

The Transport Networks in Pre-colonial Northwest Borneo: A Historical Perspective

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Abstract: The transport networks of pre-colonial Northwest Borneo, here understood as the territories of present-day Brunei, Sarawak, and Sabah, are examined in terms of their general conditions. The region had a long history of political dynamics, a thriving economy, and active commercial ventures. Drawing on archival records, travelers' accounts, and secondary literature through a qualitative historical method, the study analyzes the nature, capacity, form, and function of the transport systems that served this trade. Two systems operated in the pre-colonial period. Waterways were the primary means of communication because of the riverine and coastal landscape, while overland transport was used mainly where water transport was limited. Differences in the shape and functionality of both systems reflected the region's geo-environmental conditions: swamps and dense forest restricted road development, whereas rivers, ports, and the South China Sea supported inland and maritime trade. The findings provide a foundation for understanding the later evolution of modern transportation in Northwest Borneo.

Abstrak: Jaringan transportasi di Borneo Barat Laut pada masa pra-kolonial, yang di sini dipahami sebagai wilayah Brunei, Sarawak, dan Sabah masa kini, dikaji berdasarkan kondisi umumnya. Kawasan ini memiliki sejarah panjang dinamika politik, ekonomi yang berkembang, dan kegiatan perdagangan yang aktif. Dengan memanfaatkan arsip, catatan perjalanan, dan literatur sekunder melalui metode sejarah kualitatif, penelitian ini menganalisis sifat, kapasitas, bentuk, dan fungsi sistem transportasi yang melayani perdagangan tersebut. Dua sistem beroperasi pada masa pra-kolonial. Jalur air menjadi sarana komunikasi utama karena lanskap sungai dan pesisir, sedangkan transportasi darat digunakan terutama di tempat yang tidak terjangkau transportasi air. Perbedaan bentuk dan fungsi kedua sistem itu mencerminkan kondisi geo-lingkungan kawasan: rawa dan hutan lebat membatasi pembangunan jalan, sementara sungai, pelabuhan, dan Laut Cina Selatan menopang perdagangan pedalaman dan maritim. Temuan ini menjadi landasan untuk memahami perkembangan transportasi modern di Borneo Barat Laut.

INTRODUCTION

The transport networks of pre-colonial Northwest Borneo were shaped by the interaction between a demanding physical environment and long-established commercial activity. This paper reviews the general conditions of those networks and examines their nature and characteristics. It argues that the region developed two distinct transport systems, water transport and overland transport, and that both evolved alongside its economic and commercial growth.

Northwest Borneo faces the South China Sea and is crossed by large rivers. Its coastlands are dominated by swamp and mangrove, and its interior by dense rainforest. These conditions made rivers and the sea the natural highways of the region (Cleary & Eaton, 1992; Reid, 1988, 1993). The region also had a long commercial history. Maritime trade linked Borneo to China, the Malay world, and the wider archipelago from early times, and the sultanate of Brunei later became its principal political and commercial center (Hall, 1985; Saunders, 2002; Wang, 1958). Forest products moved down the rivers to coastal ports, where they were exchanged for ceramics, cloth, and metal goods (Ooi, 1997; Reid, 1988). Transport was therefore



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driven by trade, and its forms, capacities, and routes responded to both geography and commerce.

Water transport was the chief means of communication. Indigenous peoples used canoes, rafts, and other river craft to move people and goods between inland settlements and the coast, while larger vessels served coastal and overseas trade (Sandin, 1967; Sather, 1997). Numerous ports along the South China Sea coast connected the interior with maritime networks (Saunders, 2002). Overland transport was a secondary system. Because swamps and thick forest made road building difficult, and because political and administrative authority was concentrated along coasts and riverbanks, land routes remained limited to jungle tracks used mainly on foot, connecting the interior to the river systems (Hose & McDougall, 1912; Pringle, 1970).

The transport systems of this period were largely indigenous in origin. Over time they were influenced by Malay and Chinese traders, who brought new commercial practices and, in some cases, new craft and routes (Chew, 1990; Wang, 1958). Before the colonial period the region saw few technological changes, and the modernization of transport came late. It was transformed first by Brooke rule in Sarawak and later by the chartered company in North Borneo (Baring-Gould & Bampfylde, 1909; Black, 1983; Tregonning, 1965).

