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The Factors of Supply chain management in Cambodia related to agricultural exports, logistics, value chain integration, and operational capacity

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Abstract

This study aims to assess the critical factors influencing the supply chain management of Cambodian cassava, a vital agricultural export. As a major contributor to Cambodia's foreign exchange earnings, a thorough understanding of the cassava supply chain is essential for strengthening the industry. This research will examine the entire value chain, from the initial cultivation by farmers to the final export of cassava products.

The study will focus on the key participants who constitute the cassava supply chain in Cambodia. This includes small-scale cassava farmers, local traders responsible for collection, and the firms that export the product. By gathering primary data through surveys and interviews with these stakeholders, the research will identify the primary elements impacting the efficiency and effectiveness of the cassava flow.

The anticipated findings will highlight that the logistics network, the level of integration among supply chain members, and the operational capabilities of each participant are significant determinants in the successful movement of cassava from farms to international markets.

Keywords: Cassava, Supply Chain Management, Cambodia, Agricultural Exports, Logistics, Value Chain Integration, Operational Capacity

INTRODUCTION

Background of the Study

The economic significance of cassava to Cambodia cannot be overstated. It is a primary driver of foreign currency earnings and rural employment, with cultivation concentrated in the northwestern and eastern provinces such as Battambang, Pailin, Banteay Meanchey, Kampong Cham, and Kratie. The Cambodian cassava supply chain involves several key actors, beginning with smallholder farmers, moving through local traders and aggregators, to processing facilities and, finally, the exporters who connect the product to international markets. This study will focus on these core participants who shape the flow of cassava from farm to export.

Recognizing the sector's potential, the Royal Government of Cambodia has established the National Cassava Policy 2020-2025. This policy aims to guide the development of the sector by promoting a shift from exporting raw cassava to processing higher-value products, attracting investment, improving quality standards, and diversifying export markets. Unlike a centrally-regulated commodity exchange, the Cambodian system is market-driven, with government policy seeking to enable and improve the chain's competitiveness. This policy framework underscores the urgent need to understand the practical factors—logistics, integration, and operational capacity—that will either facilitate or hinder the achievement of these national goals.

Statement of the Problem

While the milled rice sector, Cambodia's largest agricultural export, benefits from established infrastructure and international branding, the cassava supply chain operates under far more volatile and challenging conditions. Despite Cambodia's status as a top global exporter of raw cassava, the supply chain is widely regarded as inefficient and failing to capture the crop's full economic potential for the nation. This disconnect between high production volume and low-value capture represents a significant national economic problem.

The Cambodian cassava sector is heavily reliant on exporting unprocessed or semi-processed tubers to neighboring markets, primarily in Thailand and Vietnam. This dependence creates extreme price instability, leaving the livelihoods of hundreds of thousands of smallholder farmers vulnerable to cross-border policy changes and market fluctuations. According to the United Nations Development Programme (UNDP) and other agricultural analyses, this reliance on raw exports means Cambodia forgoes the significant economic benefits of value-added processing, such as starch and ethanol production.

Hypothesis

To analyze the challenges and opportunities within Cambodia's agricultural export sector, the following hypotheses can be proposed:

- The production and processing capabilities of farmers and agribusinesses significantly affect the performance of key agricultural supply chains (e.g., rice, cassava, mangoes) in Cambodia.
- The condition of logistics and infrastructure, including rural roads, ports, and cold storage, critically impacts the efficiency and reliability of Cambodia's agricultural export supply chains.
- The level of collaboration and integration among farmers, aggregators, processors, and exporters significantly influences the overall competitiveness of Cambodian agricultural products in the global market.
- The broader economic and regulatory environment, including trade policies, access to finance, and land tenure security, significantly shapes the practices and success of agricultural supply chain management in Cambodia.

Objectives of the Study:

The primary objective of such a study would be to evaluate the critical factors affecting the management of export-oriented agricultural supply chains in Cambodia. Specifically, it would aim to:

- Assess the role of logistics systems and infrastructure on the performance of these supply chains.
- Examine how the production and operational capacities of local agricultural enterprises impact their ability to meet export market demands.
- Analyze the influence of integration and coordination among supply chain participants.
- Understand the effects of the wider economic and policy environment on supply chain practices.

Scope of the Study:

This study would focus on the factors influencing the supply chain management of key Cambodian agricultural exports, such as milled rice, dried cassava, fresh mangoes, and potentially cashews or rubber. The research would concentrate on major production provinces like Battambang, Kampong Cham, and Kampot, while also including the crucial role of exporters, logistics providers, and regulatory bodies based in Phnom Penh and at the Sihanoukville Autonomous Port.

