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Cambodia's Banana Export Industry in a China-Centered Agrifood System

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Abstract

China's growing demand for fruit has accelerated the expansion of China-centered agrifood production networks across Southeast Asia. This study examines the integration of Cambodia's banana export industry into this network from a global production network perspective. Drawing on fieldwork conducted in Cambodia between 2023 and 2025, including participant observation, interviews, and worker surveys, the study analyzes lead firms, governance arrangements, labor organization, and value distribution. Chinese agribusiness firms serve as lead firms. Governance is facilitated by economic land concessions, bilateral phytosanitary agreements, the Belt and Road Initiative, and the Cambodia Banana Industry Association Federation. The network is characterized by low-wage and highly mobile labor, reflecting tensions between plantation management and workers' livelihood strategies. Although Cambodia has been integrated into the network as an export-oriented production base, value enhancement has not necessarily translated into greater value capture and remains concentrated in downstream distribution and retail. This study argues that China-centered agrifood production networks reproduce the unequal value distribution observed in established banana commodity chains. Although based on a qualitative single-case study in Cambodia, the findings provide empirical insights into the governance and developmental implications of China-centered agrifood production networks and offer a foundation for future comparative research.

Keywords: global production networks; China-centered agrifood systems; banana industry in Cambodia; Chinese agribusiness; governance facilities; value capture; uneven development; South–South production networks

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1. Introduction

Since the early 1990s, globalization has been reshaped by the rapid expansion of global production networks and the rise of emerging economies, particularly China, which has evolved as a central actor in global production networks [1–4].

In agriculture, China's rapid industrialization and urbanization, accompanied by a dietary shift toward greater consumption of animal protein and fresh fruits, have contributed to the development of China-centered agrifood production networks. These developments have reshaped global agricultural trade patterns, shifting them from the tradi-

tional North–South configuration toward intra-Asian trade flows centered on the Chinese market [5,6].

In this study, the term “China-centered agrifood system” refers to an emerging regional agrifood order in which China serves as a central hub for food imports, capital investment, and market coordination across East and Southeast Asia. China’s rapid industrialization and urbanization have shaped this system, as has expanding food demand and the growing overseas activities of Chinese agribusiness firms. Recent studies have highlighted the increasing influence of China within the contemporary food regime. Belesky and Lawrence (2019) demonstrated how state capitalism and neomercantilism are embedded within the overseas expansion of Chinese agribusiness [7]. McMichael (2013) characterized China as a new hub of global food imports [8]. Similarly, Isoda (2023) conceptualized the rise of a “China-centered food import complex” as a new phase of the contemporary food regime [9].

Building on these studies, this paper conceptualizes China-centered agrifood production networks as regionally organized systems structured around the Chinese market, Chinese capital, and cross-border production linkages that connect Southeast Asia to China. From a global production network (GPN) perspective, these networks are coordinated through a combination of Chinese market demand, overseas investment by Chinese agribusiness firms, and state-supported institutional arrangements, including bilateral export protocols, phytosanitary regulations, and infrastructure development. Thus, the Chinese market functions both as a destination for agricultural products and as a central mechanism organizing production, investment, and value distribution within the regional agrifood network.

Research has started to examine the fresh fruit trade between Southeast Asia and China [10]. The literature highlights the rapid expansion of fresh fruit exports from mainland Southeast Asia—including Thailand, Vietnam, Myanmar, and Laos—to China, positioning the region as a growing supplier within the China-centered agrifood system. Driven by rising demand in China, many rural regions in Southeast Asia have been incorporated into cross-border production networks, often located in border areas and operating through formal and informal trade channels [11–16].

The literature has identified distinctive governance characteristics of this agrifood system. Unlike fruit supply chains in Europe and North America, which are typically dominated by supermarket chains and private standards, Southeast Asia–China fruit networks are coordinated to a greater extent by mid-chain actors, such as traders and brokers. This arrangement is characterized by flexible coordination and a limited role for formalized standards.

However, as Pritchard et al. argued, research on the fresh fruit trade between Southeast Asia and China serves only as a starting point for applying GPN analysis to this emerging agrifood system. Whether Southeast Asia–China agrifood production networks exhibit governance structures and value distribution patterns fundamentally different from those observed in conventional GPNs dominated by the advanced economies remains underexplored.

This study examines the rapid expansion of banana exports between Cambodia and China. Cambodia remains a predominantly agrarian economy, with rapidly expanding export-oriented agriculture since the late 2010s. Banana exports, which were virtually nonexistent before 2016, have grown rapidly, especially to China, which accounts for more than 99% of total banana exports. Following the establishment of direct export channels in 2019, exports to China increased sharply, reaching approximately 337,000 tons in 2022.

Despite this rapid expansion, limited research has examined how Cambodia’s banana export industry has been organized and integrated into China-centered agrifood

production networks, particularly regarding production organization, institutional arrangements, governance structures, labor organization, and value distribution.

Accordingly, this study addresses two research questions: (1) How has Cambodia's China-centered agrifood production network been organized and governed through Chinese agribusiness firms and institutional arrangements? (2) What developmental outcomes has this governance generated, particularly in terms of value enhancement, value capture, and the long-term sustainability of plantation production? By focusing on Cambodia as a latecomer economy, this study contributes to the GPN literature by providing empirical evidence from an emerging China-centered agrifood production network and examining how importers' agrifood production governance impacts developmental outcomes within this new production system.

2. Materials and Methods

This study examines the integration of Cambodia's banana industry into the China-centered agrifood system using a qualitative case study approach grounded in the GPN framework.

The GVC literature emphasizes governance structures and the role of lead firms in coordinating production [17–20]. However, the GVC framework has been criticized for its limited attention to nonfirm actors and spatial contexts.

The more comprehensive GPN approach addresses these limitations by conceptualizing production as a network of relational processes involving firms, states, and institutions. It highlights the importance of regional assets and introduces the concept of strategic coupling to explain how local economies are integrated into global networks [21,22]. More recent developments in GPN 2.0 further emphasize the dynamic processes of value creation, enhancement, and capture, as well as the interaction between firm strategies, institutional environments, and regional development outcomes. This perspective is particularly useful for analyzing how participation in production networks generates economic opportunities as well as uneven patterns of development across different actors and regions [23]

Cambodia was selected as a critical case because banana exports to China were virtually nonexistent before 2016 but expanded rapidly after the establishment of direct export channels in 2019. By 2022, exports to China had reached approximately 337,000 tons, accounting for over 99% of Cambodia's total banana exports [24]. This rapid expansion provides a valuable opportunity to observe the early-stage formation of the China-centered agrifood production network.

The analysis is based on fieldwork at multiple sites combining participant observation, semistructured interviews, and structured surveys conducted in Cambodia between 2023 and 2025. Unless otherwise indicated, the cutoff date for all enterprise information, statistical data, and documentary materials used in this study was 5 December 2025.