Comparative work on Java offers a useful frame, although it concerns a later and more developed colonial setting. Studies of road transportation, land use, and the Semarang-Joana steam tram show how transport routes were tied to commercial and administrative priorities (cf. Hartatik et al., 2022, 2024). Research on plantation agriculture and on the Mangkunegaran sugar industry shows how enterprises and their supporting infrastructure were shaped by changing forms of political authority (cf. Wasino & Hartatik, 2017; Wasino et al., 2019). In Northwest Borneo such processes belong largely to the colonial period, which this paper treats only as a point of contrast.

Studies of the region have concentrated on political history, trade, and colonial rule, and transport has rarely been treated as a subject in its own right. This paper addresses that gap by bringing the scattered evidence on waterways and land routes together within a single framework, as a background for studying the development of the modern transport system.

METHODS

This study uses a qualitative historical method based on primary and secondary sources. The pri-

mary sources are published and unpublished archival records, including government and public documents, administrative reports, and the accounts of travelers and officials (for example, Brooke, 1866; Low, 1848; Mundy, 1848; St. John, 1862). These were collected from [name the archives and libraries actually consulted].

Because such sources were written mostly by outsiders with commercial or political interests, they were evaluated through external criticism (authenticity, date, and authorship) and internal criticism (the author's position, purpose, and reliability). Claims were compared across independent sources before being accepted, and the findings were placed within the wider historiography of Borneo and maritime Southeast Asia (Andaya & Andaya, 2015; Reid, 1988). Historical accounts are shaped by the selection and arrangement of evidence, which calls for caution in reading narrative sources.

Secondary sources, including printed and online books and journal articles, supplied context and were used to interpret and cross-check the evidence. The analysis is descriptive and thematic, organized around water transport and overland transport. Studies of transport and infrastructure in Java were consulted only for comparative framing (Hartatik et al., 2022, 2024; Wasino & Hartatik, 2017; Wasino et al., 2019). Limitations include the scarcity of indigenous written records, the uneven coverage of the interior in colonial-era accounts, and the difficulty of dating practices described only in nineteenth-century sources.

RESULTS AND DISCUSSION

Geographical Setting

The natural environment, physical geography, and abundant natural resources of Northwest Borneo have influenced transport development. As a part of Northwest Borneo, Sabah possessed a diverse topography consisting of mountain ranges and an extensive river system. The Crocker Range, known as the backbone of Sabah, stretches approximately 30 km from the south end of Marudu Bay to the west coast, shaping topography significantly. Coastal plains and mangrove forests characterise Sabah's physiography, creating a diverse and unique landscape (Kaur, 1994, pp. 2-3). The river system in Sabah can be categorised into three main groups based on their flow into the sea. The first group includes the long east coast rivers running from the interior into the Sulu Sea. The second has short west coast rivers that flow into the South China Sea, and the third group, comprising the small streams of the

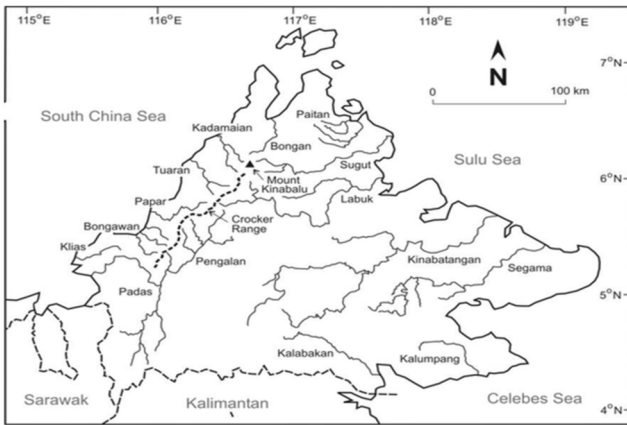


Figure 1. Major Rivers in Sabah (Source: Ng, et al. 2017)

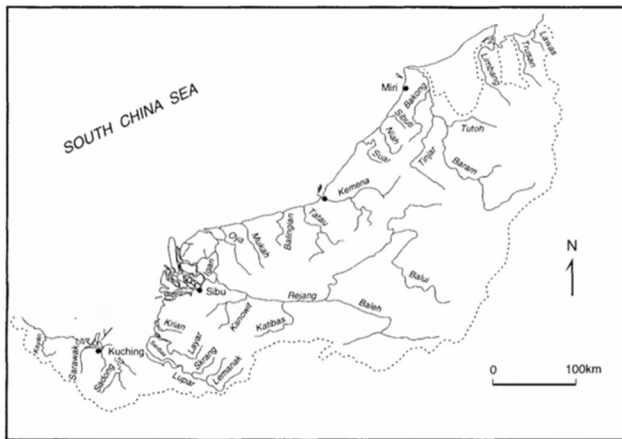


Figure 2. Major Rivers in Sarawak (Source: Kaur 1993, 85)

