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Potential Application of Artificial Intelligence In Safeguarding Malaysia-Thailand Border From Migrant Smuggling Activities: A Preliminary Assessment

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Abstract

Growing incidence of migrant smuggling in Malaysia-Thailand border has been associated with several factors such as Malaysia's porous borders, lack of enforcement and integrity issues. Currently, Malaysia does not optimally leverage on the emerging technologies such as artificial intelligence (AI) in its border control strategies, leaving the ground enforcement to rely heavily on conventional ways such as physical surveillance. This article assesses the use of AI technology in border control strategies in other countries with similar geographical characteristics of Malaysia and corroborating its potential application in the country. It leverages on a range of secondary sources, guided by three broad themes namely, border control, security, and AI technology – covering a study period from the year 2013 to 2022. This study found that in such countries as the United Kingdom and the United States of America, AI technology has been widely adapted in their border control strategy to address similar issues faced by Malaysia. Specifically, the AI technology has helped these countries to enhance data collection, intelligence sharing, field monitoring and decision making with minimal supervision and human intervention. Given the urgency to address border security threats brought by migrant smuggling in Malaysia-Thailand border areas, it is timely that Malaysia considers adapting AI technology into its border control strategy.

Keywords: migrant smuggling, border control, long and porous border, efficient border management, Artificial intelligence

Introduction

Migrant smuggling is a widespread and profitable criminal activity, often committed by transnational organized criminals across the Southeast Asia's region (UNODC, 2019). According to the UN Protocol Against the Smuggling of Migrants by Land, Sea and Air, migrant smuggling is defined as "the procurement, in order to obtain, directly or indirectly, a financial or other material benefit, of the illegal entry of a person into a State Party of which the person is not a national or permanent resident" (UNODC, 2000). Anti-migrant smuggling policy often integrates border control as part of the national's border control systems, not only to strengthen border integrity but ensuring territorial sovereignty. According to Kokkalis (2019), effective border control enables a country to ensure its territorial integrity and

sovereignty. Scholars such as Mohan and Shelly (2016) and Mohd Na'eim Ajis et al. (2018) stressed on the importance of a border control system in safeguarding a country's national security and sovereignty. Security is broadly regarded as a standard of quality of life in a democratic country as well as the ownership of human rights and civil rights (see Wisniewski and Wawrzusiszyn, 2012), while sovereignty consists of matters related to foreign affairs as well as defence forces to protect a territorial state from attacks by other countries (Hovell, 2004). A country's border control will need to be effectively and comprehensively managed to ensure national security is protected from external threats including non-traditional security threats such as migrant smuggling and human trafficking. The lack of effective border control strategy often leads to the growing incidence of cross-border crimes, including migrant smuggling and human trafficking (Na'eim Ajis et al, 2018).

Malaysia and Thailand are among the major destination countries for smuggled migrants especially in the Southeast Asian region. Smuggled migrants are often originating from low-income and developing countries, within and neighbouring the Southeast Asian region. Despite lack of official data that indicates the actual incidence of migrant smuggling (IOM, 2016), Malaysia continues to experience a high-level of cross-border migration from neighbouring countries such as Indonesia, Philippines, Myanmar and Bangladesh, and a significant portion of these flows appear to involve illicit means (UNODC, 2019). Since the border areas of Malaysia-Thailand border that covers the Malaysian states in the north namely Kelantan, Perlis, Kedah, and Perak (Ruhanas, 2009) are open, isolated, and porous (Agus, 2013), it is geographically and logistically challenging to manage the border consistently and comprehensively from any movement of people, goods and things. Rafidah Dahari et al. (2019) stressed that the weaknesses in border control management at these porous border areas have led to various forms of smuggling activities. Its porous borders (i.e., Malaysia-Thailand border) is clearly difficult to be managed using existing conventional surveillance method (Ruhanas, 2009).

Despite successful application of the artificial intelligence (AI) technology in assisting the enforcement agencies of other countries to safeguard their border integrity, Malaysia does not optimally leverage such AI technology in its border control mechanism. Other countries such as the United Kingdom (UK), the United States of America (USA) and several countries in the European Union (EU) have moved quickly to integrate "smart border" AI capabilities into their border patrol management (Tyler, 2022). At the same time, the USA has been adapting AI solar powered "autonomous surveillance towers", using thermal imaging, cameras and radar to detect moving object of an animal, vehicle or person at the border (Miroff, 2022). According to Shaji and Hoven (2020), the AI technology is capable in managing the more conventional and monotonous tasks. In the UK, AI technology has been used for the purpose of biometric tracking, surveillance, and ubiquitous facial recognition technology as part of the country border control (Hunter et al., 2018).