2.1. Fieldwork and Case Selection

In July 2023, the author established contact with a Chinese trader (hereafter referred to as Mr. Y) engaged in the commercial banana trade in Cambodia. With his assistance, field visits were conducted at a leading banana-producing firm in Kratie Province and several plantations in Kampong Cham Province.

Table 1 provides an overview of the major banana-producing companies in Cambodia. Among these, the author directly visited four plantations (Table 1, Nos. 1, 2, 3, and 4), which constitute the empirical basis of this study.

Table 1. Banana-producing companies in Cambodia.

No.	Company Name	Nationality	Cultivated Area (ha)	Province
1	Cambodia Banana Agricultural (CBA)	China	1000	Kratie
2	Jiazhixin	China	200–300	Kampong Cham
3	Longsheng Huajian	Cambodia	1000	Kampong Cham
4	Longsheng Hefeng	China	600	Kampong Cham
5	Jinshi	Vietnam	100–200	Kratie
6	THADI	Vietnam	10,000	Ratanakiri
7	Xiuyu	China	1000–1500	Ratanakiri
8	Fengming	China	1000	Kampong Cham
9	Dize	China	600	Kampong Cham
10	Longfuda	China	300	Siem Reap
11	Longmeida	China	400	Kampot
12	Quanqiu	Cambodia	1000	Kampot

Source: Compiled by the author based on field interviews conducted between 19 August and 29 September 2024. Note: Cultivated area refers to the land area used for banana production.

Participant observation was a key component of the research. The author resided at a banana plantation operated by Cambodia Banana Agricultural (CBA) during two field stays—from 3 to 20 March and from 19 August to 29 September 2024—for a total of 58 days. Extensive qualitative data were collected through daily interactions with plantation workers, smallholder farmers in surrounding villages, and company managers. Worker surveys included workers who were available and willing to participate in the field investigation in coordination with the participating enterprises. Additionally, the author engaged with members of the Cambodia Banana Industry Association who visited the plantation for training and inspection, providing further insights into industry organization and coordination.

CBA was selected as the primary case study because of its early entry into commercial banana production in Cambodia and, more importantly, its significant role in the national export sector and in shaping the industry's institutional environment. Although field investigations were conducted at four major banana enterprises, this study does not provide a statistically representative analysis of the entire Cambodian banana industry. Instead, a qualitative case study approach is adopted to examine the organization and governance of the China-centered banana production network. The information obtained from other enterprises investigated and industry stakeholders was used to cross-check the production organization and export practices observed at CBA.

Lobbying efforts by CBA's management of the Chinese government resulted in the direct export of Cambodian commercial bananas to China. Before 2019, Vietnam was the sole export destination for Cambodian bananas, although their ultimate market was China. In practice, Cambodian bananas were reexported to China via Vietnam, requiring double customs clearance and phytosanitary procedures, thereby increasing transport costs and inefficiencies.

To address these problems, lobbying by the CBA's management contributed to the establishment of bilateral phytosanitary protocols governing the direct export of Cambodian bananas to China in 2019. Under this regulatory framework, Cambodian plantations authorized for export are required to print government-registered plantation codes and location information on export cartons, ensuring traceability and centralized regulatory control.

As a result, direct exports to China expanded rapidly after 2019, and since 2020, China has become the overwhelmingly dominant export destination for Cambodian bananas.

In 2024, CBA's shipment volume reached 1450 forty-foot containers. Each container can accommodate approximately 1540 boxes of bananas; assuming a standard weight of 13.0 kg per box, the total load per container is estimated at approximately 20.0 tons. The company's total shipment volume in 2024 is estimated at approximately 29,000 tons, accounting for approximately 12% of total banana exports from Cambodia to China, which amounted to 246,000 tons the same year. Thus, CBA accounted for approximately 11.8% of Cambodia's banana exports to China in 2024 [25]. This highlights the firm's political influence within the regulatory environment governing cross-border agricultural trade.

Owing to this substantial export share and institutional influence and the availability of comprehensive field data, CBA occupies a central position in the Cambodia–China banana production network and provides an appropriate case for examining its organizational structure and governance.

2.2. Data Collection and Research Activities

Table 2 presents the timeline and content of the multisite fieldwork conducted in this study. Fieldwork began in July 2023 with visits to banana plantations and related facilities in Kampong Cham Province, including a carton manufacturing factory and multiple plantation sites, which provided an initial understanding of the production environment and supply chain structure.

In March 2024, the research focused on worker-level data collection through a series of structured surveys conducted at the CBA plantation among different categories of workers, including packaging workers, temporary workers, and contract worker households, enabling a comprehensive analysis of labor characteristics and employment conditions. Packaging worker surveys were conducted during working hours. To minimize disruption to the continuous assembly line production, factory supervisors invited workers to participate individually, and each survey lasted approximately 2–3 min, collecting basic demographic and employment information. To better understand labor organization and work practices, one team of temporary workers was accompanied throughout an entire workday. Contract worker household interviews were conducted in their production areas with the assistance of regional field supervisors and lasted approximately 20 min per household.

Structured surveys included 168 packaging workers, 25 temporary workers, and 64 contract worker households. Among the surveyed packaging workers, 103 (61.5%) were female and 65 (38.5%) were male. Among the surveyed temporary workers, 17 (68.0%) were female and 8 (32.0%) were male. However, these temporary workers belonged to a flower-removal team observed during fieldwork and do not represent the overall gender composition of temporary workers. Contract worker households were generally managed by husband-and-wife pairs, resulting in a nearly balanced gender composition. No substantial gender differences in wage arrangements were observed during the field investigation. Therefore, gender is not treated as a major analytical dimension in this study.

During the same period, interviews were conducted with key informants, including industry stakeholders and representatives of academic and institutional organizations, to obtain insights into land acquisition processes under the economic land concessions (ELCs) and the role of the Belt and Road Initiative (BRI) in shaping banana exports.

Subsequent fieldwork in August and September 2024 further expanded the study's empirical basis. This included meetings with input suppliers and investors, as well as additional worker surveys and site visits, which provided information on supply chain or-

ganization, investment motivations, and production practices. Operational and managerial information was also collected from plantation management.

Together, these data provide a comprehensive empirical foundation for analyzing the structure and dynamics of the Cambodia–China banana production network.

Table 2. Research activities.