southeast coast, drains into the Celebes Sea. These rivers serve as essential waterways, cutting through densely forested areas, particularly in the eastern and central parts of the region. Major rivers such as the Kinabatangan, Segama, Sugut, Paitan, and Labuk, along with their tributaries like the Papar, the Padas, the Kalabakang, and Serundong, facilitate transportation networks in the region (Kaur, 1994, pp. 3-4).

The topography of Sarawak is categorised into three main types (The Official Portal of Sarawak Government, Kaur, 1995, p. 68): (i) coastal plains consisting of peat and mangrove, as well as narrow deltaic and alluvial plains; (ii) a large inland hilly area with numerous hills reaching heights of about 300 meters; (iii) mountain highlands that stretch to the Kalimantan border, featuring undulating mountains from 762 meters (2,500 feet) to 2,119 meters (4,000 feet) in height.

There are two major river systems in the region with multiple tributaries: the larger rivers originate from the mountain ranges along the Sarawak-Kalimantan border, while the shorter but mature coastal rivers traverse the mid-Sarawak plains (Kaur, 1995, p. 68). The main river in the area is the Rajang, the longest river, which flows from the Iran Mountain range to Kapit,

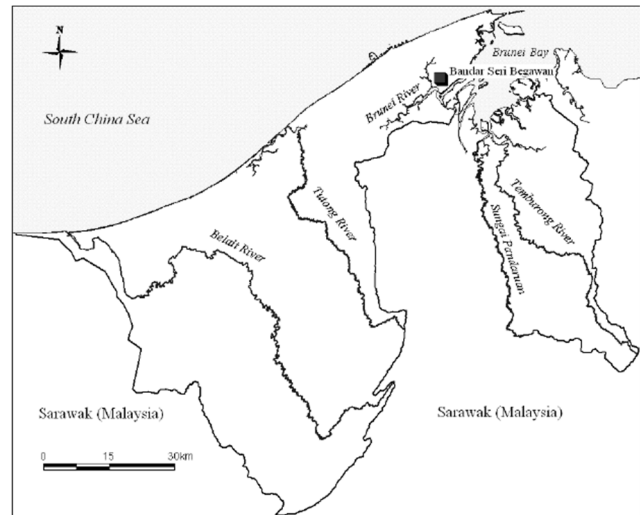


Figure 3. Major Rivers of Brunei (Source: Bac-Bronowicz & Becek, 2009)

taking a westward turn to complete its 563-kilometer journey to the South China Sea. Other significant rivers in Sarawak include the Baram and Sarawak Rivers and notable tributaries like the Balui River, Katibas River, Iran River, and Balleh River (the Official Portal of Sarawak Government).

Brunei occupies a small part of Northwest Borneo, characterised by a flat coastal plain that changes into mountainous terrain in the east and hilly, undulating lowlands in the west. The majority of land is covered by Borneo lowland rainforests, with approximately 161 kilometres of coastal areas facing the South China Sea. These coastal regions include undulating lands and swampy, alluvial plains. The Brunei River system is predominantly fed by four main rivers: the Belait River, the Brunei River, the Temburong River, and the Tutong River, as documented by Bac-Bronowicz and Becek in 2009.

In pre-colonial Northwest Borneo, the geographical features mainly influenced transportation and communication within the region. People usually moved everywhere by the river and established their own inhabitants and trading centres on the banks of the river. Sometimes, they communicated with undulating hilly tracks or narrower, dense jungle paths. In the colonial period, the British rulers modified this landscape by deforestation, flattening hills, and rock drilling to facilitate the construction of modern roads and railways. These infrastructure projects aimed to enhance the region's connectivity and transportation networks.

Waterway

River

In Northwest Borneo, the rivers served as the main trade route, connecting the highlands deep within the region to estuaries and ports. These waterways were crucial for commerce and served as the primary means of communication, drinking water, and a natural drainage system (Kaur, 1994). Hugh Low, secretary to James Brooke, observed the lack of established paths in the flat and swampy regions of the island. He noted that all communication among the people, even those residing far inland, relied on boats (Low, 1848).