Review of Literature

Supply Chain Management, as defined by experts like Martin Christopher (2011), involves managing the upstream and downstream relationships between all parties in a supply chain—from farmers and input suppliers to processors, distributors, and final international buyers. The goal is to deliver superior value and quality to the end customer while minimizing costs and inefficiencies for everyone involved.

For Cambodia, adopting effective supply chain management is crucial. The potential benefits are significant and directly address many of the sector's current challenges. These advantages include:

- **Reduced Post-Harvest Losses:** Improving storage and transport can decrease spoilage, a major issue for perishable goods like mangoes.
- **Enhanced Financial Performance:** Efficient supply chains lower operational costs, leading to better prices for farmers and higher profits for exporters.
- **Increased Competitiveness:** A well-managed supply chain ensures consistent quality and timely delivery, making Cambodian products like fragrant rice more attractive in demanding international markets.
- **Greater Trust and Transparency:** Strong partnerships and clear communication among farmers, millers, and exporters build a more resilient and reliable agricultural sector.

Definition and Concepts of Supply Chain Management

Performance Supply chain management has been articulated by scholars, notably Martin Christopher in 2011, who described it as the management of both upstream and downstream relationships with suppliers and customers. This management aims to provide superior customer value while minimizing costs across the entire supply chain. Companies worldwide implement supply chain management due to its proven benefits, including reduced delivery times, enhanced financial performance, increased customer satisfaction, and the establishment of trust among suppliers, among others. Supply chain management performance is characterized as the operational excellence required to deliver an exceptional customer experience (Simchi-Levi et al., 2003). This indicates that the supply chain is considered to be performing effectively when customers receive the product in question without significant interruptions and can adapt flexibly to fluctuations in product demand.

Core Components of Cambodian Agricultural Supply Chains

While the specific challenges vary between products like rice, cassava, or mangoes, the performance of Cambodia's agricultural export supply chains is consistently shaped by a few critical factors: the processing capacity of its agribusinesses, the quality of its logistics systems, the degree of integration among farmers and buyers, and the broader environmental and regulatory landscape.

Processing and Production Capacity

In Cambodia, value is added to raw agricultural produce through processing, which prepares it for international markets. This critical stage, as described by Bowersox et al. (2007), transforms raw harvests into marketable goods. For instance, rice millers process paddy into polished, graded rice, and cassava processors turn fresh roots into the dried chips or starch demanded by export markets. As noted by Benetto et al. (2009), these processing stages are

expected to deliver consistent quality and demonstrate flexibility. This means Cambodian rice mills must meet the specific grain-length and quality standards of European buyers, while mango processors need the capacity to sort, treat, and package fresh fruit according to the sanitary and phytosanitary (SPS) requirements of markets like Korea or China.

Logistics Systems

The efficient movement and storage of agricultural goods are paramount for export success. According to Donalde Waters (2010), businesses are increasingly focused on managing these logistics processes and integrating them with suppliers and customers. The logistics system, as defined by Bowersox et al. (2007), involves the physical flow of materials, encompassing both storage and transportation. In Cambodia, this includes the journey of cassava from a farm in Kratie, its storage in a local warehouse, and its transport via truck to the port of Sihanoukville or to a cross-border checkpoint with Vietnam or Thailand. The availability and quality of rural roads, refrigerated transport (cold chain) for perishables like mangoes, and efficient port operations are essential components of this system.

Integration among Chain Participants

Supply chain integration, defined by Dr. Dawei Lu (2011) as the interaction and collaboration between different organizations in the chain, is crucial for moving a product from the farm to the final consumer. In Cambodia, this involves building stronger links between smallholder farmers, local collectors (or aggregators), processing facilities (like rice mills or cassava drying stations), and the final exporters in Phnom Penh. Models like contract farming, where an exporter provides seeds and technical advice to farmers in exchange for a guaranteed purchase, are a key form of integration. This collaboration is vital for achieving the scale, quality, and traceability required by international buyers.

