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Dry Port Location Selection for Integration with Inland Waterway Transport in Developing Countries: A Case Study in Cambodia

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Abstract

The research highlights the current state of dry ports in Cambodia, primarily concentrated around Phnom Penh and reliant on trucking, noting challenges such as limited connectivity, fragmentation, and high operating costs. It emphasizes the potential of integrating dry ports with the Mekong, Tonle Sap, and Bassac rivers to enhance logistics efficiency and reduce costs.

The study proposes a framework for dry port location selection considering factors relevant to a developing economy:

Proximity to Cargo Generation and Consumption Centers: *Including agricultural hubs, industrial zones/SEZs with waterway access, and major consumption centers like Phnom Penh.*

Inland Waterway Network Connectivity and Capacity: *Assessing navigability, draft limitations, existing and planned infrastructure (like the Funan Techo Canal and PPAP terminals), and identifying bottlenecks.*

Intermodal Connectivity: *Crucially, integration with the road network for last-mile delivery and the potential for future rail connectivity.*

Land Availability and Suitability: *Identifying sufficient, suitable land along waterways, considering flood risk and site preparation costs.*

Regulatory and Institutional Environment: *Examining customs procedures, government support, and alignment with logistics policies.*

In conclusion, the study posits that strategically located dry ports integrated with inland waterways are vital for improving Cambodia's logistics performance and economic growth. It underscores the importance of the government's master plan and ongoing infrastructure projects, suggesting that addressing the identified challenges through detailed feasibility studies is the necessary next step to realize the potential of Cambodia's waterway-based logistics network.

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Introduction

The increasing flow of container traffic by sea and the use of larger ships have led to significant problems at seaports, such as ongoing congestion, strain on port infrastructure, and containers staying at the port for too long. These issues have made main seaports in many countries less competitive. Dry ports were introduced as a solution to these problems, aiming to improve how much cargo seaports can handle and how well they perform, while also shortening the distance goods need to travel between the seaport and inland areas [1,2]. They are essentially seen as extensions of seaports that facilitate the movement of goods between the coast and inland regions.

A crucial element for a dry port to be successful is its location. The choice of location directly impacts how far containers must travel, as well as the expenses associated with transport and how easily accessible major transport routes like highways and railways are. However, when deciding where to place dry ports, it's also essential that the network supports global efforts towards sustainability. The Paris Agreement, for example, emphasizes reaching net-zero emissions by 2050, with the transport sector playing a significant role. suggest that a well-planned network of dry ports can help reduce pollution from logistics by encouraging the use of more environmentally friendly transport methods. Currently, many dry ports primarily rely on road connections with limited access to inland waterways. Despite this, inland waterway transport is recognized as an economical, fuel- efficient, and low-cost option for both developed and developing nations. It has a smaller negative environmental footprint compared to road, rail, or air transport. Furthermore, shifting more cargo to inland waterways can help ease traffic congestion on main roads.

In summary, if dry ports can effectively promote the use of multiple transport modes in inland areas, including inland waterways, they can contribute to resolving sustainability challenges in the global logistics sector. In Western Europe, inland waterway transport has become a vital component of dry port operations, with barge transport gaining a considerable share in moving containers between the Rhine-Scheldt-Meuse delta and the European interior. These dry ports utilizing barges can overcome the limitations of the waterway network by integrating with rail transport [3,4]. However, in other parts of the world, particularly in developing countries, this combination of transport modes has not progressed significantly over time. Poor connections with other transport options, especially rail, have limited the service areas of inland terminals and prevented them from effectively channeling large volumes of containers via inland rivers.

Therefore, the main purpose of this paper is to propose a systematic approach for choosing the most suitable dry port location, with a specific focus on how well it can integrate with inland waterway transport in developing countries. This approach considers the objectives of three key groups: government bodies and advisors, the owners and operators of the dry ports, and the businesses that use the dry ports. A study focusing on Northern Vietnam will be used to demonstrate how this approach works.