During his visit to Brunei (Borneo Proper) in 1775, John Jesse, an official of the British East India Company, made detailed observations about the region. He emphasised various aspects of Brunei's navigation system in his communication to the Board of Directors as: (i) the River of Borneo is navigable, far above the Town, for Ships of a very considerable burthen; and the only difficulty lies at the mouth of it, where the Channel is very narrow, for about a quarter of a mile in length, through which there is not above 17 feet at high water, however the bottom is soft mud, and the place so completely landlocked, there never can be any Surf, and consequently a ship taking the ground, attended with no bad consequences (Quoted in Dalrymple, 1808, p. 7); (ii) as a riverine region, Sabah had a flourishing waterway within its territory. A mountain range divided Sabah in a southwest-northeast direction, resulting in shorter rivers in the west than those in the east. The eastern rivers, which are longer, provided navigable waterways into the inland areas of Borneo throughout the year. Before the British colonial period, Chinese traders sought various goods such as edible birds' nests, camphor, rattans, resin, and other jungle products of Borneo Island. They accessed the interior regions via rivers like Labuk, Sugut, Kinabatangan, and Segama (Kaur, 1994, p. 9). Most significant villages were strategically located along these rivers, and sovereign chieftaincies' governance structures were centred around river estuaries. The early European travellers utterly depended on these rivers to penetrate the island's interior, underscoring the significance of navigable waterways as an influential component in Sabah's social and economic development.

In Sarawak, rivers played a central role in facilitating internal trade and communication, primarily transporting goods and providing distribution feeder services. During the mid-nineteenth century, a significant portion of Sarawak's inhabitants resided along riverbanks, relying on boats and

rafts to journey upriver (Kaur, 1998, pp. 75, 95). The Sarawak River system was also remarkable with its extensive network of tributaries and distributaries. The Rajang River, a major regional waterway, offered navigability for marine vessels up to 130 km to Sibu and an additional 160 km into the otherwise hard-to-reach interior using shallow-draft boats like sampans. The Rajang Delta encompassed approximately 4,200 square kilometres and featured a coastline stretching 97 kilometres, as documented by Green (1909, p. 4). The other significant rivers, like the Sarawak, Batang Lupar, Baram, and Limbang, are linked to the Rajang River system. Additionally, the branches of the Rajang River provided shorter waterways between the mouth and Sibu Port. While the river network overall enhanced mobility, some parts of the network were troublesome and time-consuming. (Kaur, 1998, p. 77).

River transport served as an alternative to sea vessels carrying goods inland. Coastal ships initially transported commodities to the river ports, from where these goods were conveyed between different river systems and major trading ports. Typically, products were transferred via sailing craft, poling boats, or rafts, then transported upriver to smaller villages. The inland villages were local trade centres and markets for essential goods like salt, fish, rice, and forest products such as damar, rattan, gutta-percha, and bamboo (Kaur, 1998, pp. 75, 93). This complex network of rivers facilitated the distribution and exchange of goods, contributing to economic activities in the region.

Ports and Maritime Trade

During the fourteenth century, many Southeast Asian ports developed rapidly, and their trading activities and revenue income also increased significantly. One of the most critical maritime trade centres during this period was the Malay-speaking Sri Vijaya. Among other ports, Samudra-Pasai in northern Sumatra, Melaka on the Malay Peninsula, Brunei in Northwest Borneo, Cebu in the Philippines, and Makassar in Sulawesi were remarkable for their significant contributions to trade and commerce (Reid, 1988; Hall, 2011; Henley & Nordholt, 2015).

According to Rodrick Ptak, there were two routes through which inter-Asian trade, particularly the connectivity of spice islands, was facilitated. The first route, known as the 'Java route' involved sea vessels traversing from the Malayan peninsula or western Indonesia to the Java and Flores Seas. These vessels would then make their way to the ports of

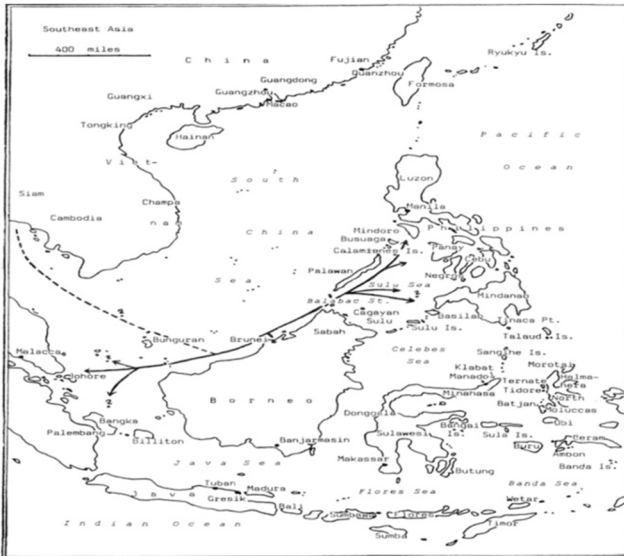


Figure 4. Trade along the Brunei route in the 15th and 16th Century (Source: Ptak (1992), p. 40.)

