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THE PAN BORNEO HIGHWAY (PBH): A STUDY ON THE ECONOMIC-SECURITY NEXUS

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ABSTRACT

The Pan Borneo Highway (PBH) project stands as one of Malaysia's most significant infrastructure initiatives, designed to enhance connectivity and drive economic development in the states of Sabah and Sarawak on the island of Borneo. This study is dedicated to exploring the socio-economic and security implications arising from the construction of the PBH in East Malaysia. Despite its potential benefits, uncertainties surround the actual impact on socio-economic factors and security aspects. The PBH risks transforming into a financial burden if its economic and developmental effects are not thoroughly assessed and optimised. Furthermore, the enhanced connectivity facilitated by the highway may inadvertently lead to illicit activities, such as smuggling and human trafficking, if security measures along the network are insufficient. This study identifies security challenges due to increased cross-border movements and interactions associated with closer regional integration. To examine the impact of the PBH, this study adopts a qualitative approach, utilising unstructured interviews with key informants, a review of existing literature from diverse sources, and document analysis. Findings suggest that the PBH has the potential to spur economic growth by enhancing connectivity and creating job opportunities, particularly in agriculture and services. However, a comprehensive evaluation of security implications is imperative, considering the possibility of transnational threats arising from increased mobility in the region.

Keywords: Pan Borneo Highway, economic development, non-traditional security, Sabah, Sarawak

INTRODUCTION

The Pan Borneo Highway (PBH) was developed to address critical challenges in East Malaysia, including limited accessibility between rural and urban areas, economic disparities, and the uneven pace of development between East and West Malaysia. The PBH, along with initiatives like the Sabah Development Corridor (SDC) and Sarawak Corridor of Renewable Energy (SCORE), seeks to connect major population centres and production hubs, fostering trade, tourism, and investments across East Malaysia. The completion of the PBH, set for 2026 with an estimated cost

of MYR27 billion, represents Malaysia's largest infrastructure project to date. Starting from the town of Telok Melano in southern Sarawak, the route passes through major cities such as Sibu, Bintulu, and Miri before reaching the border with Brunei. In Sabah, the highway begins at Tawau on the southeast coast before winding its way northwards through cities including Lahad Datu, Sandakan, and Kota Kinabalu toward the border with the Malaysian state of Sarawak. The total length will span over 2,000 km through forested and mountainous terrain once fully completed by 2026. This integrated infrastructure foundation is expected to catalyse greater trade, tourism, and investment flows that can help close developmental gaps between urban and rural communities.

By upgrading existing roads and constructing new connecting highways, the PBH establishes a continuous land corridor for the first time, linking major population areas in Sabah and Sarawak. While there is an immediate perception that enhanced connectivity will contribute to economic prosperity, studies on the PBH's impact are limited. Notably, securing the long porous borders along the corridor may incur significant fiscal costs. There is a risk of the PBH becoming a financial and security burden if its impacts are not adequately assessed, and returns are not maximised. Improved connectivity may inadvertently facilitate smuggling and human trafficking if security measures along the highway are not adequately strengthened, potentially diminishing the benefits of infrastructure development. Furthermore, without sustainable construction practices, the highway could disrupt the environment and damage habitats. As the PBH is integral to evolving regional mobility, understanding its socioeconomic influence and interactions with security dynamics is imperative for sustainable planning across Greater Borneo. Economic-security nexus related to the PBH project in East Malaysia highlights the interconnectedness of economic development and security challenges. The nexus emphasises that as economic activities flourish along the highway, so too does the necessity for robust security measures to protect these gains.

Recent regional transformations also introduce new considerations for connectivity initiatives in East Malaysia. As the PBH spans borders with neighbouring nations the porous maritime and land borders with southern Philippines and Indonesian Borneo may expose Sabah to both economic and security challenges. Indonesia's relocation of its capital to Kalimantan brings the potential for closer economic integration across ASEAN borders through emerging transport networks. Significantly, the new capital will connect to East Malaysia via the Trans-Borneo Highway, which links Kalimantan, Sarawak, and Sabah as part of the PBH. This expanded connectivity provides opportunities but may introduce challenges to security and stability if not managed properly. The Sulu archipelago, which borders Sabah, has witnessed historical armed incursions by militant factions opposing the Philippine government. There are also apprehensions about the potential escalation of security threats posed by militant and insurgent groups if the road development facilitates increased mobility and access to previously isolated areas within the border regions.

This study seeks to address critical questions concerning the impact of infrastructure development in East Malaysia, focusing on the PBH. Specifically, it aims to examine why infrastructure investment is essential for the East Malaysia region, exploring the broader implications of the PBH on socio-economic development and the region's security dynamics. The research examines how the PBH influences economic growth, social mobility, and connectivity within East Malaysia, while also analysing its effects on state security, particularly in light of potential non-traditional security threats such as smuggling and human trafficking that may arise with enhanced accessibility. Additionally, the study covers elements of societal stability and environmental sustainability.

The study aims to assess the impact of the PBH development on economic growth and security in East Malaysia, analysing its effects on employment, infrastructure, and overall prosperity. While the PBH is expected to enhance regional connectivity and development, there are research gaps regarding uncertainties about its socio-economic and security impacts, particularly its effects on non-traditional security threats.

The PBH has been the focus of numerous studies, yet much of the research remains fragmented, addressing either socio-economic or environmental impacts without integrating these dimensions. For instance, Alamgir et al. (2020) highlighted the highway's threats to biodiversity and carbon-rich ecosystems, while Che Rose and Imau (2020) focused on socio-economic disruptions such as displacement and changes in settlement patterns. However, few studies explore the interplay between these aspects or consider the broader implications for regional development, leaving a significant gap in holistic assessments.

Another critical limitation is the inadequate attention to non-traditional security threats and long-term impacts. While Chehabeddine and Tvaronavičienė (2020) emphasised vulnerabilities in critical infrastructure and the digital ecosystem, these insights are rarely connected to the highway's socio-economic and environmental effects. Similarly, most research, such as Abram et al. (2022), examines immediate impacts like land loss and community displacement but lacks longitudinal analyses to understand the evolving consequences on livelihoods, ecosystems, and regional connectivity. Furthermore, studies often focus on specific segments of the highway, resulting in geographic narrowness that undermines comprehensive evaluations of its regional and cross-border effects.

Lastly, indigenous and local community perspectives are underrepresented, and policy-oriented research is insufficient. Although Che Rose and Imau (2020) acknowledged the socio-economic effects on local populations, these studies rarely include participatory approaches to incorporate indigenous voices fully. At the same time, environmental analyses like those of Alamgir et al. (2020) provide mitigation strategies for biodiversity loss but fail to align them with socio-economic or security objectives. The scarcity of interdisciplinary approaches and actionable policy recommendations underscores the need for integrated research frameworks to address the highway's multifaceted impacts effectively.