The remaining sections of the paper will cover the following: Section 2 will review existing research to identify gaps that this study addresses. Section 3 will provide an overview of the research methods used. Section 4 will apply the proposed framework to a case study in Northern Vietnam. Section 5 will discuss the main findings, and Section 6 will conclude the paper, outlining its limitations and suggesting areas for future research.

While the text specifically mentions a case study in Northern Vietnam, the general principles discussed regarding the challenges of seaport congestion, the role of dry ports, the importance of optimal location considering sustainability and intermodal transport (especially inland waterways), and the need for integrated planning considering different stakeholders are highly relevant to studying the potential for dry port development in Cambodia. Cambodia faces similar challenges with its seaports and has significant inland

waterways that could be utilized more effectively to improve logistics efficiency and sustainability.

Literature Review

In this section, we discuss key findings from the literature concerning core concepts and various methods used for selecting dry port locations in developing countries. These methods include least- cost models and multi-criteria decision analysis. Additionally, we provide a list of factors that influence the selection of dry port locations in these regions. A conclusion summarizing the research gaps is provided at the end of this section.

Core Concepts

In 1986, Hanappe first introduced the term "dry ports" in a scientific journal, describing it similarly as an inland terminal that serves a port. Today, several terms are used to describe this facility, including dry port, inland terminal, inland port, inland hub, inland logistics center, and freight village. Among these, "dry port" is one of the most commonly used terms (Varese et al., 2020) [5].

Jaržemskis and Vasiliauskas (2007) characterized a dry port as "a port located in the hinterland that services an industrial or commercial region [6]. It is connected with one or several seaports via rail and/or road transport and offers specialized services between the dry port and transmarine destinations. Typically, the dry port is container and multimodal-oriented and possesses all logistics facilities required for shipping and forwarding agents at a port." Meanwhile, provided a simpler definition of a dry port as "an inland intermodal terminal directly connected to seaports with high-capacity transport means, where customers can leave or pick up their standardized units as if directly at a seaport [7]." This research primarily focuses on dry ports in integration with inland waterway transport. According to a model by, inland waterways can be effectively integrated into existing dry port-based intermodal transport systems.

Methods Used for Selecting Dry Port Location in Developing Countries

Least-Cost Models

Many established models for deciding the best location for facilities heavily emphasize how transport expenses influence the ideal site. These approaches, which aim to minimize transport costs, include methods such as the conditional logit model, mixed-integer programming, dynamic programming, and the center of gravity model. Researchers have addressed this location challenge by developing mathematical programming models and various facility location frameworks [8]. To find solutions for these complex problems, researchers frequently use sophisticated techniques like greedy algorithms, genetic algorithms, and other heuristic methods [3]. Additional tools used include cluster analysis, spatial models, data mining, and complex network theory. However, pointed out a key limitation: these methods most commonly focus on quantifiable criteria, such as cost and distance, often neglecting qualitative aspects.

For dry port location planning specifically in developing countries, the process involves multiple parties (stakeholders), including the companies operating the ports, the businesses using them, and the local community. Consequently, beyond just the costs of logistics, planners must consider many non-monetary (qualitative) location factors that are important to these stakeholders. Effective dry port planning should incorporate diverse qualitative factors like environmental impact, the availability of suitable land and labor, the level of technological infrastructure, support for regional trade activities, and the overall reliability of services. For instance, a study in Vietnam, a developing nation, by demonstrated that the route resulting in the lowest environmental emissions (the "greenest" option) was not necessarily the most cost-effective overall. Their research explicitly considered environmental factors, not solely financial costs. Furthermore, dry ports in developing economies are often built to support industrial zones focused on exports, making land availability a primary driver for their location. This also means their placement is more influenced by the interests of businesses reliant on land-based activities compared to the situation in developed countries. Ultimately, the factors that influence where a dry port is located are varied; they can be economic or non-economic, involve direct costs or not, and be either measurable (quantitative) or descriptive (qualitative).