northern Java, southern Borneo, Sulawesi, and the eastern islands of Madura and Bali, ultimately reaching the prominent trading hubs of Ternate or Tidore in the North Moluccas. Alternatively, ships possibly followed the 'Borneo route,' where they journeyed past Vietnam, Cambodia, Thailand, or the Malayan peninsula, crossing the South China Sea until they reached the coast of Borneo. From there, they would travel along this coast in a north-easterly direction, stopping at the port of Brunei before entering the Sulu Sea via the Balabac Strait (Ptak, 1992). In the eastern archipelago, Malay traders based in Brunei, Sulu, and other regions wielded influence over the regional and Chinese trade to the Spice Islands (Hall, 2011).

Brunei, with its expansive hinterland and seafaring populations, played a significant role as a key trade junction in the South China Sea, and it was well-prepared to facilitate international trade. The Chinese traders regularly sailed to Brunei to operate their commercial activities between the northern Philippine Islands and the Sulu archipelago (Andaya & Andaya, 2015, p. 110; Henley & Nordholt, 2015). In historical Chinese records, Brunei was referred to as P'o-ni. Chau Ju Kua, a Chinese traveller from the twelfth and thirteenth centuries, documented that camphor was sourced from P'o-ni (Brunei) and also from Pin-su (Hirth & Rockhill, 1911, pp.193-4; Jane, 1989, p. 67). This region was renowned for its camphor trees and resin collection, making it a significant camphor source according to Chinese accounts (Hirth & Rockhill, 1911; Jane, 1989; Nicholl, 1980). Even in modern times, Bornean camphor retained its reputation for superior quality and was exported through Brunei. Eda Green (1909, p. 7) mentioned

that camphor, the most valuable export commodity on Borneo Island, was known as hard camphor and was purchased by the Chinese for as much as fifty times the price of ordinary camphor. The Brunei coast of Borneo was also important for the Chinese traders due to its abundant jungles, providing sought-after resources like bird's nests, camphor, and various gums and resins used in traditional Chinese medicine (Nicholl, 1983; Hall, 2011).

During the reign of Sultan Bolkiah, the fifth Sultan of Brunei, the empire exerted authority over the coastal regions of Northwest Borneo, encompassing present-day Brunei, Sarawak, and Sabah. Sultan Bolkiah expanded the empire to Seludong (present-day Manila), the Sulu Archipelago, and parts of the island of Mindanao (Nicholl, 1989; BAR, 1947). During this period, Sarawak held a distinct position among the Bruneian regions due to its active involvement in maritime trade. It established enduring trade relations with Chinese traders for centuries. Archaeological findings at Niah Caves in North Sarawak and Santubong on the Sarawak River provided evidence supporting these trade connections (Harrison, 1949; Kaur, 1998). Chinese traders engaged in commerce carrying ceramics, beads, gold, silver, and silk, exchanging these goods for local products such as camphor, rattans, resin, and bird's nests. When Raja Brooke established his control over Sarawak in 1841, these early trade ties were re-established, marking a shift in Sarawak's economy towards an international orientation with the participation of Chinese traders and European merchants (Kaur, 1998, p. 68). Sabah, another integral part of the Brunei Sultanate, played a significant role in coastal trade. Its strategic location in the Sulu Sea facilitated ocean trade, serving as a midpoint between various coastal areas. Trade routes during the northeast monsoon saw exchanges with China and Japan at harbours on the west coast, and the east coast dealt primarily with trade partners from China and Australia. The primary export commodity from Sabah was timber, contributing to its economic significance (Kaur, 1994). Like Chinese traders, Malay traders from Borneo Island actively participated in maritime trade activities, exerting influence on inter-island and archipelago trade. These traders settled in key coastal areas near strategic river estuaries, overseeing the major rivers and their tributaries. The Through establishing political control, they forged relationships with the indigenous people, particularly with collectors of forest products. This political control extended to imposing taxes, tolls, and receiving tribute payments (Hornaday, 1885; Kaur, 1998).