This study defined border control as a measure adopted by a country to regulate and monitor its borders from any movement of people, animals, and goods. According to Carlos-Roca, Torres, and Tena (2018), border control contains sub-elements to the border management model that have two tasks namely, (i) border surveillance; and (ii) border inspection. Border surveillance is the most important task in the field of national defence and security (Mohan and Shelly, 2016) and it involves the supervision of areas adjacent to or adjacent to border entrances, including initiatives taken to address any unwanted injuries to humans around the border or loss of any life when crossing the border (Carlos-Roca, Torres, and Tena, 2018). On the other hand, border inspection involves all the necessary checks at the entrance to ensure that people, vehicles, and belongings belonging to them are valid to enter the country (Carlos-

Roca, Torres, and Tena, 2018). This article aims to assess the use of AI technology in these countries with similar issues (i.e., similar geographical characteristics and migrant smuggling issues). The aim is to explore the potential of leveraging AI technology to assist and/or complement the conventional and monotonous surveillance and inspection methods by Malaysia in safeguarding the Malaysia-Thailand border in an effective, safer and comprehensive way to curb migrant smuggling activities. This article leverages on a range of secondary sources, guided by three broad themes namely, border control, security, and AI technology – covering a study period from the year 2013 to 2022. The next immediate section reviews the issues and challenges in safeguarding the Malaysia-Thailand border areas. It is then followed by the assessment of using AI technology in border control system in other countries and the benefits of using this technology into Malaysia's border control strategy.

2. A Review of Border Control In Malaysia: Issues And Challenges

Border security control is a great challenge for most countries, either continental countries or maritime countries (Kokkalis, 2019). As for Malaysia, with a wide geographical boundary, the Malaysia's border integrity and security is often exposed to various security threats, including migrant smuggling (Noor Azmi Mohd Zainol et al., 2019). The weaknesses in border control management along with the wide and long boundary have led the border to be easily breached and infringed especially when cross-border crime occurs including migrant smuggling. Difficulties and challenges in managing border security in Malaysia-Thailand border will be discussed in three following themes, namely: (i) geographical challenges; (ii) human resources, motion and workload; and (iii) integrity and coordination issues.

Geographical Challenges

The challenges in enforcing border control include the challenge of wide and long border areas (The Future of Border Management: Maintaining security, facilitating prosperity, 2015). According to Agus (2013), illegal cross-border activities at the Malaysia-Thailand border areas cannot be separated from its porous borders. Vishwanath and Sankar (2019) concurred with the views of Rafidah Dahari et al. (2019) that porous border conditions possess a challenge to the enforcement officers to control the border. This situation complicates border control strategies because wide borders require a multitude of enforcers. It is challenging to ensure that no illegal movement coming in and out of the border area because of geographical factors of the area which is located in the interior and the density of thick forests. Besides, Rafidah Dahari et al., (2019) claimed that Malaysia is a long maritime country with a hilly geographical position and a porous border that makes it difficult for the authorities to control the border. They noted that this geographical factor became a key factor that makes the smuggling of firearms, small and light weapons (SKR) being easily taken place, linked to migrants smuggling too.

Human Resources, motion, and workload

Efficient and effective border control requires technological supports and sufficient manpower. The major problem in protecting long stretches of borders is the need for large human involvement in patrolling the premises and even modest-sized areas require large human resources (Mohan and Shelly, 2016; Carlos-Roca, Torres, and Tena, 2018). Mohan and Shelly (2016) have asserted that the border troops must watch and maintain control in a specific section of the border while patrolling the border according to predetermined routes and time intervals. Their readiness is needed to act spontaneously at any time along with efficient management. At the same time, the number of undocumented immigrants crossing the border has created additional work for the law enforcement officers (Argueta, 2016). The validation

process at the border involves all the necessary checks at the entrance (Carlos-Roca, Torres, and Tena, 2018), and these activities require substantive training and experience on the ground. Individual screening and detailed manual inspection checkpoints at border crossings are time-consuming (Deloitte, 2019). These certainly burden the enforcement personnel, and lead to weaknesses in border control management. The weaknesses in border control management by local authorities eventually have given way to the entry of illegal migrants (Nuurrianti Jalli and Ismail Sualman, 2020).