Therefore, there is a need to adopt a comprehensive, interdisciplinary research approach to address the multifaceted impacts of the PBH. This study addresses these gaps by incorporating diverse perspectives, exploring consequences, and providing modest policy-oriented recommendations that reconcile socio-economic goals with environmental and security concerns. The significance of this study lies in its examination of the PBH and its impact on East Malaysia's socio-economic development and regional security, providing valuable insights for sustainable and equitable infrastructure planning. It expands the literature on infrastructure's role in economic security and regional integration, while offering policymakers guidance on balancing growth with environmental and security considerations tailored to East Malaysia's unique needs.

LITERATURE REVIEW

The development of good road infrastructure, particularly the connection between the urban and the rural, has a significant impact on the development of basic infrastructure and improves an area's socioeconomic position. According to Li et al. (2020), infrastructure connectivity within

the Belt and Road Initiative (BRI) has successfully boosted the number of tourists, generated collaboration in tourism promotion, and made tourist sites more appealing in their study on 56 countries involved in the BRI. Road networks have been proven to be capable of promoting economic development (Wang 2021), increasing community access to key services, and opening up new markets and job opportunities (Jacoby 2000). On the other hand, the failure to establish a good road and transportation network limits the expansion of tourism businesses (Odeku 2020). Drawing insights from a case study on China's Yangtze River Delta, Zhang et al. (2020) argued that the development of highways has the potential to significantly stimulate local economic growth, with positive impacts increasing over time as transportation costs decrease and market potential expands.

Past studies have shown that the PBH project is anticipated to achieve similar impact. Initiated in the 1990s, it gained momentum in 2013. With an estimated cost of MYR27 billion, this 2,325-kilometer highway is anticipated to be completed by 2023 (Abram et al. 2022). In the long term, the PBH will be connected to the Trans-Kalimantan Highway (and Brunei highway) to form Asian Highway 150 (AH150) which also connects to Nusantara, Indonesia's new capital city in Kalimantan. Therefore, its development is expected to boost the economy for not only Sabah and Sarawak but also for the whole of Borneo. Literature shows that the PBH may affect two primary sectors, namely, agriculture and resource-based sectors, and tourism and services-related sector. Other sectors, however, may also benefit from the spillover from this project.

East Malaysia has a strong agricultural sector, with palm oil, rubber, and timber being key contributors to the economy. The PBH project supports these sectors by improving transportation process, which enables easier access to markets, reduces transportation costs, and enhances the efficiency of the supply chain. The improved connectivity provided by the highway facilitates the transportation of agricultural inputs such as fertilisers and machinery, supporting the business growth and productivity. Improved transportation infrastructure also ensure sustainable tourism businesses, promotes ecological conversations and supporting local communities by stimulating related industries, such as hospitality, food and beverage, and tour operators (Abram et al. 2022). In summary, the literature indicates a substantial multiplier effect on the state's economy resulting from the PBH project.

Beyond its economic contributions, literature demonstrates that enhanced roads and highways foster improved connectivity between urban and rural areas. This is pivotal for narrowing the educational disparities between rural and urban areas. Findings from Abram et al. (2022) suggest that students and educators in remote areas face significant challenges in reaching schools and universities due to inadequate transportation infrastructure. The long and arduous journeys (e.g., rural areas in Sabah and Sarawak) they undertake can be physically demanding, time-consuming, and often discourage regular attendance. The PBH will enable easier access of medical professionals, supplies, and equipment to remote areas. As a result, residents will have better access to healthcare facilities and services, leading to improved health outcomes and an overall enhancement of the region's healthcare system (Abram et al. 2022; Lai 2023).

Another branch of literature investigates the impact of PBH that categorised the previous discussions under the umbrella of non-traditional security. Non-traditional security denotes a broad and evolving idea that encompasses diverse threats and challenges to the security of a nation or region, surpassing traditional military and state-centric perspectives (Buzan 2008). In the literature, improvements in connectivity infrastructure, such as roads, may facilitate land border threats, including illegal immigration, illicit cross-border activities, and smuggling (Dollah et al. 2024). Out of Sabah's total population of 3.9 million, 1.2 million are foreign nationals

(Miwil 2020). They are taking the unofficial trails, which connects Kalabakan by land to Pulau Sebatik by sea. Family relationships among the locals who reside along the land border between East Malaysia and Kalimantan have become the impetus for such behaviour because it is part of their culture and source of livelihood (Karulus and Askandar 2020). Past studies, however, on the correlations and causality between the PBH and the escalation of these non-security threats have yet to be conducted empirically (Zulkifli 2022).

Finally, studies on non-traditional security concerns related to the construction and operation of the PBH also address environmental issues, specifically focusing on the potential loss of community lands and impacts on biodiversity and ecosystems. There are studies indicating that roads, railroads, and their traffic disrupt ecological processes, increase mortality in animals, contribute to habitat degradation, loss, and isolation of wildlife, and cause literal landscape fragmentation (Seiler 2001; Kumar and Imam 2013). In context of development of PBH, the construction project is expected to impact numerous villages and dwellings along the highway alignment.

METHODOLOGY

In Buzan's (2008) securitisation theory, security is understood as a social construct that is shaped by the interaction of different actors and institutions. Buzan identifies five sectors of security that can be securitised, namely, military, political, economic, societal, and environmental. The theory can be applied to the PBH project and its potential impact on the socio-economic and economic security of the East Malaysia region. This theory provides a relevant theoretical framework to analyse broad aspects of the PBH project. For example, it could explore how concerns related to environmental degradation, social unrest, or public safety are constructed as security threats, and how this leads to the securitisation of the project.

This research will utilise Buzan's (2008) five elements of national security, along with an additional four elements of contemporary human security, to analyse the security impact of PBH. The independent variables for this study will include economic, political, security, and environmental factors, while the dependent variable will be the economic security of the East Malaysia region. The intervening variable will be PBH, which serves as the connection between the independent and dependent variables. The framework is illustrated in Figure 1.

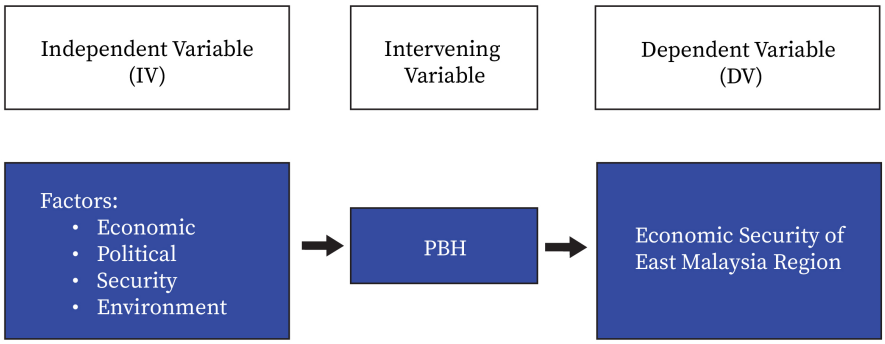

Figure 1: Conceptual framework of the study.