Date	Research Activities	Interview/Data Collected
9 July 2023	Visit to an export banana carton manufacturing factory	Material supply chain
10–11 July 2023	Visits to three banana plantations in Kampong Cham Province	General observation of plantation conditions
3–5 March 2024	Worker survey at the CBA plantation	Basic attributes of 86 workers in Packaging Facility No. 2
6–8 March 2024	Worker survey at the CBA plantation	Basic attributes of 82 workers in Packaging Facility No. 3
8 March 2024	Interview with Mr. D (Royal University of Agriculture/Industry Association)	BRI and banana exports
9–12 March 2024	Worker survey at the CBA plantation	Basic attributes of 25 temporary workers on the plantation
13–16 March 2024	Worker survey at the CBA plantation	Basic attributes of 16 contract worker households in Plantation Zone No. 4
13 March 2024	Interview with Mr. L (Asia World Agriculture Development)	Land acquisition process (ELCs)
20 March 2024	Participant observation	Wage payment process
25 August 2024	Meeting with input suppliers	Supply chain conditions
29 August 2024	Meeting with investors	Entry background and investment motivations
28 August–19 September 2024	Worker survey at the CBA plantation	Basic attributes of 48 contract worker households across Plantation Zones No. 1, 2, and 3
11 September 2024	Visit to the research base of Mr. D (Royal University of Agriculture/Industry Association)	Seedling development and production
During the field stay	Regular meetings with the CBA management	Operational and managerial information

The field investigation collected enterprise-level information on production, labor, procurement, exports, and marketing, forming the empirical basis of the value distribution analysis. The cost and price data collected in different units and currencies were standardized to a common per-kilogram basis using observed shipment volumes, standard carton weights, and exchange rates to enable comparison across different supply chain stages. Detailed data sources, assumptions, calculation procedures, and intermediate calculations are provided in Appendixes A and B, Tables A1 and A2.

2.3. Secondary Data

To complement the field-based evidence, this study draws on secondary data from FAOSTAT, UN Comtrade, and national statistical agencies. These data are used to analyze trends in production, trade, and price dynamics, and to situate the Cambodian case within a broader regional and global agrifood system.

3. Results

This section analyzes the China–Cambodia banana production network, with a particular focus on CBA and other Chinese agribusiness firms. It presents empirical findings on how lead firms, institutional arrangements, labor structures, and value distribution are configured and interrelated within this network.

3.1. Chinese Agribusiness as Lead Firms

Corporate actors, rather than smallholders, predominantly engage in banana production in Cambodia. Although smallholders cultivate approximately 26,000 hectares of bananas, and approximately 803,000 households (about 40% of all households) are engaged in banana farming, their total output remains limited to 91,000 tons, with a low yield of 3.5 tons per hectare. This indicates that smallholder production is largely oriented toward subsistence or domestic markets, with minimal participation in export-oriented commercial banana production.

The commercial segment is dominated by 12 companies that cultivate approximately 16,947 hectares, with an average plantation size of roughly 1500 hectares per firm (see Table 1). Their total output is estimated to be 3.8 times greater than that of smallholders, with a significantly higher productivity of approximately 20 tons per hectare [26].

The total cultivated area of these firms expanded to approximately 38,000 hectares by 2024, representing a 2.2-fold increase over 2020. Among them, eight are Chinese agribusinesses, accounting for approximately 5100–5700 hectares. CBA was among the earliest entrants, while the largest plantation is operated by the Vietnamese firm THADI, with an estimated area of 10,000 hectares.

Despite the presence of Vietnamese firms, Cambodian commercial banana exports are almost exclusively oriented toward China. Furthermore, the Cambodia Banana Industry Association Federation (CBIAF)—an organization that integrates multiple Cambodia–China banana supply chain stages—is predominantly composed of Chinese agribusiness firms. Rather than directly balancing member firms' economic interests, the association coordinates with Cambodian and Chinese governments, provides technical support, and establishes common export standards, such as the 13 kg export carton specification.

3.2. Institutional Arrangements and the Cambodia–China Banana Supply Chain

3.2.1. Economic Land Concessions in Cambodia

Under the ELCs introduced by the Cambodian government in the early 2000s, foreign firms are legally permitted to utilize large-scale landholdings. The ELC framework allows foreign investors to engage in large-scale plantation agriculture, livestock production, and agroprocessing activities. The maximum land area that can be granted under an ELC is 10,000 hectares, with concession periods of up to 99 years.

The ELCs have been widely criticized, both domestically and internationally, for contributing to land grabs and the displacement of local communities. In response, the Cambodian government imposed a moratorium on new ELCs in 2012 and implemented measures to reduce the size of certain existing concessions. It has become increasingly difficult for new foreign firms to acquire such concessions, although many ELCs continue to operate [27].

All the firms listed in Table 1 obtained land for banana plantation development through ELCs. Two distinct modes of access can be identified: direct acquisition of ELCs and leasing land from existing concession holders.

The predecessor of CBA was Green Island Agricultural Development. On 15 March 2006, the company obtained an ELC in Kratie Province, covering 9583 hectares, with a 70-year concession period. In approximately 2015, Green Island Agricultural Development

was acquired by Mr. B, a Cambodian Chinese national, and Mr. C, an investor from Zhejiang Province, China, with the company's assets and liabilities, including its ELC holdings, subsequently transferred to the newly established CBA.

By the end of 2025, approximately 1000 hectares of CBA's ELC will have been developed into banana plantations, with approximately one million plants under cultivation. The concession area is located about 60 km from the Kratie provincial capital and 10 km from the 380 km marker on National Road No. 7. Because the site is some distance from the Mekong River, water resources depend primarily on rainfall during the wet season (Figure 1). A stable water supply during the prolonged dry season requires artificial irrigation. CBA constructed two large reservoirs within the plantation to ensure a stable water supply for large-scale banana production and provide irrigation water throughout the year.

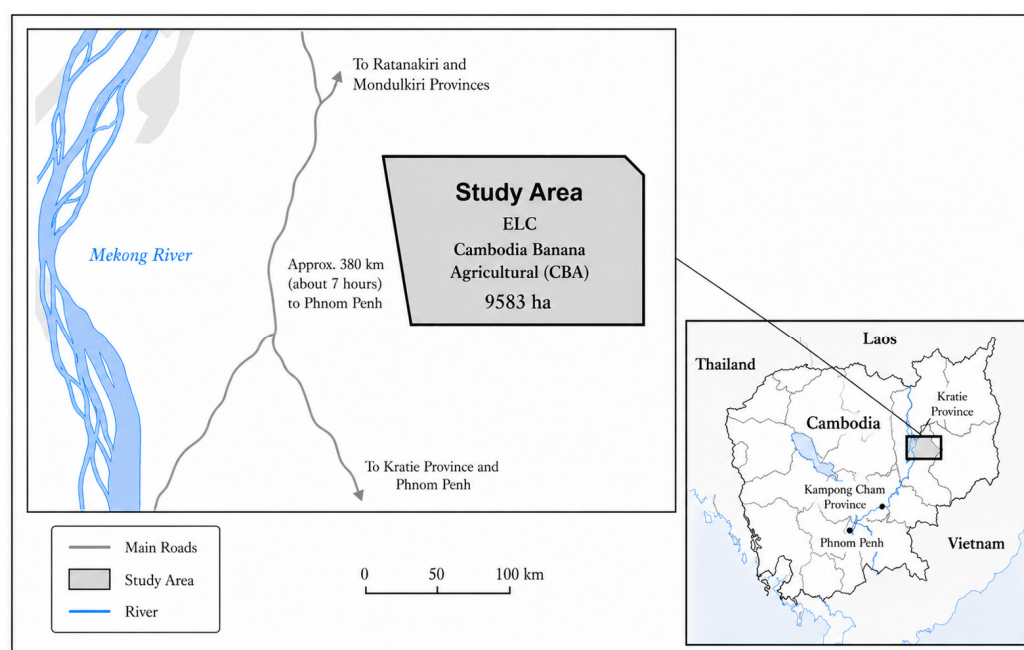


Figure 1. Economic land concession (ELC) owned by Cambodia Banana Agricultural (CBA). Source: Compiled by the author based on Open Development Cambodia [28]. The approved ELC area does not necessarily correspond to the actual area under banana cultivation; within a single concession, land may be allocated to other crops, forest conservation, or remain undeveloped.