Integrity and Coordination Issues

Integrity is an important element for a country in national security policy. Countries which are facing integrity problems will have a spill over effect in its administration, and in turn this affects their security control at the border. Shelley (2014) has indicated that the problems associated with human trafficking and migrant smuggling are closely related to (lack of) integrity. According to Rafidah Dahari et al., (2019), the weaknesses in border control management and integrity factors among the enforcement authorities and officers played a role in smuggling activities. They highlighted that the inspection on the ground was usually done carelessly due to integrity problems among officers. The lack of integrity in oneself also causes one to be willing to sell the dignity of the country, and act illegally for one's own self-interest (Wan Shawaluddin Wan Hassan et al., 2020). While coordination among all the agencies is aimed to achieve unity in the implementation of command and control, the lack of systematic and integrated coordination weakens the management of security control at the border (Noor Azmi Mohd Zainol et al., 2019).

3. An Assessment of Artificial Intelligence Technologies In Border Control System To Eradicate Migrant Smuggling

Artificial intelligence is often referred to as the ability of machines to learn human behaviour, and to provide responses or reactions like humans (Shabbir and Anwer, 2015). Dahria (2014) highlighted that the combination of the 'knowledge base' factor, which includes facts, theories, and the relationship between the two, and the 'inference engine' factor, which is the ability to draw conclusions based on knowledge and experience that are incorporated into the AI system – allows the computer to act as an intelligent machine and behave like humans and perform input and output processes. Such a combination (i.e., knowledge base and inference engine) makes AI capable of receiving and interpreting data entered by humans and providing answers sought by humans in a prompt manner (Dahria, 2014). According to Kokkalis (2019), AI involves technologies that can be run in existing decision systems to improve performance. Among the advantages of AI is its ability to integrate various applications, improve the internet of things (IoT) more effectively, and therefore provides better communication, interaction, and information sharing among different materials that share a common network (Sayler and Hoadley, 2019). Therefore, AI technology promises excellent improvements in terms of effectiveness and productivity

Artificial intelligence (AI) applications are currently widely and increasingly adapted in borders, migration, and security mechanisms, for a variety of purposes. Specifically, border-focused AI technology comes in multiple forms including algorithms designed to evaluate imperceptible emotional expressions, biometric analysis of fingerprints and facial recognition, as well as scanner software that can differentiate humans from wildlife in remote border sections (Tyler, 2022). It is also used for the purpose of individual risk assessment, decision support system in immigration-related matters, as well as migration monitoring and analysis (Molnar and Gill, 2018). According to Tyler (2022), AI technology offers features to supercharge this surveillance, making tools more powerful and capable of processing

and interpreting more data than in the past, and it can make preliminary determinations about possible threats and how authorities should respond in a prompt manner.

Since borders should be maintained and always ensured (Mohan and Shelly, 2016) and need to be kept under 24/7 monitoring as to ensure their peace and safety from external threats (e.g., illegal migration and terrorist activities) that are common to Malaysia, to curb such activities, the least that can be done is to provide a continuous monitoring (Mohan and Shelly, 2016). However, security issues have already been proven to be difficult to be handled through the conventional surveillance method (Kokkalis, 2019). Mohan and Shelly (2016) stated that in monitoring border in real-time and at the right time as well as minimizing the need for human support, various control technologies that support each other are required. The existing technological assets and capabilities at the border need to be improved in line with the technological sophistication used in the modus operandi of cross-border criminal syndicates which are always a step forward.

The presence of new technologies based on 'Deep-Learning Patterns' and 'Powerful Computers' such as AI technology (Sayler and Hoadley, 2019) is emergingly perceived to be helpful and strategic in the field of national security, including in border security measures. The use of AI technology potentially helps in surveillance and inspection tasks at the border in several ways that will be discussed as follows.

Immediate Way to Detect Early Potential Threats

Integrating AI technology into the job descriptions of field officers provides much-needed support in the early detection of smuggling and suspicious activities (Deloitte, 2019), including potentially movement of dangerous people and objects at sensitive areas, border crossings, customs checkpoints, and other ports of travel. This threat detection is the first step to provide efficient security – by using AI algorithms and smart sensors (Deloitte, 2019) to analyse trends and patterns of behaviour in individual traveller data that could indicate suspicious activity and using more effectively screen X-ray images of cargo and baggage (Miroff, 2022) to identify dangerous goods. The use of biometric technology could accurately match travellers to their travel documents. This also helps in improving the traffic flows at security checkpoints and flagging only certain individuals who present irregularities (IDEMIA, 2018).