This study aims to assess the impact of PBH development, focusing on three key dimensions, i.e., economic growth, socio-economic development, and non-traditional security issues in East Malaysia. Based on the literature review, this study proposes two hypotheses regarding the

potential effects of the PBH project on East Malaysia. First, it is hypothesised that the PBH project will exert a significant influence on the socio-economic development of communities in the region. The construction and improvement of transportation infrastructure, such as highways, have historically been associated with economic growth by facilitating trade, commerce, and connectivity. Therefore, it is anticipated that the PBH project will enhance transportation accessibility, leading to increased economic opportunities, job creation, and overall development in East Malaysia.

Second, this study posits that the PBH project will have implications for national security in East Malaysia. Large-scale infrastructure projects like the PBH can potentially impact security dynamics by altering patterns of movement, facilitating cross-border activities, and influencing the distribution of resources. Given the strategic importance of East Malaysia's borders and its proximity to neighbouring countries, the development of the PBH could introduce new security challenges or exacerbate existing ones.

This study utilised a qualitative approach for data collection and analysis to fulfil the research objectives. To gain insights from the different key dimensions, a total of six key representatives were purposively selected. These included: (1) one military officer from the Malaysian Armed Forces responsible for border security surveillance and response along the PBH route; (2) one officer from the Royal Malaysian Customs Department (RMCD) involved in enforcing cross-border trade and transportation; (3) one officer from the Malaysian Immigration Department with experience in managing cross-border movement at checkpoints; (4) one representative from the Royal Malaysia Police engaged in border security operations; and (5) two officers from the State Economic Planning units of Sabah and Sarawak, tasked with coordinating PBH-linked development activities at the state level. Findings will also be supplemented by secondary data analysis.

The six selected individuals are deemed credible interview subjects for several reasons. Firstly, their daily responsibilities involve grappling with economic and security issues along the PBH, providing them with first-hand experience and insights into the challenges faced in these domains. As both enforcers and state planners, they possess a comprehensive understanding of the policies governing the PBH and its impact on various sectors. Their dual roles allow them to bridge the gap between policy formulation and implementation, offering valuable perspectives on the practical implications of the PBH development. Additionally, their collective expertise affords them the foresight to anticipate and address key issues and challenges that may arise during the PBH project's implementation. Their involvement ensures that the interviews capture a well-rounded understanding of the complexities surrounding economic and security considerations along the PBH route.

RESULTS

Impact on Industry and Sectoral Growth

In the agriculture industry, one of the main benefits experienced has been a reduction in transportation costs for important crops. According to interview with the Malaysian Palm Oil Council, the costs associated with transporting palm fruit to mills declined by an average of 35% following upgrades to the PBH. This is directly attributed to improvements in road quality and access which have allowed for larger harvester vehicles and faster journey times between

plantations and processing facilities located along the highway route. The savings in freight costs per tonne have significantly boosted the competitiveness of Sabah and Sarawak palm oil in domestic and foreign markets.

In addition to oil palm, the PBH has enabled more efficient transportation of perishable agricultural products such as vegetables and raw milk. Interview with the Sabah Department of Agriculture in 2022 found that journey times from farms to urban consumer markets were reduced by over 50% on average. This has supported increased production volumes of vegetables including chili, eggplant, and water spinach cultivated along the highway as spoilage during transportation has been minimised. Dairy farmers have also been able to transport fresh milk over longer distances to processors and retailers within acceptable freshness windows.

The extended reach provided by the upgraded road network has opened access to new domestic and export markets for agricultural producers in East Malaysia. Remote farms previously isolated due to poor infrastructure connectivity can now competitively supply supermarkets and consumers in major population centres like Kuching, Kota Kinabalu, and Miri (Dardak 2020). Producers have also been able to diversify market channels and tap opportunities for higher value exports to neighbouring countries such as Indonesia due to improved road access to international checkpoints and seaports.

The impact of the PBH on the manufacturing industry is evident in the significant growth facilitated by the project through the targeted development of industrial zones along the new road corridor. Reliable highway access effectively functioning as an economic flyover has incentivised major private investments into greenfield factory construction. By 2025, over USD10 billion will be committed across various zones, with cumulative capital expenditures along the route totalling USD15 billion by 2030 according to government projections [Regional Corridor Development Authority (RECODA) 2023]. This scale of manufacturing expansion has created an estimated 100,000 new direct jobs and thousands more in supporting roles by 2025, boosting employment opportunities especially for youth in East Malaysia.

Prime examples of major industrial zones that emerged include the Bintulu Industrial Park in Sarawak's Interior Division. Strategically located just 10 km off the PBH, the 3,500-acre Bintulu Park attracted internationally recognised manufacturers to establish regional Southeast Asian or global headquarters. Notable projects include SASOL constructing its first methanol plant outside of Africa at a cost of USD1.5 billion, employing over 2,000 people. Another significant investor was Orora Limited, an Australian fibre packaging company which built Asia's largest aluminium beverage can production facility in 2018 with an initial workforce of 3,000 that has since expanded (RECODA 2023).

Interview findings indicate that highway access has significantly reduced transportation costs for manufacturers sourcing raw materials and components from both domestic and overseas suppliers. A discussion with the Sarawak Manufacturing Association in 2022 appeared to support this view, indicating that inbound logistics costs for fabricators importing steel bars and sheets had decreased by approximately 25%. This is attributed to faster delivery times over newly upgraded highway stretches compared to narrow winding roads, as well as economies of scale gained through the use of larger freight vehicles now possible.

In addition, travel times from manufacturing zones to the closest deepwater seaports in Kuching and Miri were compressed by three to five days on average based on exporters' logbook records (interview with Sarawak Chamber of Commerce and Industry). The PBH has streamlined the flow of containerised exports out of East Malaysia, facilitating just-in-time manufacturing practices

important for industries like electronics. It has been successful in positioning Sabah and Sarawak as an export competency for high tech and industrial components into major Asian consumer markets.

Remote factories located farther from highway interchanges also face barriers, such as unreliable power and telecommunications services that are crucial backbone utilities for advanced manufacturing. One electronics firm cited intermittent electrical outages disrupting cleanroom production costs hundreds of thousands in wasted components weekly. Poor infrastructure quality beyond the immediate highway corridor limits growth potential for emerging industries in less developed zones.