Multi-Criteria Decision Analysis (MCDA) Approach

The Multi-Criteria Decision Analysis (MCDA) frame

work is well-suited for tackling the issue of selecting dry port locations because it can evaluate both measurable (quantitative) data and descriptive (qualitative) factors.

In Asia, specifically, considerable research has explored Chinese dry ports using various criteria and different MCDA techniques. For instance, used a combination of fuzzy Analytical Hierarchy Process (AHP) and Elimination Et Choix Traduisant la Realité (ELECTRE) to choose the best dry port construction projects along China's New Eurasia Continental Bridges (NECB) route, incorporating qualitative considerations like political and environmental aspects. applied the Analytic Network Process (ANP) to identify dry port sites near the Tianjin Port area, taking into account specific qualitative elements such as the natural and operational environments, along with infrastructure conditions, in addition to quantitative data [9,10].

Beyond Asia, a study in the Western Balkans utilized environmental and socio-political criteria to assess potential new dry port locations, responding to current market trends. Returning to the Asian context, employed the consistent fuzzy preference relations method to suggest ways to improve Vietnam's logistics systems, considering factors related to logistics infrastructure connections, service quality, regulatory frameworks, technology levels, workforce skills, manufacturing logistics links, telecommunications, international cooperation, and financial services. More recently, proposed a methodology to pinpoint the optimal location for a new dry port, demonstrated with a case study of Bangladesh's main port, Chittagong [11,12]. Their work involved three MCDA techniques: fuzzy AHP, Best Worst Method (BWM), and the Preference Ranking Organization Method for Enrichment Evaluation (PROMETHEE).

In essence, these examples show how MCDA methods are valuable tools for incorporating the diverse, often qualitative, factors crucial for complex location decisions like those for dry ports, particularly in dynamic environments like those found in many developing countries.

Factors Influencing the Selection of Dry Port Location in Developing Countries

There are differences in the list of factors considered important by decision-makers in selecting dry port locations in developed and developing countries. While economic factors such as transport cost and time, along with accessibility factors like proximity to various means of transport, are commonly considered in both contexts, distinctions are evident in location factors. Dry ports in developing nations are predominantly land-based and are often situated near local production bases, such as industrial zones or even within economic zones, as seen in India, South Africa and Vietnam. Therefore, factors related to this characteristic, such as proximity to production bases and proximity to consumption markets, are more heavily weighted in the selection process in developing nations [12,13]. Some studies analyzing dry port location selection in developed countries also consider these factors, but assign them less significance, such as the low weighting of the factor "integration into the main supply chain", indicated by variables like "distance to a principal freight corridor" and "distance to a principal passenger corridor".

Political factors are also considered differently in the selection of dry port locations by developed and developing countries. In more advanced economies, dry ports are typically privately owned, as in the United Kingdom, or co-owned by the private sector and municipality, as in Europe [7,14]. Conversely, in developing countries, dry ports are often funded and operated by the government. Total state ownership is a prevalent investment model for dry port development in these nations, exemplified by cases in China and Nigeria [14,15]. Thus, political factors are given more consideration in developing countries when selecting dry port locations also highlighted that the political significance of dry ports in promoting regional integration and development holds greater importance compared to developed nations. [8,16].

Conclusion of Literature Review

The selection of dry port locations is a well-established topic in the literature. Previous research has aimed to develop various frameworks to aid stakeholders in selecting optimal sites for dry ports. Many studies have explored dry ports within the context of inland waterway container terminals, considering their potential

for sustainable logistics development. However, these studies have predominantly focused on advanced economies.

In recent years, an increasing number of researchers have recognized the stagnant integration of dry ports with inland waterways in developing nations, despite significant potential. Notably, no case study has been analyzed in Vietnam concerning the selection of dry port locations with a focus on integration with inland waterway transport, which could serve as a model for similar developing countries.