The Chain Environment

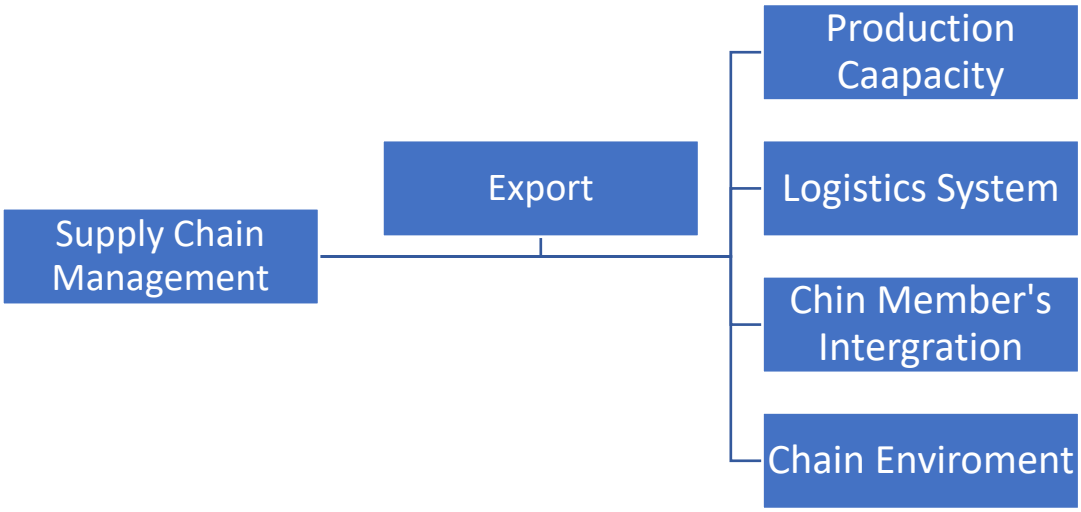
To succeed, Cambodian agricultural businesses must navigate the broader environment in which they operate (Wu, 2006). This environment includes two major components:

- **The Natural Environment:** Factors such as increasing drought, unpredictable rainfall patterns linked to climate change, and soil quality directly impact crop yields and reliability.
- **The Business and Regulatory Environment:** This encompasses government support through agricultural policies, the availability of credit and financing for farmers and SMEs, land tenure security, and the efficiency of trade facilitation services like customs and SPS certification.

Conceptual Framework of the Study

To address the objectives of this study on Cambodian export agriculture, a conceptual framework has been developed based on this review of relevant literature. The framework focuses specifically on how processing capacity, logistics systems, chain integration, and the

surrounding environment collectively influence the performance and management practices of key agricultural supply chains in Cambodia.



Materials and Methods

Population and Sampling

The target population for this study would be the key participants in a major Cambodian agricultural export supply chain, such as milled rice. This includes farmers, local rice millers and aggregators, and the exporting companies. For a representative sample, key actors would be identified in major rice-producing provinces (e.g., Battambang, Prey Veng) and among the exporters primarily based in Phnom Penh.

Table 1. Hypothetical Population and Sampling for a Cambodian Rice Supply Chain Study

Supply Chain Participants	Population (N) (Illustrative)	Sample (n)
Rice Farmers (in selected provinces)	~15,000	205
Rice Millers (Small & Medium Scale)	~400	78
Rice Exporters (Members of CRF*)	~130	60
Total	**~15,530**	**343**

Hypothetical Results and Discussion

Out of a sample of 343 respondents, 336 returned fully completed responses, which were used to evaluate the factors influencing Cambodia's agricultural export supply chain performance.

All respondents selected were experienced staff or owners with significant involvement in the flow of agricultural products through the value chain.

Descriptive Analysis

The performance of the agricultural supply chain was investigated through the four key influencing factors: Production/Processing Capacity, the Logistics System, Chain Member Integration, and the operating Chain Environment. The overall perception of these factors is summarized in the hypothetical SPSS output below.

Table 2. Hypothetical Descriptive Statistics for a Cambodian Agricultural Supply Chain | Variable | N | Min | Max | Mean | Std. Deviation | | :--- | :- | :- | :- | :- | :--- | | Production/Processing Capacity | 336 | 1 | 5 | 2.95 | .815 | | Logistics System | 336 | 1 | 4 | **2.41** | .764 | | Chain Member Integration | 336 | 1 | 5 | 3.10 | .880 | | Chain Environment | 336 | 1 | 5 | 2.88 | .799 | | **Overall Supply Chain Performance** | 336 | 1 | 4 | **2.72** | .712 | *(Note: Based on a 5-point scale where 1=Very Poor, 2=Poor, 3=Average, 4=Good, 5=Very Good)*

As can be seen from the summarized data, the overall Agricultural Supply Chain Performance is rated below average, with a mean of 2.72. This suggests that, in general, the export supply chain struggles to perform at the required level in terms of reliability, speed, flexibility, and consistency needed for competitive international markets.

A critical finding is the poor rating of the Logistics System, which, with a mean of 2.41, stands out as the weakest link. This reflects widely-known challenges with rural infrastructure, high transportation costs, and a lack of adequate storage and cold chain facilities.