Thus, ELCs are a key institutional mechanism enabling the territorial embedding of Chinese agribusiness in the Cambodia–China production network.

3.2.2. Cambodia Banana Industry Association Federation

The CBIAF integrates multiple stages of the Cambodia–China banana supply chain. All stages of the supply chain—from the procurement of production inputs such as seedlings, fertilizers, and agrochemicals, to harvesting, packaging, and exports—are coordinated by Chinese agribusiness firms through their membership in the CBIAF.

As of 2022, all 37 member firms of the CBIAF are Chinese-affiliated enterprises. Among them, 10 firms are engaged in plantation management, 15 supply agricultural inputs such as seedlings, agrochemicals, and fertilizers, seven provide logistics, shipping, and cold-chain services, and five are responsible for export operations [29].

Notably, Mr. B and Mr. C of CBA serve as the President and Vice President of the CBIAF, respectively, and are key figures in leading the development of Cambodia's commercial banana industry.

Thus, the CBIAF functions as a coordinating platform that facilitates the division of labor and information sharing among Chinese agribusiness firms. In this sense, it operates as an intermediary governance structure that reinforces network coordination within a China-centered GPN.

3.2.3. Cambodia–China Banana Supply Chain

This section explains the structure and operation of the Cambodia–China banana supply chain using selected case studies (Figure 2).

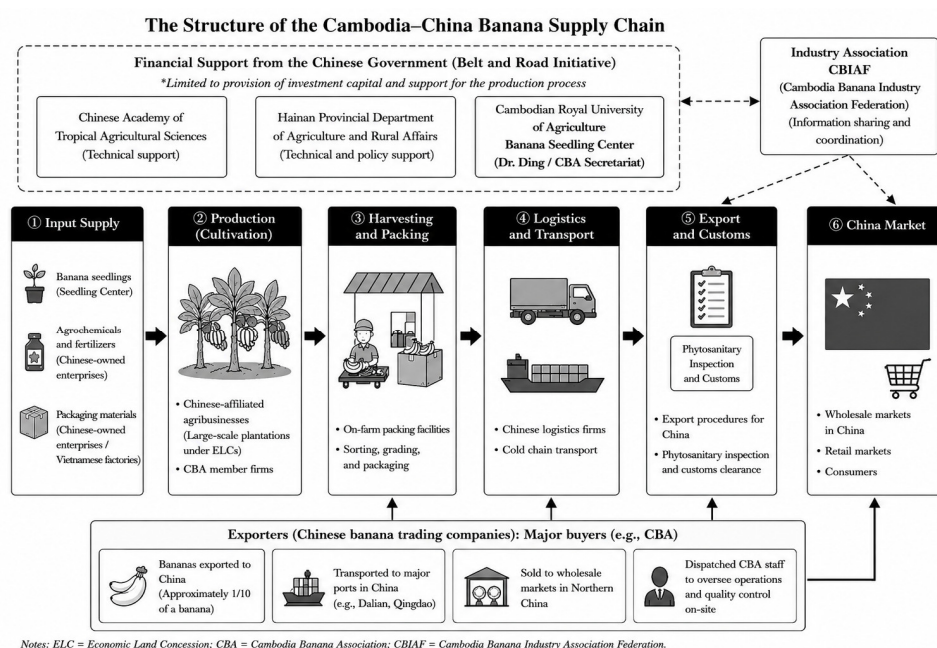


Figure 2. Structure of the Cambodia–China Banana Supply Chain. Source: Compiled by the author. * The BRI provides policy support, while business operations are primarily undertaken by private companies.

1. Supply of seedlings

A key actor in the supply of banana seedlings is the Banana Nursery Center, established in 2018 at the Royal University of Agriculture in Cambodia. This center was founded in 2017 following consultations among the Chinese Academy of Tropical Agricultural Sciences, the Department of Agriculture of Hainan Province, and the Royal University of Agriculture, with technical and financial support from China. The project is positioned as part of China's BRI. At present, the center supplies approximately one-third of the banana seedlings used in plantations across Cambodia. Dr. D, a representative of the center, also serves as Secretary-General of the CBIAF. This overlap highlights how deeply embedded Chinese technical and financial assistance is, even at the input stage, forming the foundation of Cambodia's commercial banana industry.

2. Procurement of agrochemicals and fertilizers

Shandong Kesaiji Agricultural Holdings Co., Ltd., a private firm headquartered in Shandong Province, China, entered the Cambodian market in 2017 and established a subsidiary in Phnom Penh. The company primarily supplies herbicides and fungicides. According to plantation managers, fungicides are routinely used as part of plantation disease management; Fusarium wilt (TR4) was identified as one of the major production risks facing commercial banana plantations. Additionally, GenYuYa International Agriculture (hereinafter, the Company Y), located on the premises of CBA, produces organic fertilizers for distribution to banana plantations. The president of Company Y is a technician affil-

ated with the Institute of Tropical Bioscience and Biotechnology of the Chinese Academy of Tropical Agricultural Sciences, seconded to the firm.

3. Packaging and protective materials

During the growth period, foam sheets are inserted between banana bunches to prevent damage caused by friction and pressure. These sheets are also used during packaging to reduce transport-related damage. Moreover, plastic bags are used on banana bunches at the maturation stage for pest control and protection against low temperatures. These materials were supplied from a factory in Vietnam operated by Ms. Z, a businesswoman from Hunan Province, China. To reduce transport costs, CBA reached an agreement with Ms. Z in 2023 to establish a related manufacturing facility within its plantation area, enabling local production and supply of these materials.

Only one factory in Kampong Cham Province produces export-grade cardboard boxes. Export license numbers are printed on the boxes, and strict quality control is enforced to meet China's quarantine and quality standards. At the time of shipment, exporters supply their own branded boxes to the plantation packing sites, where packaging is carried out.

4. Exporters.

A banana trading firm operated by Mr. Y, originally from Hainan Province, China, is responsible for export operations. Mr. Y conducts banana export business in Cambodia, Laos, Vietnam, and Indonesia, forming an extensive network across Southeast Asia. In Cambodia, he handles approximately one-tenth of the bananas exported to China, representing a significant share of the commercial banana trade. Bananas are transported to ports such as Dalian and Qingdao, and then sold wholesale at agricultural markets in northern China. To ensure strict quality control, Mr. Y regularly dispatches employees to plantations and personally supervises production conditions and shipping processes.