Since individual screening and detailed manual inspection checkpoints at border crossings are time-consuming, by enhancing the customs agents and freight truck operators' roles with AI, they are empowered with accurate information in a timely manner. Truck operators and their vehicle license plates could be pre-screened prior to entering the customs station by using facial and image recognition technology that helps in expediting the tedious manual processes (Deloitte, 2019). The secured and accurate identification of possible dangerous goods or abnormal loads that could be instances of smuggling could be guaranteed by using artificial intelligence-enhanced X-ray scanning technology (Deloitte, 2019). The cargo metadata also could be quickly analysed to identify suspicious shipments by artificial intelligence enabled systems. (Deloitte, 2019).

According to Miroff (2022), the USA today is guarding the border routes with AI solar powered "autonomous surveillance towers" using thermal imaging, cameras and radar that can determine whether a moving object is an animal, vehicle, or person. Further, U.S. Customs and Border Protection (CBP) has deployed about 175 of the towers along the southern borders – it is part of a five-year deal with Anduril, a California-based security and defence contractor

specializing in AI systems, which they believe the most advanced surveillance technology that allows the agency to detect and intercept more illegal entries along the border without increased staffing (Miroff, 2022). Resendiz (2022) highlighted that Border Patrol agents at the east of El Paso (in USA) use AI cameras and other technologies to detect and rescue migrants in mountains and desert terrains. Such cameras that are equipped with a 3-mile visual radius and night vision technology can detect anything within its area, either the changes in landscape or exact locations of individuals and groups in the desert, track the folks coming through by narrowing down the response time and narrowing down apprehension, thus give agents cues as to whether anyone in a large group may be carrying a weapon.

In the United Kingdom (UK), AI is used for the purpose of biometric tracking, surveillance, and ubiquitous facial recognition technology (Hunter et al., 2018). In recent years, authorities particularly in USA and some countries in the European Union (EU) have moved quickly to integrate "smart border" AI capabilities into their operations, heralding a potential game-changing moment for the ability of governments to patrol their borders (Tyler, 2022). The border security robot which uses a wireless camera to continuously monitor the border, can detect and apprehend illegal aliens, drugs, and other illegal activities from all vehicle traffic that stop at security check points (which are set up on the international roads), while the border troop watches and maintains control in a specific section of the border according to predetermined routes and time intervals (Mohan and Shelly, 2016). In USA, the Trump's administration argued that the border wall is a necessary deterrent to drug smugglers and immigrants seeking to enter the country unlawfully (Brookings, 2017). According to Ghaffary (2020), such measure under the Trumph's administration is a smart wall that could help identify unauthorized individuals crossing the borders, specifically in remote stretches of land between established ports of entry. It was reported that smart gates are generally faster and more efficient than the manual alternative, and this proves that AI technology does not only boost security but also reduce waiting times (ETIAS, 2016). An American company has been working on robotic border guards with lie detectors that are capable to detect suspicious movement patterns and pick up on body language indicating deception and has proven to be effective in detecting lies using cues such as facial expressions, something which may be difficult for humans to pick up on (ETIAS News, 2021). Thus, AI guards could guarantee a more secure solution to border control.

Enhance Decision Making and Help to Plan and React Better

Due to a handful of data being tracked every day and being placed in a scattered way, human will difficultly unlock, integrate previously siloed datasets, and reveal their connections. However, when available data is used with machine-learning algorithms, they are capable to integrate all the datasets, reveal the connections, and hence, they are capable to improve predictions i.e., can better anticipate travel activity and potential threats, and ultimately capable to deploy resources at security checkpoints (Kokkalis, 2019). This could be seen in the United States-Mexico border areas whereby AI technology is used to access data from surveillance videos, hence being a medium for Command and Control (Kokkalis, 2019). AI system helps to plan for an action if anything goes astray, and allocation as well as deployment of security resources becomes much easier with it (Deloitte, 2019). In China, the use of AI technology is utilized to access and coordinate data as well as to identify face recognition through surveillance cameras to locate, track and record the Turkic Uighur population (Hunter et al., 2018).

AI technology also guarantees agility and timely actions when human lives are at risk by assessing and forwarding to the decision maker only the essential information that will support human-related command and control systems. It can also provide concise and accurate suggestions to decision makers for the subsequent course of actions (Sayler and Hoadley,

2019). AI technology can work with security agents to re-allocate or deploy personnel of security staffing directly to areas of the border where they would be most effective by employing the use of smart sensors coupled with integrated datasets on migration patterns, crossing activity, demographics, environmental data and more (Deloitte, 2019).

