comparisons indicate that all the commodity flow networks have the characteristics of a small world network. The degree distribution graph is used to identify scale free phenomenon. Based on the graph, none of the commodity flow networks have scale free characteristics.

Keywords : Commodity Flow, Complex System, Maritime Network, Small-World