The least-cost mathematical model for dry port positioning, effective in advanced economies, proves inadequate for developing systems in this research. This is due to the need to emphasize specific qualitative criteria related to cultural, societal, and political contexts. Multi-criteria decision analysis (MCDA) methods are better suited to address this complexity, capable of analyzing both quantitative and qualitative factors and facilitating decision-making involving multiple stakeholders.

Methodology

This section first outlines the methodology process flow proposed in this paper, followed by detailed explanations of each method used. For data gathering, both literature review and stakeholder interviews.
Here is a paraphrase of the provided text, adapted to highlight its relevance for understanding dry port considerations in a developing country context like Cambodia:
The criteria used for decision-making in this particular case study were derived from existing academic literature, supplemented by insights from Vietnamese experts to specifically address the factors crucial for this location selection challenge. When assessing the importance of the main factors, economic considerations were deemed the most significant, carrying a weight of 0.36. According to the experts consulted in Vietnam, most businesses, including those in logistics and import/export, primarily focus on profitability. For growing companies in a developing nation, a solid financial footing is seen as key to expanding both domestically and internationally.

In contrast, environmental factors were considered the least important criterion. While environmental is increasing in Vietnam, and some logistics firms are exploring greener transport options like inland waterways, these early efforts haven't elevated environmental concerns to the same level of importance as economic benefits, location attributes, or accessibility in this specific decision.

Looking at the specific sub-criteria, the potential for reducing transport costs received the highest weight at 0.24. This reflects a significant challenge for businesses in Vietnam, where transport expenses make up roughly 60% of total logistics costs [17]. Such high costs heavily impact profits, particularly given fluctuating fuel prices. All other sub-criteria were assigned weights below 0.1. Notably, access to railway infrastructure had the lowest weight among the sub- criteria (0.02). This low weighting is due to the fact that railway networks in Northern Vietnam are not optimally configured for freight transport. Only one of the dry ports considered, Hai Linh, is connected to the rail line, but even it struggles to fully utilize the rail service due to operational schedules.

Regarding the final evaluation of the five potential dry port locations, Phu Dong dry port in Hanoi was ranked first. Its strong position is attributed to its high scores on the most heavily weighted criteria, including its potential to decrease transport costs (weighted 0.24), its closeness to production centers (0.12), good road access (0.09), and proximity to other logistics facilities (0.08). Furthermore, Phu Dong significantly outperformed other options in performance data for certain criteria, such as cargo handling capacity, closeness to consumer markets, and potential for future expansion.

Hai Linh dry port secured the second position. This ranking is understandable given its top performance in the most critical criterion, reducing transport costs, and being the sole option with a railway connection. However, it did not achieve the top rank because it showed weaker performance in other areas, such as cargo throughput capacity, proximity to markets, and expansion potential.

The results of this research, including the weights assigned to the criteria and the final ranking of the dry port alternatives, were discussed and confirmed as useful and valid by the Vietnamese experts.

Conclusion, Limitations, and Further Research Direction

In conclusion, this research presents a methodology framework for determining the optimal dry port location for integration with inland waterway transport in developing countries. A case study in Northern Vietnam, involving five alternative dry port locations, is proposed to test this methodology framework. Four main criteria are considered in this case study: economic, accessibility, location, and environmental criteria. Economic criteria are evaluated by three sub- criteria: decrease in transport cost, increase in transport time, and cargo throughput capacity. Accessibility is divided into accessibility to inland waterway infrastructure, road infrastructure, railway infrastructure, and seaport infrastructure. Location criteria include proximity to other logistics platforms, proximity to production bases, proximity to consumption markets, and room for expansion. Environmental criteria encompass a decrease in air pollution, a decrease in transport congestion, and an impact on urban areas.