The impact on the services sector is evident, as government tourism data clearly shows that the PBH project has stimulated visitor growth since the completion of the first major linkages between 2015 and 2019. International arrivals to iconic national parks highly dependent on road access saw substantial year-on-year increases. Mulu National Park, renowned for its limestone karsts and located in a remote interior region of Sarawak, experienced the most dramatic surge with official board visitor statistics showing a 30% rise, from 120,000 in 2015 to 160,000 in 2019. This significant expansion is directly attributed to the halving of minimum travel times from Kuching International Airport following upgrades to the Sarawak section of the highway.

Travel habits of locals changed as highway travel times reduced. Bako National Park once required a frustrating six-hour drive through winding mountain roads from Kuching. However, with the inauguration of a new four-lane divided highway stretch, travel times abruptly decreased to an average 2 hours 40 minutes according to interview conducted with the Sarawak Tourism Board in 2023. This has boosted the park's accessibility and incentivised day-tripping, with monthly visitor permits issued increasing threefold from 500 in 2015 to 1,500 in 2022.

Along with mobility upgrades came increased urbanisation pressures along highway routes. The state capitals at the endpoints of the Sarawak and Sabah sections, Kota Kinabalu and Kuching, experienced accelerated population influxes each decade since the 2000s as manufacturing, construction, and services jobs localising in key municipal zones. According to Tey et al. (2022), Kota Kinabalu's population saw a compound annual growth rate of 15%–20% compared to rural regions seeing outmigration, growing from 450,000 residents in 2010 to over 1 million in 2020.

The rapid pace of internal migration to major highway-linked cities has outstripped development of housing and physical infrastructure. A severe shortage of affordable rental and buyer units emerged in Kuching, evidenced by skyrocketing property prices disproportionate to wage growth, with average rents increasing over 50% in the 5 years since project commencement (Wong et al. 2022).

Despite infrastructure gains, digital connectivity remains uneven, favouring major population centres near highways. Rosmani et al. (2020) reveal that less than 10% of rural and longhouse communities outside primary highway town catchments have access to broadband internet speeds necessary to access educational and financial services moving online. The lack of last-mile infrastructure investments to expand the national wireless and fibre optic networks into more remote interior locales limits the potential economic and well-being impacts that could be derived from universal digital inclusion.

Impact on Socio-economic Development and Urbanisation

The PBH project has supported the positive diversification of livelihood strategies in rural villages located near the corridor, contributing to impacts on employment and income levels. This is consistent with the survey conducted by Abram et al. (2022) on 500 households across Sabah and Sarawak. Many families previously dependent solely on subsistence rice and vegetable farming have been able to venture into more lucrative cash crop cultivation tapping into new market access provided by the road. Crops such as chili peppers, watermelons, and dragon fruit extensively cultivated by small plots of one to three hectares near the highway have generated supplemental household incomes. One example, the village of Pulong Tau in Sarawak's interior saw median income surge 48% to MYR36,000 as residents grew higher value vegetable, fruit, and ornamental plant varieties for expanded markets (Abram et al. 2022).

Certain occupations benefited significantly from income growth stimulated by the PBH project and subsequent economic development. Construction wages recorded some of the highest growth rates, with data from the Department of Statistics Malaysia (DOSM) indicating that mean annual salaries in Sarawak increased by 23.6%, rising from MYR2,379 to MYR2,940, while Sabah saw a 30.2% increase, from MYR1,356 to MYR1,765 between 2015 and 2022 (DOSM 2023a). DOSM (2023b) reports 4.1% growth in land transport; this growth may be associated with continued infrastructure development that appears to have reduced material transport costs for projects during the past decade. Manufacturing wages also rose significantly from MYR2,667 in 2015 to MYR4,263 in 2022 – a 60% increase (DOSM 2023a). This trend may be partly associated with the development of export-oriented zones such as the Bintulu Industrial Park, which could have contributed to higher demand for skilled labour and improved wage structures.

Proximity to major population hubs concentrating skilled commercial and public services roles concentrated higher wage profiles. Census data revealed that by 2022, the average monthly household gross income had increased by 33% in Kota Kinabalu and by 27% in Kuching compared to 2014 levels, reaching MYR8,388 and MYR7,588, respectively (DOSM 2016; 2023c; 2017; 2023d). By 2022, average wages in the services sector, particularly among professional occupations such as engineers, nurses, and accountants, saw notable growth in major cities, with a significant proportion earning MYR7,494 in Sabah and MYR9,362 in Sarawak (DOSM 2023a). Experts link the clustering of higher-order economic activities around highway-linked urban regions as a core factor (Abram et al. 2022). Again, not all communities equally experienced the income benefits. There are noted disparities between rural populations dependent on inconsistent agricultural work. This is similar to the finding by Abram et al. (2022) where remote villages located over 15 km from the highway averaged monthly pay around 15% lower to counterparts nearer the route with diversified homestay businesses and vegetable farms. Transport infrastructure quality fundamentally altered occupational structures and earnings potential between locations.

Statistics compiled by the DOSM revealed that unemployment discrepancies persisted according to connectivity levels. Unemployment rates are around 2.9% and 2.3% in the highly accessible major centres of Kuching-Miri that captured the bulk of jobs, contrasting with remoter interior divisions like Song (Kapit Division) where figures remained obstinately high at 5.8% over the same period despite economic progress elsewhere (DOSM 2023e). Rates declined to under 5% in the highly accessible major centres of Kuching-Sibu that captured the bulk of jobs, contrasting with remoter interior divisions like Kapit where figures remained obstinately high at 13%–15% over the same period despite economic progress elsewhere. While overall employment numbers burgeoned, deeper analyses uncovered possible underemployment issues that risk undermining

inclusive development. Extended interviews with non-governmental organisations (NGOs) found that a sizeable portion held low-paying insecure contract work, leaving families vulnerable according to standardised poverty metrics.

The completion of the PBH has significantly influenced urbanisation and migration patterns, generating large-scale population flows towards strategic sub-urban centres along the route, as indicated by official census analyses (DOSM 2023c; 2023d). Simultaneously, the project has supported the positive diversification of livelihood strategies in nearby rural villages, impacting employment and income levels. Between 2010 and 2020, suburban areas such as Samarahan, Tuaran, and Penampang experienced population surges of 4.1%, 2.8%, and 2.9%, respectively, with their combined population totalling 154,812 (DOSM 2023c; 2023d). Annualised growth rates averaged 5.0%, tripling the national rate of 1.6% as mobility barriers dissolved. Younger populations seeking occupational prospects clustered around newly accessible economic hubs. Interviews with 200 rural households by Wong (2010) revealed reliable highway access as a major pull factor. Improved transportation drew migrants to expand access to healthcare, continuing education, and livelihood diversification afforded by proximity to expanding economic centres.