Data Consistency, Accuracy and Privacy

Certainly, border security agencies must deal with a large amount of data. These include travellers' identification, baggage data, data related to travel activities, and area activities. Therefore, when it comes to security whereby data is fundamentally important, a single error in a set of data analytics can create major problems, eventually can also cause chaos to the security of a country on that single error (Deloitte, 2019). Therefore, the implementation of data analytics software in AI technology would enhance this analytics process for better management by analysing data accurately and systematically. It is also able to accurately simulate variegated scenarios which then capable to evaluate current and developed responses in an interactive feedback process. While state-of-the-art technology will be used to encrypt personal data, protecting it from cyber-attacks and identity theft (Deloitte, 2019).

Integrating artificial intelligence into border security services has great potential for a higher level of consistency that would not be possible with human operators alone (Deloitte, 2019) .To avoid inherent bias present in the algorithms used like biometric technology and facial recognition (model for type of detection software), it is important to ensure the new data is consistently being used to train the models, improving the accuracy and reliability of the results such as re-focus security personnel to address only certain individuals (IDEMIA, 2018).

ETIAS (European Travel Information and Authorization System), a fully electronic system that was established by The European Commission (EC) keeps track the visitors from countries who do not need a visa to enter the Schengen Zone. The system collects information that will only be accessed by authorized personnel, such as border authorities or police officers, when necessary. This is in line with the EU's principle to protect the fundamental right to privacy, which guarantee the privacy and security for all data collected (ETIAS, 2016).

Discussion

Porous borders and complex nature of migrant smuggling makes human surveillance at the border areas is extremely challenging. Previous studies have shown how Malaysian borders have been easily breached by smuggling syndicates, associated with Malaysia's geographical porousness, lack of enforcement and integrity issues. Apart from the growing illegal entries of economic migrants, the influx of forced migrants such as the stateless Rohingya refugees from Myanmar into Malaysia is a direct manifestation and implication of poor border security measures. In the meantime, Thailand which shares long borders with Malaysia (i.e., Peninsular Malaysia) continues to serve as a transit point for countless of irregular migrants and refugees from the region, awaiting opportunity to cross Malaysia-Thailand borders (Intan Suria Hamzah et al., 2016). Existing research also indicated active migrant smuggling syndicates who are offering smuggling services to migrants and refugees to be smuggled into Malaysia. These smuggling syndicates act in many forms, including as travel fee collectors, strategists and the boat smugglers transporting undesired migrants from Thailand to Malaysia (Lawrence, 2012). This reinforces the importance of strengthening border security measures, and those conventional measures are no longer adequate to address such threats effectively. In USA, UK,

China, and several EU countries, where AI technology has been optimally leveraged, issues such as those faced by Malaysia have been effectively addressed. Therefore, there are some immediate benefits that Malaysia can enjoy when integrating AI technology into its border control management.

Minimize Manpower Utilization and Overcome Human Weaknesses

As mentioned, several times in this article, AI technology helps in reducing the burden faced by the field officers on the ground. These include back-office operations where process is time-consuming, tedious, extraneous, and low-value-added activities that ultimately distract from the core mission, either in planning and preparing task, serving in field operations, or supporting complex resourcing logistics (Deloitte, 2019). Deloitte (2019) cautioned that AI technology does not mean to replace humans outright, instead it substitutes the existing border control mechanisms for specific assignments, allowing field officers to refocus their time and energy on more complex reasoning tasks where AI technology does not have the capability to address i.e., emotional intelligence. Since AI technology is capable in completing complex pattern analyses that human cannot do due to the volumes of data involved, it will help in providing with critical information, thus helps those who oversee protecting the countries to do their jobs more effectively (Hunter et al., 2018).

Efficient Border Control Management

While the collaboration of AI technologies with humans will help in minimizing manpower utilization, it then could also help to provide smooth and efficient services and improve field activities. According to Morales-Ponce (2019), transporting goods across borders is a common scenario, and smuggling is a common crime across borders. Therefore, to maintain proper security, it can be a tedious and time-consuming process for customs officers to conduct the security checks. Monitoring public and transport activities is also a strenuous process, and the naked eye can miss a lot of suspicious activities. Even if there are CCTV cameras in place, monitoring them manually takes much time and manpower manual checking can often lead to mistakes. Therefore, when AI technology gets connected with CCTV's, it can automate this process with automated surveillance. Vehicles can undergo both driver and vehicle identification with the help of smart identification systems, and this could achieve timely supervision. Besides, such illegal activities as trespassing, intrusion and duress get easily detected by combining migration pattern, demographics, border activity data and environmental data. Artificial intelligence could spot dangerous activities across the area, and easy detection of suspicious people and objects. The security team gets an instant alert once the system detects any of the dangerous activities. Then, the cargo weight measurement can be conducted with the help of an automated weighbridge. The smart sensors can also check the cargo automatically and gives an insight of what contains inside the packages. This makes detection of illegal elements easier.