Despite differences in the preferences of the three expert groups, the final aggregated results indicate that the most important criterion is economic, followed by location and accessibility. The environment is the least important criterion in the selection of a dry port location for integration with inland waterway transport in Northern Vietnam. Among the sub-criteria, the decrease in transport cost is assigned the highest weight, which is twelve times higher than the weight of accessibility to railway infrastructure, the least important sub-criterion. Phu Dong dry port, located in Hanoi, surpasses the other four alternatives and is chosen as the best location for the Vietnamese government to invest in developing integration with inland waterway transport.

This research contributes to the literature by addressing the gap in dry port location selection for integration with inland waterway transport in developing countries. The case study in Northern Vietnam, along with the combination of BWM and ELECTRE III, is scrutinized for the first time in this field. This methodology framework.

Conclusion and Research Implications (Relevant to Cambodia)

In summary, this research proposes a systematic (a methodology framework) for identifying the most suitable location for dry ports that integrate with inland waterway transport, specifically designed for developing countries. This methodology was tested through a case study involving five potential dry port sites in Northern Vietnam. The study considered four main categories of criteria: economic factors, accessibility (to various transport modes), location attributes, and environmental impacts. Within these main categories, specific sub-criteria were evaluated: economic factors looked at reducing transport costs and time, and cargo capacity; accessibility considered links to inland waterways, roads, railways, and seaports; location focused on closeness to other logistics hubs, production sites, consumer markets, and potential for expansion; and environmental criteria included reductions in air pollution and traffic congestion, and impact on urban areas. Although the experts consulted represented different perspectives, the combined results clearly showed that economic factors were the most crucial criteria in selecting a dry port location for inland waterway integration in Northern Vietnam. Location and accessibility followed in importance, while environmental considerations were deemed the least significant. Among the specific sub-criteria, the potential to decrease transport costs was assigned the highest weight – twelve times greater than the weight given to accessibility to railway infrastructure, which was the least important sub-criterion. Applying this weighted assessment, the Phu Dong dry port in Hanoi emerged as the top-ranked option among the five alternatives, suggested as the best site for the Vietnamese government to invest in for developing inland waterway integration [19-25].

Conclusion

The development of dry ports integrated with inland waterway transport holds significant potential for enhancing Cambodia's logistics performance and supporting its economic growth. Strategic location selection, guided by criteria that consider proximity to cargo sources, waterway connectivity and capacity, intermodal links, and land suitability, is paramount. The Cambodian government's focus on intermodal transport in its master plan, coupled with specific projects like the Funan Techo Canal and PPAP's terminal development, provides a strong foundation. By addressing the inherent challenges of infrastructure development, regulatory efficiency, and capacity

building, Cambodia can effectively leverage its inland waterways to create a more cost- effective and integrated logistics network, ultimately boosting its competitiveness in regional and international trade. A detailed feasibility study for specific prioritized locations, taking into account cargo volumes, infrastructure costs, environmental impacts, and stakeholder interests, would be the next crucial step in realizing this potential.

This research contributes to the existing body of knowledge by addressing a specific gap: the selection of dry port locations with a focus on integrating with inland waterway transport within the context of developing nations. The use of the Northern Vietnam case study, combined with the application of the BWM and ELECTRE III multi-criteria decision analysis methods, represents a novel contribution in this field.

This methodology framework is considered adaptable for use in other developing nations that are also interested in choosing optimal dry port locations connected with inland waterway transport.

The paper acknowledges several constraints in its approach. Firstly, all three groups of stakeholders (policymakers, owners/operators, users) were treated as having equal importance in the decision-making process. Future studies could delve deeper into stakeholder analysis to better understand and potentially assign different levels of influence to each group. Secondly, the process of obtaining preferences from stakeholders sometimes revealed inconsistencies in their comparisons between criteria. While the authors explained the method again and asked experts to revise their input for consistency, this intervention might have introduced some potential bias into the results. Thirdly, the list of decision criteria used could potentially be refined with input from a wider range of experts offering diverse viewpoints. For future research, it would be beneficial to include factors such as customs procedures and associated costs at different dry ports, particularly if these vary significantly when containers move from seaports to inland locations. Additionally, since the dry ports analyzed in this specific case study primarily served distinct areas, future research could examine a situation where alternative dry ports are in direct competition, serving overlapping areas. This could offer deeper insights into the trade-offs involved when evaluating different criteria in a competitive environment.