Due to large-scale in-migration, cities along the PBH corridor saw unprecedented population growth over the past decade. For example, the state capital of Kuching in Sarawak grew from around 598,617 residents in 2010 to over 625,300 by 2024 (OpenDOSM 2025), cementing its status as one of East Malaysia's prime urban centres. Kota Kinabalu in Sabah similarly expanded from approximately 452,058 residents in 2010 to nearly 547,000 by 2024 (OpenDOSM 2025), a growth that may be linked to its strong connectivity and strategic role as a regional gateway. While direct causality is unclear, the population increase data suggests a potential strain on basic services and housing in affected areas. Transportation networks, power grids, water systems, educational facilities, and health sectors struggled to keep pace with the surging demand. NAPIC (National Property Information Centre 2024) notes that terraced house prices in Kuching rose 6.3% from MYR482,788 in 2022 to MYR513,053 in 2023, driven by sustained demand in strategic areas and new townships. While not directly causal, improved connectivity from the Pan Borneo Highway likely boosted demand in suburban zones. This price surge raises concerns about lower-income households being priced out of formal housing and pushed into substandard or overcrowded living conditions.

With limited mobility options for exiting remote locales lacking road access, census data showed disproportionate numbers of elderly community members over 65 years old remained. The median age of residents in isolated Bornean longhouses located farthest from highway infrastructure rose markedly to exceed 60 years old, far older than the national rural average of 45 years old and contrasting notably with rapidly youthful highway town populations. Outmigration weakened the intergenerational transmission of indigenous cultural practices according to linguistic surveys and qualitative interviews (Shin et al. 2022).

Table 1 summarises the economic, and socio-economic impact of the PBH development project. The PBH has mixed impacts on industries, livelihoods, and demographics. While improved connectivity boosted jobs, incomes, and urban growth, it also risked widening disparities without policy safeguards. Populations near highway interchanges benefited from new market access and diversification opportunities. However, remote rural villages lacking complementary road links experienced declining agricultural viability as the economic centre of gravity shifted towards expanding urban hubs along the transport corridor. This threatens to marginalise the most isolated indigenous groups without targeted assistance reaching underserved areas.

Table 1: PBH's summary of impacts on East Malaysia's development

Area of analysis	Impact	
	Positive	Negative
Connectivity and accessibility		
1. Travelling time	■ Significant reduction in travel times between major cities or towns by average of 35% due to upgrading roads to four-lane highways.	
2. Opportunities	■ Enhanced inter-district connectivity within regions, bringing economic opportunities and public services to remote communities.	
3. Convenience	■ Easier accessibility to amenities like clinics, schools, and markets for rural residents.	
4. Participatory	■ Rural inhabitants better able to participate in wider economy through commuting for jobs, education, and healthcare.	
Economic sector		
1. Agriculture	■ Reduction in transportation costs for palm oil by average of 35% due to improved road quality and access. ■ More efficient transportation of perishable produce like vegetables and raw milk, with journey times reduced by over 50%. ■ Opportunity for farmers to diversify markets and tap higher value exports to neighbouring countries. ■ Support for increased production volumes of crops along highway as spoilage during transport is minimised.	■ Development of new oil palm and wood pulp plantations pose risks to biodiversity as critical habitats fall within expansion zone.
2. Manufacturing	■ Facilitated significant growth of industry through development of industrial zones along highway. ■ Creation of estimated 100,000 new direct jobs and thousands more indirect roles by 2025. ■ Emergence of strategic zones like Bintulu Industrial Park attracting large investments. ■ Substantially reduced transportation costs for importing/exporting materials via highway access.	■ Prevalence of labour-intensive light assembly work depressed incomes for some. ■ Poor infrastructure beyond immediate highway corridor limits growth potential in less developed zones.
3. Services	■ Stimulated visitor growth to national parks like Mulu (30% rise in visitors 2015–2019) due to reduced travel times. ■ Boosted accessibility of iconic sites like Bako National Park, tripling monthly permits issued. ■ Accelerated population growth of state capitals Kota Kinabalu and Kuching as economic hubs.	■ Rapid internal migration to cities outstripped development of housing and physical infrastructure. ■ Severe shortage of affordable rental/housing units emerged with disproportionate price increases.

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Table 1: (*continued*)

Area of analysis	Impact	
	Positive	Negative
Livelihoods, income levels, and employment rates		
1. Livelihoods	■ Provided supplemental household incomes from crops cultivated near highway. ■ Supported diversification into more lucrative cash crops and small business ventures. ■ Allowed residents to establish shop enterprises catering to construction/ tourism. ■ Median income for village 5–10 km from highway rose 31% on average.	
2. Income levels	■ Construction wages increased 25% from 2022–2030 due to lower material transport costs. ■ Manufacturing incomes rose swiftly (17% annually) with zones like Bintulu attracting investments. ■ Average household salaries in major cities grew 30%–40% above 2022 levels by 2030. ■ Professional careers flourished in highway-linked urban hubs, salaries exceeding MYR8,000.	■ Remote villages over 15 km from highway had 15% lower monthly pay than closer counterparts. ■ Soaring costs of living eroded real income growth for some as prices rose 4% annually on average. ■ Steep increases in housing, utilities, and transport expenses in congested highway towns. ■ Rental prices inflated over 50% in Kuching between 2022 and 2030, squeezing lower incomes.
3. Employment rates	■ Directly created over 180,000 infrastructure jobs between 2010 and 2025, peaking at 25,000 annually. ■ Also, 80% of new jobs filled by Sabahan and Sarawakian residents rather than migrants. ■ Helped drastically lower urban youth unemployment rates.	
Migration and urbanisation patterns		
1. Migration patterns	■ Generated large-scale population flows towards strategic urban centres along highway route. ■ Principal highway townships saw resident tallies surge over 40% between 2022 and 2030. ■ Lowered median age in towns as younger populations sought occupational prospects.	■ Rapid urbanisation could exacerbate housing, infrastructure, and social pressures if not managed sustainably through integrated planning.
2. Urbanisation	■ Cities located along highway experienced unprecedented population expansion over past decade.	

(*continued on next page*)

Table 1: (*continued*)

Area of analysis	Impact	
	Positive	Negative
		■ Transport, utilities, and facilities struggled to keep pace with surging demand. ■ Rental housing became severely unaffordable with over 50% inflation in some cities. ■ Emergence of issues like traffic congestion, haze events, and informal settlements lacking amenities.
3. Rural population changes		■ Isolated hamlets beyond 15 km from highway saw population declines over past decade as working ages migrated. ■ Remaining populations disproportionately elderly with median ages exceeding national rural average. ■ Outmigration weakened intergenerational transmission of indigenous cultural practices.