3.3. Labor Structure and Value Distribution

3.3.1. Low Wage Levels and High Labor Mobility

CBA regularly employs approximately 800–1000 workers. However, due to the lack of formal employment contracts for many workers and high turnover, it is difficult to determine the exact number of employees at any given time. Consequently, the company records the number of workers at the time of monthly wage payments.

The managerial staff of the plantation consists entirely of Chinese nationals, numbering approximately 20 individuals. All other employees are Cambodians, who can be broadly classified into four occupational groups (Table 3).

Table 3. Occupational categories of Cambodian workers on CBA's banana plantation.

Occupation	Wage Level (USD)	Working Hours	Main Tasks
Packing facility workers	7/day	7:00–11:00. 14:00–17:00	Washing, disinfection, grading, sorting, packaging, and shipment
Plantation workers (temporary)	7/day	From 5:00 am until completion	Pest control, cold protection, flower removal, and harvesting
Plantation workers (contract)	Base salary: 180/month. Housing and interest-free loans were provided. Bonus: 5000–7000 (per 7-month cycle) 800–1200/month.	24 h on-site residence	Planting, irrigation, pesticide application, pest/cold protection, flower removal, and harvesting
Interpreters	Housing, meals, and motorbikes provided.	7:00–11:00. 14:00–17:00	Support Chinese managers and supervise Cambodian workers
Auxiliary staff	400–600/month	7:00–11:00. 14:00–17:00	Driving, machinery maintenance, and food provision for managers

Source: Compiled by the author based on field interviews.

1. Packing facility workers (approximately 300 workers)

These workers are responsible for postharvest processing of bananas, including washing, disinfecting, sorting, drying, and packaging, as well as preparing them for shipment. They represent the core labor force responsible for transforming bananas into final export products.

2. Plantation workers (approximately 420 workers)

Plantation workers are engaged in all stages of banana production, including planting, weeding, pesticide application, flower removal, and harvesting, and routine plantation maintenance, such as irrigation management and disease prevention. These workers can be divided into two main categories based on their employment status. The first group consists of contract workers employed for a fixed period of approximately 7–8 months (i.e., one production cycle from planting to harvest) and responsible for specific plots. The second group comprises temporary workers hired on a short-term basis.

3. Interpreters (approximately eight workers)

Interpreters assist the Chinese managerial staff and facilitate communication and instruction between managers and Cambodian workers. They play a crucial role as intermediaries in organizational coordination, linking foreign management with the local labor force.

4. Auxiliary staff (10–15 workers).

These workers perform supporting functions essential to plantation operations, including truck driving, machinery maintenance and repair, and food provision for Chinese managerial staff.

Regarding labor conditions and wage levels, Table 3 shows that interpreters represent a stable occupational group, earning monthly wages of approximately USD 800–1200. In addition to their salaries, they receive free accommodation and meals, as well as motorbikes for mobility within the plantation. In contrast, auxiliary staff—many of whom perform technical tasks—earn lower wages, typically USD 400–USD 600 per month.

The largest groups of temporary plantation workers and packing facility workers receive the lowest wages and are paid daily. They receive 28,000 riel (approximately USD 7) per day, with wages paid monthly. Considering the continuous employment, this wage level is broadly comparable to Cambodia's statutory minimum wage in the export-oriented garment sector (USD 204 per month in 2024). In contrast, contract plantation workers reside on-site with their families and work under a different remuneration system based on monthly wages and harvest-related bonuses. Many migrant workers designate the day following payday as a day off to remit their wages to their families.

A large proportion of temporary plantation workers, as well as some packing facility workers, are seasonal migrant laborers from nearby villages or other provinces, resulting in frequent labor turnover. These workers tend to prioritize their own farming activities over wage labor. During peak periods in their farming cycles—such as the planting and seedling stages from April to May and the harvest period from October to November—many temporarily suspend or even withdraw from plantation work. Conversely, during the agricultural off-season, many return to plantation employment. In this sense, wage labor on banana plantations serves primarily as a supplementary source of income during the agricultural slack season.

From a CBA perspective, the introduction of a modern irrigation system has overcome seasonal constraints, eliminating clear distinctions between peak and slack periods. Additionally, by rotating planting and harvesting schedules across plots, the company has achieved year-round production in an effort to maximize output and shipment vol-

umes. Consequently, maintaining a stable workforce, rather than relying on seasonal labor, is a key managerial priority.

This creates a structural contradiction between the temporal organization of production and the actual supply of labor. The tension between the firm's production rationality and workers' livelihood strategies is manifested in the high degree of labor mobility observed on the plantation.

3.3.2. Value Distribution in the Cambodia–China Banana Production Network

Table 4 presents an estimate of the value distribution based on the decomposition of the final retail price per kilogram in the Chinese market, using bananas exported by CBA. The retail price is disaggregated into cost components and profit margins and allocated across different actors along the supply chain, showing that, of the retail price of 306.6 yen per kilogram, only 12.4 yen corresponds to labor costs paid to Cambodian workers.

In terms of profit distribution, the share of profits at the production stage (CBA) is 2.2%, at the distribution stage (export wholesalers) 3.9%, and at the retail stage (retailers) 19.6%. This distribution pattern is typical of a retailer-driven, vertically integrated structure.

Table 4. Retail price composition and value distribution of bananas produced by CBA.

Item	USD/kg	Share (%)
Seedlings	0.02	
Agrochemicals	0.01	
Fertilizers	0.04	
Labor costs	0.08	
Materials	0.09	
Corporate tax (Cambodia)	0.15	
Farm maintenance costs	0.30	
1. Total cost (CBA)	0.69	34.7%
2. Profit (CBA)	0.04	2.2%
Selling price	0.73	
Container cost	0.13	
Export cost (Cambodia)	0.00	
Import cost (China)	0.06	
Ripening	0.04	
4. Total cost (wholesaler)	0.23	11.5%
5. Profit (wholesaler)	0.08	3.9%
Port price in China	1.03	
Labor (China retail)	0.16	
Rental cost	0.11	
Other costs	0.29	
7. Total cost (retailer)	0.56	28.1%
8. Profit (retailer)	0.39	19.6%
Final consumer price	1.98 USD/kg	100%

Source: Compiled by the author based on field interviews. The calculation of the banana value chain is based on the methodology presented in Banana and Mango Value Chains and Banana Value Chains in Europe and the consequences of Unfair Trading Practices [30,31]. The data used are based on figures as of the end of 2024. Data on labor costs, rental costs, and retailer profit margins in China are based on the 2018 Community Fresh Food Survey Report published by the Ministry of Commerce of the People's Republic of China [32]. Exchange rates used for conversion to USD are based on the reference rates published by Sony Bank [33]: CNY = JPY 21.9; USD = JPY 155.0. This table presents an approximate decomposition of the price structure based on interviews and publicly

available data. It does not represent a strict national accounts measure of value added but provides an indicative distribution of costs and profits among actors.