Cambodia, with its extensive inland waterway network centered around the Mekong, Tonle Sap, and Bassac rivers, presents a compelling case study for the strategic location of dry ports integrated with river transport. Such integration is seen as crucial for improving logistics efficiency, reducing transport costs, and supporting the country's economic development, aligning with the government's "Comprehensive Master Plan on Cambodia Intermodal Transport and Logistics System 2023-2033" (CITLS-MP).

Currently, Cambodia's dry port landscape is characterized by a number of facilities, predominantly clustered around Phnom Penh and often linked to trucking operations. While existing, these dry ports face challenges including limited connectivity, fragmentation, and high operating costs compared to regional peers. Recognizing these limitations, the Cambodian government and entities like the Phnom Penh Autonomous Port (PPAP) are prioritizing the development of a more integrated and efficient logistics system that leverages the potential of inland waterways.

The strategic selection of dry port locations in this context is a complex undertaking, requiring careful consideration of various factors pertinent to a developing economy. Drawing upon general criteria for dry port location and the specific conditions in Cambodia, key considerations for integrating with inland waterway transport include:

Proximity to Cargo Generation and Consumption Centers:

- Agricultural Hubs: Provinces bordering the Mekong and Tonle Sap are significant agricultural producers, particularly of rice. Locating dry ports near these areas would facilitate the efficient collection and transport of agricultural products by waterway to processing centers or export points.
- Industrial Zones and SEZs: Cambodia has a growing number of Special Economic Zones (SEZs) and industrial areas. Identifying SEZs and industrial clusters with existing or planned access to navigable waterways is vital to enable

the seamless flow of raw materials and finished goods via river transport.

- Major Consumption Centers: Phnom Penh, as the capital and a major consumption hub, is a natural focal point. Dry ports near Phnom Penh with good waterway and road connections can serve as crucial nodes for distributing imported goods and consolidating exports.

Inland Waterway Network Connectivity and Capacity:

- **Navigability and Draft:** The feasibility of year-round navigation and the draft limitations of different sections of the river network are critical. Dry port locations must be situated on waterways that can accommodate relevant vessel sizes consistently. While the main rivers offer significant navigable lengths, some tributaries and sections may have seasonal limitations.
- **Existing and Planned Waterway Infrastructure:** Leveraging existing PPAP terminals and incorporating planned waterway improvements and new sub-feeder terminals outlined in the CITLS-MP is essential for network integration. The Funan Techo Canal, a major upcoming project connecting the Mekong to the coast, will significantly alter waterway logistics patterns and create new opportunities for dry port locations along its route.
- **Bottlenecks:** Identifying and understanding current bottlenecks in the waterway network, such as areas requiring dredging or lacking adequate navigation aids, is important for assessing the immediate and future viability of potential dry port sites.

Intermodal Connectivity:

- **Road Network Integration:** Dry ports must have excellent road connections to the hinterland, allowing for efficient first and last-mile delivery of cargo that moves by waterway. The quality and capacity of connecting roads are crucial to avoid creating new bottlenecks.
- **Rail Connectivity (Potential):** While Cambodia's railway network is less extensive than its road or waterway networks, future plans for rail development could offer additional intermodal opportunities. Identifying potential dry port locations that could eventually integrate with the rail network might be a long-term consideration.

Land Availability and Suitability:

- Sufficient Area: Dry ports require significant land area for container yards, warehouses, customs facilities, and potential future expansion. Identifying suitable land parcels along navigable waterways that are not prone to severe flooding and have appropriate zoning is a key challenge.
- Site Preparedness: The cost and effort required for site preparation, including potential dredging or land filling, need to be factored into the location selection.