Just before the onset of the colonial period in the nineteenth century, the maritime trades in Northwest Borneo experienced significant growth, with the export of luxury forest products such as bezoar stones, hornbill beaks, camphor, and bird's nests reaching their zenith in the world market. Additionally, other forest products like rattans, firewood, *gutta-percha*, and bee's wax found their way into both regional and foreign markets. Chinese and Malay traders typically sourced these products from indigenous communities in hilly and forested areas, subsequently selling them in various markets (Mundy, 1848, p. 264; Kaur, 1998, p. 68). About Brunei's trade activities, John Leyden's observation in 1819 was that:

"Borneo Proper is one of the states which grows rice enough for its own consumption its camphor is the best in the world The trade between Borneo and the Chinese port Amoy is very considerable According to Foster there were seven junks at Borneo in 1775 and the return cargoes procured by the Chinese are chiefly camphor sea slug tortoise shell birds' nests dammar sandal wood rattans and various articles used in dyeing. The commodities procured at Malludu are nearly the same as at Borneo Proper (A Selection from Papers, 1846, p. X)."

Bornean Boats

In Northwest Borneo, various communities crafted and used many types of boats based on the specific navigational requirements of the rivers. For example, the *pakerangan*, a canoe-shaped boat about nine meters in length, equipped with a single square sail or paddle, was ideal for river and coastal voyages. The *gobangigubang*, a dug-out or hollowed log boat, was designed for river journeys. The *sapit*, with a keel, rudder, and a small cabin, was usually possessed by a chief or affluent individuals. The *dapang* featured a single or double bamboo-made outrigger boat. The *kompit* sported a boat designed with a vertical bow and stern (Rutter, 1922, pp. 316-17, 348-50). The *sampan* plied upriver near the rapids and the areas with favourable navigability, while bamboo rafts were commonly used in shallow draft conditions. These rafts were built with a double layer of bamboo secured with rattan or jungle fibres, measuring fifteen to twenty feet in length. A small platform accommodated the belongings, keeping them afloat as the raft was constantly immersed in water. Two men stood at opposite ends with long poles and controlled the direction as the current propelled the raft downriver (Rutter, 1922). For the Malays of Borneo Island,

the *prahu* was their preferred boat for fishing and trade, whereas the Chinese traders in the region used junks, or *tongkang* (Hornaday, 1885, p. 340).

Before the advent of the steamships, the junk, a Chinese prototype ship, was commonly employed for maritime trade across Southeast Asia. When the Portuguese first contacted Southeast Asian territories in 1509, they encountered a prevalent trading vessel known as the *junco*. In Malayan classical texts like the *Sejarah Melayu*, this trading ship was called *jong* (Reid, 1993; Stanley, 1874). Scholars have noted that while the *jong* shared similarities with the Chinese junk, it also exhibited distinct features characteristic of Southeast Asian shipbuilding techniques, thus setting it apart from its Chinese counterpart (Manguin, 1980; 1993).

During the medieval period, Chinese junk grew in popularity in the Indian Ocean, surpassing *dhow*, a traditional type of Asian ship. Over time, various Asian regions adopted the junk, incorporating it into their maritime practices and vessel designs. These Southeast Asian ships were typically large and had substantial carrying capacities. According to a Portuguese record, a Javanese fleet of some 60 *jong* sailed off Japara in 1512 to attack Melaka, all of which were over 200 tonnes burdened (Reid, 1993, p. 198). Anthony Reid considers the average weight of the *jong* to be around 350 to 500 tonnes, with some vessels even reaching up to a thousand tonnes and accommodating a thousand crew members for voyages (Reid, 1993; Dalrymple, 1808). In addition to these large vessels, smaller *jongs* under 100 tonnes were frequently used in coastal areas. Other multipurpose vessels like *balangs*, *lancings*, *kelulus*, and *penjajaps*, *penjajaps* served purposes of trade, transportation, and warfare (Reid, 1993, p. 198).

Ship Building

Malayan and local indigenous communities in Northwest Borneo were proficient in boat and ship building traditions. Occasionally, Chinese craftsmen also worked in manufacturing large vessels, such as junk, in the region. Northwest Borneo was renowned for its abundant source of the best quality timbers, which facilitated the development of the shipbuilding industry from early times.