4. Discussion

4.1. Lead Firms

The results confirm the central role of lead firms in coordinating cross-border production networks, consistent with the GVC and GPN literature. Within the GVC framework, powerful lead firms determine the conditions under which suppliers are incorporated into global production systems and exercise control over production, standards, and market access [34].

Building on this perspective, the GPN framework emphasizes the relational and spatial dimensions of lead-firm coordination. In GPN 2.0 studies, lead firms not only act as producers or buyers but also serve as coordinators, controllers, and market-makers that organize production networks across multiple locations [35].

Recent studies on multinational enterprises in emerging markets have emphasized the distinctive characteristics of lead firms from emerging economies. Rusak (2019) highlighted the need for greater attention to the strategic role of EMNEs in shaping GVC configurations [36]. Similarly, Pananond et al. (2023) argued that lead firms in emerging economies differ from those in advanced economies in terms of GVC objectives, trajectories, and governance structures [37]. They found that lead firms from advanced economies primarily use GVCs to disperse production activities geographically, whereas EMNEs tend to use GVCs to acquire resources, expand strategic assets, and strengthen their positions in global markets.

The Cambodian banana sector supports this perspective insofar as Chinese agribusiness firms serve as lead firms in export-oriented production networks. Their role extends beyond basic production coordination to include plantation investment, institutional coordination, traceability systems, and the organization of market access linking Cambodian production systems to the Chinese market.

The Cambodian case also shows that the expansion strategies of Chinese agribusiness firms cannot be understood solely in terms of EMNE distinctiveness. However, the Cambodian banana sector also demonstrates important continuities between Chinese agribusiness firms and historically dominant Western multinational agribusiness. Traditionally, the global banana industry has been characterized by highly concentrated and vertically integrated governance structures dominated by large multinational corporations, such as Dole, Chiquita, and Del Monte. These firms controlled extensive plantation systems, transportation infrastructure, export coordination, and international market access while exerting significant political influence over trade and regulatory arrangements. The so-called “Banana Wars” between the United States and the European Union during the 1990s highlighted the close relationship between multinational banana corporations and state trade policies and international economic governance.

The Cambodian case reveals several similar characteristics. Chinese agribusiness firms manage plantation production and actively participate in export coordination, traceability systems, industry associations, and institutional negotiations on market access between Cambodia and China. In this sense, the governance role of Chinese agribusiness resembles that of the traditional model of Western multinational agribusiness in the global banana trade.

At the same time, however, these governance structures are embedded in a distinct China-centered agrifood system that features strong dependence on the Chinese market, bilateral institutional coordination, and the growing influence of Chinese capital in mainland Southeast Asia.

4.2. States, Institutions, and Governance Facilities

Despite serving as lead firms in the Cambodia–China banana production network, Chinese agribusiness governance functions cannot be explained by firm-level strategies alone. Recent studies have shown that agricultural production networks are also shaped by state forces, institutional arrangements, and intermediary organizations. In particular, the role of states in facilitating strategic coupling and shaping network relations remains underexplored in the GVC and GPN literature [38].

Gereffi et al. (2005) proposed five governance types in GVCs—market, modular, relational, captive, and hierarchical—to explain interfirm relationships within GPNs [20]. According to this framework, governance structures are influenced by the complexity of transactions, the ability to codify information, and supplier capabilities [20]. Subsequent studies suggested that multiple governance types may coexist within a single GPN [39].

The Cambodian banana export industry illustrates such heterogeneity in governance. Large-scale plantations operated by Chinese agribusiness firms exhibit hierarchical governance characteristics, as firms exercise direct control over land, production processes, labor management, and quality control. In contrast, relationships between plantation companies and contract farmers or wage laborers are more consistent with a captive governance model, reflecting asymmetric power relations and strong dependence on lead firms. Meanwhile, interactions between Cambodian exporters and Chinese importers, wholesalers, and distributors display features of relational governance, relying heavily on trust, long-term business relationships, and repeated transactions.

The Cambodian case demonstrates that governance in China-centered agrifood production networks is not exercised solely through lead firms. Instead, it is mediated through a set of institutional and organizational arrangements that function as governance facilities, enabling different governance forms to coexist and operate across the network. This coordinated governance model involves leading firms as well as the institutional and organizational arrangements that enable network integration.

Importantly, these governance forms can coexist through a set of governance mechanisms, including the ELC system, the BRI, Cambodia–China bilateral phytosanitary agreements, export certification systems for access to the Chinese market, the CBIAF, and Chinese distribution networks. Together, these arrangements provide the institutional infrastructure through which hierarchical, captive, and relational governance can be coordinated.

Among these governance facilities, the ELC system plays a particularly important role. In addition to functioning as land allocation mechanisms, ELCs serve as governance facilities that enable Chinese agribusiness firms to establish large-scale plantations, secure long-term land access, and coordinate agricultural production across extensive territories. ELCs have transformed land resources into territorially embedded production platforms and provided the institutional foundation for China-centered banana production networks.

Governance mechanisms also encompass bilateral phytosanitary agreements and export certification systems that establish the regulatory conditions for direct exports to China, reduce transaction costs, and standardize production requirements. At the same time, intermediary organizations play an important role in network formation. The CBIAF serves as a platform linking firms, government agencies, and market actors. Through lobbying, information sharing, regulatory coordination, and communication with Chinese authorities, the association helps stabilize and expand the export industry. This finding supports recent arguments that intermediary organizations are important facilitators of strategic coupling and vertical and horizontal coordination within agricultural production networks.

An equally important aspect of the Cambodia–China banana production network concerns the governance of quality. Research on agrifood GPNs has shown that market access in European and North American supply chains is often linked to private standards concerning food safety, environmental protection, labor conditions, and traceability [40].

By contrast, the Cambodian case demonstrates that, although access to the Chinese market is regulated through phytosanitary requirements and export certification systems, quality governance is primarily exercised by exporters and importers. Fieldwork findings indicate that quality assessments focus largely on commercial characteristics, such as appearance, size, color, and marketability, with environmental standards and labor conditions playing a limited role in determining market access.

This finding highlights another aspect of how governance of the Cambodia–China banana production network differs from that commonly observed in Western retailer-driven agrifood networks. Whereas European and North American supply chains frequently integrate environmental and social requirements into quality governance, the Cambodia–China network prioritizes commercial quality and sales performance. This governance structure has facilitated the rapid expansion of Cambodia’s banana export industry and reduced producers’ compliance costs. Beyond coordinating production and market access, these governance arrangements also generated substantial value enhancement within Cambodia’s banana industry. Before the emergence of the China-centered agrifood production network, commercial banana exports were negligible but expanded rapidly thereafter, reflecting enhanced productive and export capabilities.

However, this process of value enhancement did not necessarily translate into greater value capture for producing regions.

4.3. Value Creation and Unequal Value Capture

Recent research has examined the mechanisms through which participation in GVCs generates value for the agricultural sector. Empirical analyses using the Global Trade Analysis Project database have demonstrated that direct exports of agricultural products and participation in GVCs can generate substantial value added, even in economies specializing in primary commodity production. Value creation is not limited to agricultural production itself but also arises from service-related activities, including transportation, logistics, finance, and marketing [41]. These findings challenge the conventional view that primary commodity exports inherently add little value and highlight the important role of GVC integration in agricultural development.