Regulatory and Institutional Environment:

- Customs and Border Control: The presence of streamlined customs procedures and potentially integrated border control facilities at or near the dry port is crucial for facilitating the movement of international cargo.
- Government Support and Policies: Alignment with the government's logistics master plan and the availability of incentives for dry port development and waterway usage are important factors.

Potential Areas for Dry Port Development Integrated with Inland Waterways in Cambodia:

Based on the above factors and the available information, potential areas for developing dry ports integrated with inland waterway transport in Cambodia could include:

- **Areas surrounding Phnom Penh:** Leveraging the existing importance of PPAP and the high volume of cargo movement in and out of the capital, strategic locations along the Mekong, Tonle Sap, or Bassac rivers near Phnom Penh with good road connections to industrial zones and consumption centers would be prime candidates. The planned Phnom Penh Logistics Complex (PPLC) aligns with this.
- **Locations along the Mekong River north and south of Phnom Penh:** Targeting areas in provinces with significant agricultural production (e.g., Kampong Cham, Prey Veng, Kandal) that have good access to the Mekong could facilitate the aggregation and transport of agricultural

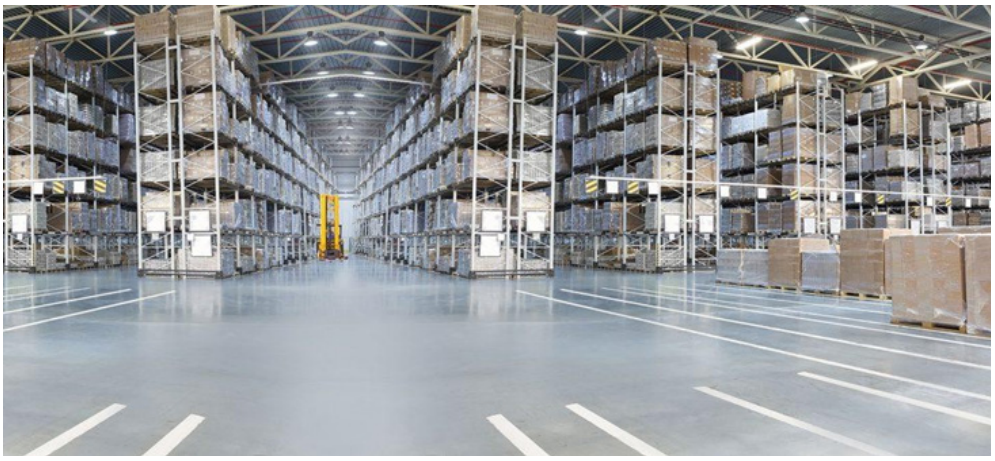
products by barge.The PPAP's sub-feeder terminals in these areas are a step in this direction.

- **Locations along the Tonle Sap River:** Connecting the Tonle Sap region, another important agricultural area and a gateway to the northwestern provinces, to the waterway network through a dry port could enhance intermodal transport options.
- **Areas along the route of the Funan Techo Canal:** Upon completion, this canal will open up new possibilities for dry port locations, connecting the Mekong River directly to the coastal areas and potentially facilitating direct barge traffic to/from Sihanoukville Autonomous Port and international maritime routes, reducing reliance on transit through Vietnam.

Challenges in a Developing Country Context:

Developing dry ports integrated with inland waterways in Cambodia, as in many developing countries, faces several challenges:

- Funding and Investment: Securing sufficient investment for infrastructure development, including dry port facilities and necessary waterway improvements, can be a significant hurdle.
- Institutional Coordination: Effective coordination among various government ministries, port authorities, and private sector stakeholders is essential for successful planning and implementation.
- Capacity Building: Developing the necessary skills and expertise in logistics management, dry port operations, and intermodal transport is crucial.
- Informal Costs: Addressing issues related to informal payments and a lack of transparency in logistics costs is necessary to improve efficiency and competitiveness.
- Infrastructure Quality: Ensuring the quality and maintenance of both waterway and connecting road infrastructure is vital for reliable operations.



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