John Jess, an official of the British East India Company, wrote a letter dated 20 July 1775 to the Court of Directors detailing his observations in Brunei (Borneo Proper). In this correspondence, he described the process of junk building as:

Having thus communicate what I know of the characteristics and Policy of the Bornean, it will

not be improper to observe, that from the plenty and goodness of the timbers found here, the Chinese have been induced to adopt the scheme of building Junks and have found it by experience turn out to advantage, although necessitated to bring the workmen, and many of the materials, from China. One of the burthen of 7000 Pencils (580 Tonnes) was built this year, of the following plan, two Noquedabs of Junks, and the Captain of the Chinese residing here, entered into a contract, whereby the latter, on the one part, agreed to provide the timber, and the former stipulated to bring the artificers and iron work from Amoy. The Keel was laid in the beginning of March, and the was launched the 28th of May. The entire cost and outfit amounting, as I have been informed by the contracting parties, to no more than 8500 Spanish Dollars, which, when allowing for the profits on their Congongs, is not more than 4250 Spanish Dollars (Dalrymple, 1808, p. 7).

Land Route

The land transport system in Northwest Borneo faced challenges in development due to difficult topographical conditions. Several factors contributed to these difficult conditions. Firstly, the presence of a consistently wet and swampy environment along riverbanks created obstacles to overland movement. Secondly, the dense tropical rainforest posed significant barriers to penetrating the interior areas. As a result, only a few paths and jungle tracks evolved in the region. Edwin Herbert Gomes (1911, p. 148), a Christian missionary in Borneo during the early twentieth century, described the situation as follows:

“When travelling has to be done on foot, one has to walk on a Dyak jungle path, which consists of the trunks of the giants of the forest placed in a line. No attempt is made to hew the round trunks into an even upper surface, so one must walk carefully lest he slip off; for in some parts the bark on these tree-trunks is rotten, and in others there is a growth of wet slippery moss. Over the jungle streams there are Dyak bridges made, like the path, of the trunk of a tree, sometimes with a light hand-rail tied to it, sometimes not.”

Thirdly, the presence of hills and mountains was a significant natural barrier to transportation, further complicating travel in Northwest Borneo. As a result, the deep interiors of the region remained unexplored. Franc Hatton, a scientific explorer associated with the British North Borneo Company in the nineteenth century, described the

challenges of penetrating Sabah, the eastern part of Northwest Borneo. Hatton (1885, p. 6) remarked,

“There are plenty of indications of treasure hidden away in Bornean forests and rivers, but the heart of Sabah is still tangled, wild, unexplored, without roads or even footpaths, populated by unknown tribes.”

During the reign of the Bruneian Empire, little evidence of road development was discovered in Northwest Borneo. Travellers noted the presence of only a few jungle tracks and footpaths established by local Indigenous communities to navigate the interconnected forest and river systems. A structured road network was notably absent even in Brunei, the capital city and key port town of the Bruneian Empire. However, historical references indicate a well-established network of rivers and sea routes that facilitated connectivity within the inland and oceanic territories of the Bruneian Empire (Dalrymple, 1808; Nicholl, 1980; Nicholl, 1983; Nicholl, 1989).

In Sabah, a footpaths and jungle tracks traversed the region, linking villages and extending to the outer peripheries to collect forest resources. These paths not only provided local journeys but also interconnected river systems. While the rivers in the region's western part were not navigable and, therefore, unsuitable for trade and communication, a rudimentary road network emerged to overcome these challenges. These paths were mere tracks, as an early British official stated, “winding in and out between buttressed trunks of the gigantic forest trees, descending steep slopes, running first on one side, then on the other of rushing hill streams, and often a foot deep in slippery mud (Gudgeon, 1913, pp. 36-37).”

Before the colonial period, Sarawak, a southern region of Northwest Borneo, experienced a scarcity of overland routes. Towns were connected to local areas by only a handful of roads, with trade and communication mostly reliant on river and sea transport. One exception was the Kuching district, where the town roads were unsurfaced earthen roads. Inside the region, a few well-constructed jungle paths served to link the river network (Kaur, 1995, p. 102). The development of land transport infrastructure was limited in Sarawak due to persistent challenges. The perpetually wet and marshy environment downstream was obstructed by land, while dense tropical forest was rugged terrain that was challenging for general people to enter.