However, value creation, enhancement, and capture are core processes within the GPN framework, shaping firm performance and regional development. The creation of value does not necessarily mean that the actors or regions generating that value can capture it. Lead firms, exporters, wholesalers, retailers, and other actors possess varying levels of bargaining power and market control, resulting in potentially uneven patterns of value capture within production networks [23].

Evaluating the developmental implications of GPN integration requires attention to how value is created and distributed among actors. Who captures value and the governance mechanisms at play ultimately determine the broader developmental outcomes of participation in global and regional production networks. As noted previously, governance within the China-centered agrifood production network has generated substantial value enhancement in Cambodia’s banana industry. However, this value enhancement process did not necessarily result in greater value capture for the producing region.

As shown in Table 4, the value distribution structure of the Cambodia–China banana production network is asymmetric. Although banana production in Cambodia relies on substantial investments in land development, plantation management, and labor recruitment, little value is captured at the production stage. The plantation operator captured

only 2.2% of the final retail value, whereas wholesalers captured 3.9%. By contrast, retailers captured 19.6% of the final consumer price, nearly nine times the share retained by producers. A significant proportion of value is concentrated in downstream segments of the supply chain located closer to final consumers.

These findings indicate that value enhancement and value capture are not necessarily aligned within production networks. Although Chinese lead firms coordinate production activities, they capture only a small share of the final retail value. Rather than being concentrated among producers, value increasingly accrues to downstream actors engaged in distribution, branding, marketing, and retailing. These actors exert greater influence over consumer markets, pricing decisions, and product differentiation, enabling them to capture a disproportionate share of value despite their limited involvement in agricultural production.

The concentration of value in downstream segments is not unique to the Cambodia–China banana production network. Major supermarket and retail chains in Europe have also increased their market power and shifted bargaining strength away from producers toward downstream actors [42]. According to Banana Link (2015), within the banana value chain between Latin American and Caribbean countries and the European Union, agricultural labor costs account for only 5–9% of the final retail price, whereas retailers capture approximately 36–43% of the total value [31]. These findings illustrate the significant value capture in downstream activities, particularly in retailing, despite agricultural production and labor constituting the foundation of the supply chain.

A similar pattern can be observed in the Cambodia–China banana production network, where a significant share of value remains concentrated in downstream distribution and retail activities located closer to final consumers, reflecting the uneven value distribution of China-centered agrifood production networks and, more broadly, the structural features of global banana commodity chains.

4.4. Sustainability Implications

The findings suggest that the China-centered banana production network's sustainability depends on continued market expansion as well as plantation production's long-term sustainability. Large-scale banana production requires continuous irrigation, year-round plantation management, and ongoing disease control. Plantation managers identified Fusarium wilt (TR4) as a major production risk, and prolonged dry seasons require continuous irrigation through artificial reservoirs.

Unlike many crop diseases, TR4 is difficult to eradicate once established, and infected land may remain unsuitable for banana cultivation for extended periods because no effective curative treatment is currently available [43]. Although this production system is exposed to such structural risks, the ELC system provides an institutional foundation for sustaining its long-term operation. While CBA currently cultivates approximately 1000 ha of bananas, its concession covers more than 9500 ha, providing sufficient land reserves for future plantation expansion or production adjustment when plantations are affected by disease.

Export-oriented banana plantations have historically faced similar production constraints. The replacement of the Gros Michel variety following the spread of Fusarium wilt illustrates that production vulnerability has long been an inherent characteristic of plantation-based monoculture [44]. Although Chinese agribusiness has restructured the geographical organization of the banana production network, it has not fundamentally transformed the logic of historical plantation production. Consequently, the China-centered banana production network has inherited the historical pattern of value distribution and structural production vulnerabilities embedded in export-oriented plantation agriculture.

From a GPN perspective, Cambodia has been successfully integrated into the China-centered agrifood production network as a production base, generating export growth and employment opportunities. The governance arrangements established by Chinese agribusiness firms have generated substantial value enhancement by strengthening Cambodia's productive and export capabilities. However, these improvements have not necessarily resulted in greater value capture because higher-value-added commercial functions are concentrated among downstream actors. From a policy perspective, the Cambodian government should promote functional upgrading by strengthening domestic wholesale, logistics, and retail capabilities to retain a greater share of value within the country. Furthermore, this production network's long-term sustainability not only depends on continued market expansion but also on the capacity to sustain plantation production under persistent production constraints. Therefore, the Cambodia case suggests that China-centered agrifood production networks reproduce uneven value capture patterns and structural production vulnerabilities characteristic of export-oriented plantation agriculture remain.

5. Conclusions

This study provides new empirical evidence on the integration of Cambodia's banana export industry into a China-centered agrifood production network from a GPN perspective. By analyzing the roles of lead firms, institutional arrangements, labor organization, and value distribution, the study reveals how an emerging China-centered agrifood system has been constructed and how it shapes developmental outcomes in a late-comer economy.

The findings demonstrate that Chinese agribusiness firms function as lead firms in the Cambodia–China banana production network, while institutional arrangements facilitate production coordination and market access. Labor organization is characterized by low wages and high labor mobility, and integration into the China-centered agrifood production network has generated substantial value enhancement but does not necessarily translate into greater value capture in producing regions.

Although Chinese capital has reorganized the Cambodia–China banana production network, it has not fundamentally transformed unequal value distribution patterns or plantation production vulnerabilities. Therefore, the long-term sustainability of this production network depends on market expansion and the capacity to sustain plantation production under continuing constraints, such as intensive resource requirements and production risks.

This study has several limitations that suggest directions for future research. First, the mechanisms underlying the discrepancy between the governance power of Chinese agribusiness firms and value capture remain insufficiently understood. Future research should investigate how different actors, particularly wholesalers, retailers, and distribution companies, influence the distribution of value and the allocation of profits within China-centered agrifood production networks.

Second, the findings are derived from a single case study of the banana production network between Cambodia and China, which shows how uneven patterns of value capture are reproduced, although it remains unclear whether similar dynamics occur across other agricultural commodities, countries, and production arrangements. Future comparative research is needed to examine the broader applicability of these findings and to identify the conditions under which China-centered agrifood production networks generate different developmental outcomes.

Rather than establishing a universal pattern applicable to all China-centered agrifood production networks, this study provides an empirical foundation for future comparative research. More broadly, the findings suggest that the rise of China-centered agrifood sys-

tems does not necessarily transform the underlying dynamics of uneven development within agricultural production networks. Instead, new forms of regional integration may coexist with persistent asymmetries in governance, labor relations, and value capture, raising important questions about the developmental implications of emerging South–South production networks.