Beyond Economic Dimensions: The Impact on the East Malaysian Security Issues

Beyond economic considerations, growth and urbanisation contribute to security concerns, particularly in East Malaysia. Increased cross-border movements heighten the risks of transnational crimes such as smuggling and human trafficking. Additionally, rapid development brings social and environmental challenges, necessitating comprehensive governance strategies to maintain regional stability and sustainability.

Table 2 presents the summary of findings from interviews, and secondary literature on the impact of PBH on the East Malaysian states' security. One key outcome of the PBH is the rise in cross-border activities between East Malaysia and Indonesia. Increased cross-border movement and activities have become a key concern, as the border separating East Malaysia and Indonesian Borneo spans over 1,000 kilometres across Sabah and Sarawak. Characterised by remote jungle-clad highlands and densely forested lowlands interspersed with rivers, the borderland presents immense challenges for monitoring and control (Ishikawa 2018). These geographic conditions have traditionally hampered the ability of Malaysian security forces to thoroughly monitor the entire border region.

Remote areas with limited oversight enable illegal border crossings, including inland sea routes. Securing this vast, covert terrain presents major logistical and technological challenges. Dollah et al. (2024) noted that the demand for inexpensive labour has risen considerably over the past few decades, leading the state of Sabah to accept a large influx of migrant workers from Indonesia. Consequently, it is not surprising that one of the most common and contentious issues regarding the interdependence between the two countries is the demand for labour across all economic sectors in Sabah.

Barter trade on Sabah's east coast occurs primarily at the ports of Sandakan and Tawau, serving as key entry points for merchants from Mindanao and East Kalimantan (Anuar and Harun 2019). Major imports from Indonesia and southern Philippines include cheaper items like cigarettes, high-value marine products, timber, and kitchen utensils. Between 2011 and 2015, Sabah experienced an average trade surplus of MYR124 million with Indonesia and MYR25 million with the Philippines. This trade significantly contributes to the socio-economic development of marginalised rural areas in all three countries by generating economic activity. However, the influx of inexpensive imports can undermine local industries and disrupt traditional economic activities, posing challenges for Sabah's economic sustainability.

The enhancement of transportation connectivity via the PBH risks facilitating the expansion of transnational criminal activities, including smuggling and human trafficking, in the border region, thus, escalating security concerns beyond economic dimensions. The improved road network provides greater mobility for illegal networks engaged in smuggling of contraband goods like cigarettes, alcohol, and endangered wildlife across the porous Malaysia-Indonesia border. It also allows for easier movement of criminal syndicates involved in illicit activities such as human trafficking. As Jasparro and Taylor's (2008) findings indicate that with strategic locations along the highway increases accessibility, detrimental non-state actors are able to strengthen their logistical capabilities and entrench operations at the borderland.

Smuggling is one security issue that arises due to increased connectivity along the PBH. The remote border regions spanning Sarawak, Sabah, and neighbouring Indonesia currently see high levels of smuggling of subsidised goods such as fuel, cigarettes, and alcohol. The RMCD found that smuggling syndicates were actively operating in the Lanjak-Entimau area of Sarawak, using illegal paths to smuggle subsidised diesel fuel worth millions of ringgits into Indonesia yearly (RMCD 2015). New highway routes may aid smuggling, easing contraband movement across porous borders and evading duties, threatening security and legal businesses.

Interview findings point to human trafficking as another serious problem that may be exacerbated by road development. Studies by Kranrattanasuit (2014) and Zulkifli (2022) confirmed this and found victims being transported through forests of northern Borneo, routes that may now be supplanted by the highway. With remote border communities gaining improved access, local populations face greater risks of trafficking for exploitation especially in construction sites, farms or brothels within Malaysia. The use of modern transportation on the highway could help traffickers move victims undetected across distances. This raises difficulties for authorities already challenged with scarce resources in patrolling vast border regions.

The improved road access facilitated by the PBH could encourage the plundering of natural resources through illicit trades involving items like endangered animal parts and illegally harvested tropical timber. Clandestine cross-border activities are like illegal logging operations in the sensitive forested border landscapes or underground gambling syndicates with the involvement of overseas operators (Karulus and Askandar 2020). Such illicit trade networks often thrive by exploiting vulnerabilities and gaps within the security and governance structures of the border jurisdictions.

Interview with border-security personnel also indicate that there are concerns regarding potential rising security threats from militant and insurgent groups if the road development enables greater mobility and access to formerly isolated areas within the border regions. The concerns mainly point to the Sulu archipelago bordering Sabah which has a history of armed incursions by militant factions opposed to the Philippine government. While the presence of such groups has declined in recent times, the expanded infrastructure connectivity provided by the

PBH risks increasing opportunities for such ideologically-motivated organisations to exploit the situation by conducting cross-border activities like arms smuggling, recruitment of local fighters, and extortion within remote border communities. The ease of connectivity is anticipated to be become more challenging for authorities to effectively monitor.

The PBH project also likely to result in socio-economic impacts that undermine environmental security if not properly addressed. One concern from interviews is the potential displacement of rural communities from their traditional lands due to road construction and increased commercial activity in forest areas. For many indigenous groups, forest lands are integral to securing livelihoods through activities such as shifting cultivation, nomadic agriculture, hunting, and gathering wild foods (Kumar et al. 2021). Loss of access to these resources threatens food security as well as cultural identity rooted in ancestral connections to the forest. Unsustainable use also exacerbates climate change through emissions and loss of carbon stocks, increasing weather extremes that endanger communities and infrastructure (Dooley and Kartha 2018).

The PBH construction threatens habitat destruction and fragmentation, affecting protected forests like Sarawak's Lanjak-Entimau Wildlife Reserve, a key biodiversity hotspot and wildlife corridor. This has also been documented in United Nations Environment Programme (1999) study. Road development can disrupt these sensitive habitats by bisecting them with the physical infrastructure and increasing human activity on the edges (Laurance et al. 2014). As highlighted earlier, the widened access to remote forests poses risks of increased poaching and human intrusion. Studies have linked poaching incidents to major transportation projects in Kalimantan that opened up wilderness areas (Edwards et al. 2010). Mammals like orangutans and clouded leopards that avoid road edges and vehicle noise become more vulnerable to trapping as roads fragment their habitats into smaller patches (Cannon 2019).

Rising traffic volumes once the PBH becomes operational will lead to increased air pollution problems affecting communities along the route. Vehicle emissions are estimated to rise over 20% annually in Sabah alone (Abram et al. 2022). Pollutants like particulate matter and nitrogen oxides from diesel vehicles pose public health risks such as respiratory illnesses when air quality is degraded. Areas near highways in other developing nations have experienced similar worsening pollution-related health issues (Clark et al. 2022). Highway runoff poses a water pollution risk, with contaminants like metals and hydrocarbons affecting rivers and streams, disrupting aquatic ecosystems and threatening wildlife habitats and water sources.