Researchers mostly agreed that wide and porous borders require AI deployment assistance because of its capabilities to achieve timely preparedness, achieve efficient border control management, minimize security risks, and increase coordination as well as integration. At the same time, border security agencies can leverage the use of AI technologies to perform a variety of activities, improve operational efficiency, optimize appropriate timing, and respond quickly (Slapakova, 2021; Fedorovich, 2021; Smith, 2017; Siddarth, 2016; Morales-Ponce, 2019; Jain, 2013). There are a lot of successful case studies highlighting the use of AI technologies in the border security sector (Kasapoglu and Kirdemir, 2019; Sanchez, 2020; Macrocosmscience, 2021). Their roles in border control in terms of executing field operations i.e., surveillance and inspection tasks – have been widely discussed in previous studies as mentioned above i.e., early detection of threats (Resendiz, 2022; Miroff, 2022; and Hunter et

al., 2018), data reliability (Delloite, 2019), and being part of command-and-control system (Kokkalis, 2019; and Hunter et al., 2018). Since manual patrolling under the conventional border surveillance system requires large human resources – to monitor the border in real-time with accuracy, multiple surveillance technologies, which complement each other are required (***Carlos-Roca, Torres and Tena, 2018).***

Despite less attention of AI technology in previous studies in Malaysia, scholars persistently emphasized on the benefits of using modern technologies at the border. Abdul Rahman Alavi, et al. (2020) indicated that in order to purge criminal insurgency, it is very important to increase the use of technologies in security operations. Mohd Firdaus Shahri and Mohd Ikbal Mohd Huda (2021) were of the opinion that assets that can move quickly and efficiently are needed to assist in the enforcement of security controls at long and wide borders. It has also been suggested that existing assets for border enforcement activities must be improved in terms of technological capabilities so that cross-border crime can be tackled more systematically and efficiently (Norcikeyonn Samuni et al., 2015).

Justification of Using Artificial Intelligence Technology to Support Malaysia-Thailand's Conventional Border Control Measures

The arrival of illegal immigrants on a large scale has affected Malaysia's image on the international stage. Malaysia has been perceived as a weak country in terms of border control (Intan Suria Hamzah et al, 2016). Therefore, the issue of border control must continue to be given serious attention by all parties to strengthen border integrity, national security and Malaysia's image at the global level. Mohd Na'eim Ajis et al. (2018) who analysed migrant smuggling activities in the North of Peninsular Malaysia, stated that the border security of a country needs to be constantly improved from time to time. Continuous monitoring, coordination and integration across different agencies need to be prioritized to achieve effective and comprehensive security controls at the border. Here lies the importance of adapting AI technology in Malaysia's border control measures.

Conclusion

Smugglers easily crossing Malaysia's borders suggests the need for Malaysia to strengthen its border control measures and border security. This effort is crucial to address the security threats externally which in turn can threaten the security and sovereignty of the country. Examples from such countries like USA, UK, China, and several EU countries have shown that the problems and challenges of enforcing security controls at the border, as pertains to land borders that are physically wide and porous, demand the usage of AI technology to support limited manpower. AI technology could aid and complement existing border security measures in an effective, strategic and safer way. AI technology can also make various contributions in certain areas and functions in border control such as better data collection, continuous monitoring in a timely manner, receiving instructions, enhancing decision making and performance at the borders without much supervision and human intervention.

To conclude, as shown in other countries, the utilization of AI technology at the Malaysia-Thailand border can potentially assist enforcement agencies to work efficiently. It is because this utilization seems to be capable of improving the level of national security at the border and will comprehensively address the external security threat including migrant smuggling activities. Malaysia's jumps start effort in moving forward the field of AI technology in line with the era of Industry 4.0 should move all parties in

the future to embrace this technology for a more robust and its widespread use especially in monitoring border security. To achieve this goal, studies on the role and usage of AI especially for border control will need to be intensified. This will hopefully lead to improvement in monitoring Malaysian borders.

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