The Dayaks built *batang* (literally tree stem/log paths) to penetrate the inside areas (Boyle, 1865). These paths were elevated footpaths con-

structed by laying logs end to end, often stretching for short distances. These paths were risky and required skilled footwork. Green (1909, pp. 32-33) provided a vivid description of one such path that:

"The Land-Dayaks make many paths straight up over the hills, through the jungle and across the rivers paths which bring the unwary European to sudden falls. They are made of the stems of trees, generally three inches in diameter; the rough bark is cut off on the upper side, and a succession of single stems is laid on supports two feet, or even six feet above the ground. Sometimes instead of trees bamboos are laid side by side; these paths are called batangs."

Charles Brooke, the White Raja of Sarawak, characterised these paths as "an introduction to a new style of walking resembling tight-rope manoeuvring more than any other (Green, 1909, pp. 32-33)." These paths extended from villages to the forest along the river, facilitating the collection of forest products. The authority built short roads linking various places in the principal localities, but there was a lack of interconnecting roads between these areas. Road development was considered unnecessary work due to the common practice of planting crops near rivers, such as sago cultivation. Even during the early colonial period, particularly in the reign of James Brooke, the road transport sector did not receive prioritised attention and remained less focused. Although large companies like the Borneo Company and Sarawak Oilfields constructed their roads for operational purposes, these roads were short and localised (Kaur, 1995, p. 102).

In the pre-colonial era, the local indigenous people in Northwest Borneo constructed numerous bamboo bridges over the rivers (Boyle, 1865, p. 49). Green (1909, p. 32) described them as follows:

"A bamboo is slung from branches of a tree on one side of the river to those on the other, or if one bamboo is not long enough, two are tied together with rattan, others fastened from higher branches are crossed below them as supports, and to these a hand-rail is fastened; this exalted bridge is reached from the banks by sloping ladders made, like those leading to the houses, of notched tree trunks. In some places a single tree trunk, given to turning round, is laid from bank to bank across a river, and in others wood and bamboo are so cleverly fastened together as to form a suspension bridge 50 or 60 feet high across a river 100 feet in width."

Road transportation was limited in pre-colonial Northwest Borneo and did not develop significantly due to its wet swampland and dense forest. Buffalos, cattle, especially bulls, and native ponies were commonly used for riding. For instance, a Bajau scarcely travelled anywhere on foot if he had a buffalo (Evan. 1915, p. 24). Before the colonial period, several jungle tracks connected the interior regions with river networks. Together, these two networks influenced the socio-economic transformation of Northwest Borneo. As Europeans arrived in Northwest Borneo, the rulers engaged with them and established business relations. Subsequently, influenced by Europeans, these rulers began constructing roads, the courthouse, and business offices in the town to align with the evolving commercial landscape (Low, 1848, p. 117).

CONCLUSION

In the pre-colonial Northwest Borneo, the evolution of waterways and road transportation systems corresponded with socioeconomic and commercial developments. Waterway emerged as the leading commercial network, which connected almost every corner of these two regions. The riverine and coastal landscapes of the regions usually shaped the transport networks until they corresponded with mechanised tools that upgraded the efficiency of the transport systems in the region. Despite the use of road networks in areas with minimal water transport, their significance was determined by the extensive river network. This was largely due to the various geophysical constraints that limited the effectiveness of road transportation.

Swampy lands and dense forests created persistent obstacles to developing a comprehensive road network in pre-colonial Northwest Borneo, resulting in a few paths or jungle tracks thriving in the region. The indigenous communities mostly used these tracks to carry their jungle produce and connect the interior region with rivers. However, the river network played a significant role in operating communication, trade, and commerce in the region until the advent of the modern transport system. The dominance of the vast river network in pre-colonial Northwest Borneo is evident from the above discussion. The local boats were used for inland movement, while prahu sailed for coastal trade. Due to the severe scarcity of roads, the rivers remained the main commercial highway, effectively connecting the interior to the coastal region.

The discussion also highlights the development of transport systems, which were shaped by their distinctive natural characteristics within these

regions. Boats were usually built using local traditional techniques, gradually incorporating advanced technology from outside the region. For instance, ship manufacturing methods were generally inspired by Chinese junk but synchronised with their regional nature in Northwest Borneo. In addition, frequent changes in the transport and communication systems were driven by increasing political, economic, and commercial activities for regional and local development. The traditional transport system's progress continued alongside the expansion of other sectors. The geo-environmental features also influenced the whole development trajectory of the transport system across this region.

The British rulers in Northwest Borneo inherited the foundation of the pre-colonial transport systems and proceeded to enhance and modernise them. They introduced modern transportation methods by transforming the existing landscape to accommodate railways and roads.

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