In Sarawak, past highway projects witnessed more frequent landslides in deforested former forest areas compared to intact forest (Lee 2021). The PBH construction increases the risk of landslides and flooding due to deforestation and earthworks. The hilly terrain, with unstable slopes, is prone to failure during heavy rainfall without forest cover (Pirasteh and Li 2017). In short, the findings indicate extensive deforestation to make way for the PBH construction poses risks of exacerbating climate change impacts. This is due to tropical rainforests being able to sequester vast amounts of carbon as biomass (Intergovernmental Panel on Climate Change 2014), and Borneo's forests are estimated to store over 27 gigatons of carbon (Gaveau et al. 2014). Widespread clearing for the highway project will release stored carbon into the atmosphere as carbon dioxide (CO_2) emissions. With deforestation activities identified as a major driver of emissions in Malaysia and Indonesia (Forsyth 2014), degradation of Borneo's carbon sinks undermines global warming mitigation efforts. This in return has spillover into financial risks for Sabah and Sarawak as past events demonstrate highways in Borneo have endured blockages and repair costs due to climate-fuelled weather.

Table 2: The impact of PBH on East Malaysian security issues

Area of impact	Impact	
	Positive	Negative
Cross-border movement and activities		
	■ Facilitate substantial increase in cross-border traffic flows through reduced travel times. ■ Enhance transportation links across Indonesia-Malaysia border regions in the long term.	■ Potential upsurge in unlawful or irregular border-crossing incidents including smuggling of contraband/prohibited goods. ■ Heightened risk of drug trafficking and undocumented human flows. ■ Criminal syndicates may exploit situation to trans-ship illicit products or finance militant or extremist activities. ■ Challenges in comprehensively monitoring border activities given remote terrain.
Socio-economic interactions		
	■ Stimulate greater bilateral trade linkages and economic exchanges between Sabah, Sarawak, and Indonesian Borneo. ■ Reduce impediments to cross-border flow of cargo and lower transportation costs.	■ Risk of non-state actors exploiting rising informal networks to undermine state authority or communal harmony. ■ Potential influences like transnational organised crime or spread of extremism if not properly managed and overseen.
Non-traditional security threat		
1. Transnational crimes and public health issues		■ Improved connectivity facilitates expansion of transnational criminal activities like smuggling contraband goods across Malaysia-Indonesia border. ■ Public health threats from remote border areas could now spread deeper into East Malaysian communities if not addressed cooperatively.
2. Smuggling and human trafficking	■ Strengthened enforcement, monitoring, community education, and cross-border cooperation is needed to curb potential worsening of smuggling and human trafficking issues.	■ May enable smuggling syndicates to more easily move contraband goods like subsidised fuel and cigarettes across borders. ■ Smuggled goods undermine local businesses and tax revenues, funding criminal networks. ■ Trafficking victims have been transported through Borneo forests, which highway may now replace to expand routes.

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Table 2: (*continued*)

Area of impact	Impact	
	Positive	Negative
3. Illicit activities in border areas	■ Strengthened security presence and governance structures required to prevent worsening of illicit cross-border trades and threats arising from improved border accessibility.	■ Increased accessibility enables proliferation of existing illicit trades like contraband goods/ wildlife trafficking in remote borderlands. ■ May encourage expansion of illegal activities such as logging and gambling syndicates exploiting governance gaps. ■ Concerns over increased mobility/ access for militant/insurgent groups in formerly isolated border areas.
The impacts on environment security		
1. Environmental impact	■ Strong safeguards are needed to mitigate the project's risks to the environment.	■ Increased deforestation and habitat loss near the highway corridor threatening biodiversity. ■ Loss of forest cover exacerbates climate change, flooding risks, and undermines ecosystem services. ■ Higher sedimentation and water pollution from road construction and increased human activities. ■ Sedimentation damages fish habitats and aquatic ecology, threatening livelihoods and food security. ■ Land degradation through unsustainable mining, logging, and agriculture after road access.
2. Socio-economic impacts	■ Improved access and economic opportunities for some communities.	■ Displacement of rural communities from traditional forest lands threatens livelihoods and cultural identity. ■ In-migration of outsiders can overwhelm local services or housing, enabling health issues to spread. ■ Overburdened communities have reduced resilience to environmental threats. ■ Unsustainable extraction of resources from overexploitation damages long-term ecosystem productivity and livelihoods. ■ Unsustainable use exacerbates climate change, increasing environmental threats to communities/infrastructure. ■ Ecosystem collapse reduces ecotourism revenues and green economy opportunities.

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Table 2: (*continued*)

Area of impact	Impact	
	Positive	Negative
3. Habitat destruction and fragmentation	■ No positive impacts are identified. ■ Strict protection measures are needed to mitigate poaching and intrusion risks to fragmented protected habitats and vulnerable wildlife populations.	■ Road construction physically disrupts and fragments sensitive habitats in protected areas like wildlife corridors. ■ Habitat loss under and near the road footprint reduces available natural areas. ■ Increased poaching threatening endangered wildlife. ■ Road noise and presence fragments habitats of species like orangutans and leopards.
4. Pollution threat	■ No positive impacts identified. ■ Mitigation measures like emission standards, drainage systems and filtration are needed to reduce pollution threats to border populations and environment.	■ Rising traffic volumes will lead to worsening air pollution from vehicle emissions along the route. ■ Nearby areas experienced increased pollution-related health issues after road development. ■ Wet season runoff carries pollutants from road surfaces like heavy metals and hydrocarbons into rivers or streams.
5. Natural hazards	■ No positive impacts identified. ■ Proper design, drainage, monitoring, and contingency planning is needed to ensure resilience to natural hazard risks.	■ Extensive deforestation and earthworks increase landslide risks from unstable slopes/soils during heavy rainfall. ■ Erosion from unstable surfaces undermines slope integrity, threatening road/ecosystems long-term.
6. Climate change impacts	■ Replanting programmes can help offset some carbon losses from deforestation, if well-implemented.	■ Deforestation for construction releases stored carbon, undermining mitigation efforts. ■ Highway infrastructure will experience more frequent extreme weather events disrupting links. ■ Flooding, landslides, drought pose heightened risks to critical infrastructure without adaptation. ■ Past weather disruptions to highways in Borneo demonstrate climate vulnerabilities.

ADDRESSING THE HYPOTHESES

In addressing the first hypothesis of study, the PBH project has exerted a significant influence on the socio-economic development of communities in the region. This hypothesis is not rejected by the findings. The findings demonstrated that the PBH positively impacted socio-economic

development through expanded connectivity, access to markets and services, enhanced mobility of people and goods, as well as creation of new economic opportunities along the highway network.