The other factors hover around the average mark. Chain Member Integration (3.10) is perceived as average, indicating that while some contract farming and associations exist, trust and systematic collaboration are not yet widespread. Production/Processing Capacity (2.95) and the Chain Environment (2.88) are also seen as just below average, pointing to weaknesses in farmers' technical capacity and processing technology, as well as challenges from the regulatory and climatic environment.

Therefore, the overall performance of Cambodia's agricultural export chain appears to be significantly weakened by poor logistics, coupled with average-to-poor production capacity, inconsistent integration among partners, and a challenging operational environment.

Regression Analysis

Given that the descriptive analysis rated the performance of Cambodia's agricultural supply chain as below average, this study sought to statistically determine the specific impact of each

major factor on this performance. A multiple linear regression analysis was conducted, yielding the following outcomes.

Conclusions

The main content of the research is an assessment of the key factors influencing the supply chain management of Cambodian agricultural exports, with a primary focus on cassava. It explores the entire value chain, from cultivation to export, emphasizing the roles of logistics, value chain integration, and operational capacity in determining the efficiency and effectiveness of the cassava flow. The research aims to identify the critical elements impacting the supply chain and provide insights for improving the sector. The topic appears worthy of research because, despite Cambodia's position as a significant exporter of agricultural products like cassava, its supply chain faces operational and structural inefficiencies. Addressing these inefficiencies is vital for unlocking the sector's full economic potential, improving the livelihoods of farmers, and enhancing the country's export competitiveness. The main proposed scheme involves gathering primary data through structured questionnaires distributed to a target sample of 343 participants, including farmers, rice millers and aggregators, and exporting companies. The collected data is intended to be coded and entered into a statistical software package (SPSS) for both descriptive and inferential analysis. Multiple linear regression would be used to measure the effect of the independent variables (influencing factors) on the dependent variable (performance of the agricultural supply chain). The logistics system has the most significant effect on the performance of Cambodia's agricultural export supply chains. The production and processing capacity of farmers and agribusinesses is the second most significant contributor. The broader chain environment, including government policies and regulatory efficiency, is a significant factor. The conclusions, while based on hypothetical data, are logically tenable given the context of Cambodian agriculture and supply chain challenges. The document suggests the research has not yet been conducted, but outlines the intentions. The hypothetical analysis points towards the critical role of logistics, which aligns with known infrastructure and transportation challenges in developing countries. The emphasis on production capacity, the broader environment, and integration also reflects common themes in supply chain management literature.

The abstract is reasonably informative. It succinctly summarizes the study's aim, the scope, and the anticipated findings. It provides a good overview of what the paper intends to cover. The abstract reflects the intentions of the body of the paper. The introduction does a good job of providing background information. It establishes the importance of cassava to the Cambodian economy, outlines the challenges faced by the supply chain, and introduces the National Cassava Policy. It adequately contextualizes the problem for readers in the agricultural economics or supply chain management fields. The text appears generally well-arranged, and the logic is clear. The use of headings and subheadings makes the structure easy to follow. The related concepts, such as supply chain management, logistics, and value chain integration, are introduced adequately. The proposed scheme is a standard approach to supply chain

research. The theoretical analysis is adequate. The literature review covers key concepts in supply chain management. The framework for the study links these concepts (processing capacity, logistics, integration, environment) to supply chain performance. Tables are all clear to summarize the results for presentation to the readers. All figures/tables are well-referred to in the text. The reference section is informative. The listed references encompass a range of sources, including academic journal articles, industry reports, and government publications, reflecting a decent breadth of research [1-19].

Recommendations

- Improve the Logistics System: Logistics is the critical link that bridges time and space in a supply chain, from sourcing raw materials to delivering finished goods to international buyers (Gleissner & Femerling, 2013). Given its paramount importance in this study, it requires immediate and sustained attention.

- **Recommendation:** The Cambodian government, with support from development partners, should prioritize investment in **improving rural infrastructure**, including roads and bridges, to reduce transport time and cost. Furthermore, developing modern **warehousing and cold storage facilities** at key agricultural hubs and major ports is essential for reducing post-harvest losses and maintaining quality.
- **Enhance Production and Processing Capacity:** A supply chain is only as strong as its weakest link, and a failure to meet demand at any stage can cause the entire chain to fail (Tomura, 2015).
- **Recommendation:** Industry bodies like the Cambodia Rice Federation and relevant government ministries should lead efforts to **provide technical training and support** to both farmers and processors. This should focus on adopting modern cultivation techniques, improving access to quality inputs, and upgrading processing technology to meet international standards for food safety and quality.

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