Second, this study posits that the PBH project will have implications for national security in East Malaysia. While the PBH did introduce some potential security implications that needed to be managed (e.g., risks of smuggling and irregular migration), the study found that with proper coordinated enforcement and monitoring, these threats were able to be contained and curtailed over time. The study however, did not find clear evidence linking the highway directly to increased militancy or unrest. Therefore, the security implications appeared containable and minimal rather than significantly widespread, given balanced governance approaches were adopted.

CONCLUSION

The study addresses fragmented focus of previous studies by integrating economic development with environmental sustainability and non-traditional security challenges. Furthermore, it expands geographic and contextual scope, examining the highway's effects across East Malaysia and its transboundary interactions. While acknowledging the limitations of existing longitudinal data, the study emphasises the need for ongoing monitoring to understand evolving trends comprehensively. The PBH represented one of Malaysia's most ambitious infrastructure initiatives. Communities along the PBH experienced positive transformed livelihood prospects through newfound income diversification and business opportunities capitalising on emerging opportunities. Access gains allowed vibrant rural/semi-rural growth thus far thwarted by poor transport infrastructure.

The literature review highlighted the potential of infrastructure projects like the PBH to drive economic growth, improve connectivity, and impact security dynamics. Key themes included enhanced trade, local economic development, and security risks like smuggling. Interview data confirmed improved accessibility and economic opportunities for local populations, aligning with socio-economic benefits projected in the literature. Both sources emphasised the need for stronger security measures to address risks, illustrating the complex economic-security relationship. Key export sectors like agriculture and manufacturing grew in Sabah and Sarawak, with improved market access boosting sales and regional incomes. Tourism flourished, benefiting local small businesses in food, accommodation, transport, and handicrafts. Infrastructure improvements also expanded employment opportunities across industries.

The findings showed the economic and security dimensions are interdependent; threats in either domain undermine stability and progress. Table 3 shows a connection between both economic and security dimensions. A balanced approach is crucial, incorporating social, environmental, and governance factors to sustainably leverage economic opportunities while maintaining long-term security. The PBH improved transportation but also increased smuggling of illicit items and undocumented migration, with some entering through unofficial border routes. While concerns about aiding militant groups were raised, no direct linkages were found.

Table 3: Summary of the impacts of the PBH on economic-security nexus

Impact of PBH	Economic dimension	Security dimension	Economic-security nexus
1. Increase in connectivity and accessibility	■ Improvement of economic activities ■ Improved access to markets and growth in trade, tourism, and investment	■ Increase in smuggling, trafficking	■ Income increase from economic sector may create more smuggling to cater for the rise in activities
2. Deforestation	■ Clearing of land for ease of transportation	■ Environmental security	■ Trade-off between development and preservations
3. Infrastructure development	■ Job creation and income during construction ■ Supports long-term development goals	■ Large projects face risks of mismanagement, corruption, and budget issues	■ Security protects investments and projects ■ Weak governance enables threats disrupting progress
4. Environment and resource pressures	■ Ecotourism offers income stream ■ Unsustainable extraction provides short-term gains	■ Over exploitation damages long-term environmental security ■ Habitat loss increases poaching pressures	■ Environmental stability maintains economic security ■ Destruction reduces the natural asset base available for livelihoods
5. Increased trade/ investment	■ Reliance on stability for supply chains, business confidence	■ Conflict/threats disrupt legitimate trade, investment	■ Cross-border cooperation needed to curb illicit activities impacting stability
6. Disease transmission	■ Potential to trigger economic and security crises if pandemic risks uncontrolled	■ Increased contact between communities facilitates disease spread	■ Holistic management of social, environmental, economic, and security factors needed for stability
7. Border communities	■ Enhanced participation in regional economy	■ Porous borders raise transnational criminal risks	■ Cooperation strengthens legal integration and joint border management
8. Urbanisation	■ Growing towns open new market opportunities	■ Rapid urban growth stresses security/ governance capacity	■ Undermanaged expansion risks social tensions, crime affecting investments

East Malaysia faces growing environmental pressures from floods, landslides, and storms due to its climate and terrain. Previously hindered by poor connectivity, the PBH now provides a comprehensive highway system for emergency response, with telephones and cameras to aid hazard detection and relief coordination. Overall, the integrated highway infrastructure served as a critical enabling framework for "golden hour" emergency operations during disasters. Lives lost were minimised and recovery hastened with optimised rapid response capabilities built upon PBH accessibility.

In terms of policy recommendations, the PBH and risk management framework should optimise security objectives without undermining economic prosperity goals. Agencies capitalised on accessibility to strengthen integrated operations while communities benefitted from development opportunities. Proactive community engagement is essential for inclusive growth.

Infrastructure projects should balance development with preserving social, environmental, and cultural assets. Including education and skills training can equip communities for economic opportunities. Dynamic border security and cross-border partnerships enhance migration management cooperation and mitigate security risks.

LIMITATIONS, RECOMMENDATIONS AND FUTURE RESEARCH

The study offers initial insights into the outcomes and policy implications of the PBH in East Malaysia, but its scope and timeframe are limited to only domestic impact. The recent decision by Indonesia to relocate its capital to East Kalimantan may raise uncertainties about future economic-security dynamics and potential territorial challenges.

Governments should take integrated approaches to connectivity planning, focusing on economic, social, and security impacts. Long-term funding and sustainability are key for infrastructure longevity, with budgets accounting for future maintenance. Regular evaluations and community engagement improve effectiveness and inclusivity. Balancing development with the preservation of assets and fostering cross-border partnerships helps mitigate risks. Successful models like the PBH in East Malaysia can promote balanced growth through better accessibility.

The PBH can enhance Malaysia's military defence by incorporating auxiliary landing sites for aircraft, with emergency strips, reinforced bridges, and upgraded shoulders. Forward airbases with fencing and lighting enable quick access. Regular training exercises improve readiness for medevac and reconnaissance, while regional cooperation supports humanitarian efforts. Hardening PBH sections into dual-use runways strengthens expeditionary mobility in defence planning.

Extending future studies on regional aspirations i.e., to gauge PBH's indirect multiplier impacts on The Brunei Darussalam–Indonesia–Malaysia–Philippines East ASEAN Growth Area or BIMP-EAGA regional development aspirations likewise also hold promise.

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COMPLIANCE WITH ETHICAL STANDARDS

The authors declares that the research adheres to and respects all ethical considerations, such as confidentiality and the right to participate or withdraw.

CONFLICT OF INTEREST STATEMENT

The authors declare that there are no conflicts of interest regarding the publication of this article. All research and findings presented in this study are based on objective analysis, and no financial or personal relationships have influenced the outcomes or conclusions.

NOTES

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