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Institutional Review Board Statement: This study is waived for ethical review as this study was conducted as qualitative field research in economics and did not involve medical research, biological samples, clinical interventions, or experimental manipulation. Accordingly, the study does not fall within the scope of the Ethical Guidelines for Medical and Biological Research Involving Human Subjects, issued jointly by the Ministry of Health, Labour and Welfare (MHLW), the Ministry of Education, Culture, Sports, Science and Technology (MEXT), and the Ministry of Economy, Trade and Industry (METI) (<https://www.mhlw.go.jp/stf/seisakunitsuite/bunya/hokabunya/kenkyujigyou/i-kenkyu/#m-naAncTarget01>, accessed on 11 June 2026). Accordingly, no ethics committee approval number was issued for this study. The re-search was conducted in accordance with the research ethics training received at Kyushu University and generally accepted ethical principles for qualitative social science research. At Kyushu University, the publicly available research ethics framework and ethics review procedures are established primarily for medical and life science research, while all researchers are required to complete Research Ethics Education (APRIN) as part of responsible research conduct (<https://www.kyushu-u.ac.jp/ja/research/ethics/>, accessed on 11 June 2026). Prior to conducting the fieldwork, the first author completed the Kyushu University APRIN Responsible Conduct of Research (RCR) training.

Informed Consent Statement: Informed consent was obtained from all participants involved in the study. Written informed consent was obtained from participants involved in questionnaire surveys. For interviewees and participant observations conducted during fieldwork, participants were informed of the purpose of the research, participation was voluntary, and verbal informed consent was obtained prior to participation. Verbal consent was used in these cases because participant observation and field interviews were conducted under natural fieldwork conditions. All personal information was anonymized to protect participants' identities.

Data Availability Statement: The original contributions presented in this study are included in the article. Further inquiries can be directed to the corresponding author.

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Abbreviations

The following abbreviations are used in this manuscript:

CBA	Cambodia Banana Agricultural
GPNs	Global Production Networks
GVCs	Global Value Chains
EMNEs	Emerging Market Multinational Enterprises
ELCs	Economic Land Concessions
BRI	Belt and Road Initiative
CBIAF	Cambodia Banana Industry Association Federation

Appendix A

Table A1. Data sources and calculation procedures for estimating the value distribution in Table 4.

Table 4 Item	Calculation Item	Original Data	Data Source	Calculation	Result
1. - ¹	Annual export volume	1450 exported 40-foot containers (2024); 1540 cartons/container; 13 kg/carton	CBA export records	$(\text{Containers} \times \text{cartons/container} \times \text{kg/carton}) \div 12 \times 8$	Export volume (kg)
2. Seedlings ²	Seedling cost	Seedling price: USD 0.33/plant; Total banana plants: 1,010,000	Seedling price: Dr. D; Total banana plants: CBA manager	Seedling price $\times$ total banana plants	Total seedling cost (USD)
3. Agrochemicals	Agrochemical cost	Average monthly agrochemical cost: USD 35,000	CBA financial records	Average monthly agrochemical cost $\times$ 8	Agrochemical cost (USD)
4. Fertilizers	Fertilizer cost	Average monthly fertilizer cost: USD 100,000	CBA financial records	Average monthly fertilizer cost $\times$ 8	Fertilizer cost (USD)
5. Labor costs	Contract worker labor cost ³	Contract worker households: 110; Monthly wage per worker: USD 337.5; Bonus per harvest cycle: USD 594,000	CBA financial records	Contract worker households $\times$ 2 $\times$ 8 $\times$ monthly wage per worker + bonus per harvest cycle	Total contract labor cost (USD)
6. Labor costs	Temporary and packing house worker labor cost ⁴	Average monthly wage for all temporary workers: USD 81,200; Average monthly wage for all packing house workers: USD 24,360	CBA financial records	Average monthly wage for temporary workers $\times$ 8 + average monthly wage for packing house workers $\times$ 8	Total labor cost of temporary and packing house workers (USD)
7. Labor costs	Interpreter and support staff labor cost	Number of interpreters: 8; Monthly wage per interpreter: USD 1000; Number of support staff: 12; Monthly wage per support staff: USD 500	Worker interviews	Number of interpreters $\times$ monthly wage per interpreter $\times$ 8 + number of support staff $\times$ monthly wage per support staff $\times$ 8	Total labor cost of interpreters and support staff (USD)
8. Materials ⁵	Major production material cost	Average monthly foam sheet cost: USD 52,000;	CBA procurement department	Average monthly foam sheet cost $\times$ 8 + average	Total cost of major production material (USD)

		Average monthly plastic bag cost: USD 4250		monthly plastic bag cost × 8	
9. Materials	Carton cost	Carton price: USD 0.90/carton	CBA procurement department	Carton price × cartons required for one harvest cycle	Total carton cost (USD)
10. Selling price ⁶	Farm-gate selling price	Average selling price: USD 9.50/carton	CBA sales department	Average selling price per carton ÷ 13 kg/carton	Farm-gate selling price (USD/kg)
11. Corporate tax (Cambodia) ⁷	Corporate income tax	Corporate income tax rate: 20%	JETRO	Farm-gate selling price × 20%	Corporate income tax (USD/kg)
12. Profit (CBA) ⁸	CBA profit	Annual profit margin: 6%	CBA financial records	Farm-gate selling price × 6%	CBA profit (USD/kg)
13. Farm maintenance costs ⁹	Farm maintenance costs	—	Calculated	Farm-gate selling price – (Seedlings + Agrochemicals + Fertilizers + Labor + Materials + Corporate income tax + CBA profit)	Farm maintenance costs (USD/kg)
14. Container cost ¹⁰	Container cost	Container cost: USD 2500 per 40-foot container	Exporter	Monthly containers × 8 × container cost	Total container cost (USD)
15. Export cost (Cambodia) ¹¹	Export cost	Export cost: USD 80 per 40-foot container	Exporter	Export cost per container × containers for one harvest cycle	Total export cost (USD)
16. Import cost (China) ¹²	Import cost	Import cost (including tariffs): RMB 8000 per 40-foot container	Exporter	Import cost per container × containers for one harvest cycle	Total import cost (RMB)
17. Ripening ¹³	Ripening cost	RMB 3.8/carton	Exporter	Ripening cost per carton × cartons for one harvest cycle	Total ripening cost (RMB)
18. Port price in China	Wholesale price	RMB 95/carton	Exporter	Wholesale price per carton ÷ 13 kg/carton	Wholesale price (RMB/kg)
19. Labor (China retail); rental cost; other costs ¹⁴	Retail cost structure	Cost shares of labor, rental, and other operating costs reported in the 2018 Community Fresh Food Survey Report published by the Ministry of Commerce of the People's Republic of China	Ministry of Commerce of the People's Republic of China (2018) [32]	Wholesale price × reported cost shares	Labor cost, rental cost, and other operating costs (RMB/kg)
20. Final consumer price ¹⁵	Retail price	Average retail price: RMB 14/kg	Exporter		Final consumer price (RMB/kg)

Notes: ¹ Bananas are traded in 40-foot containers; variation in fruit size or quality was not considered. Bananas are harvested three times every two years; therefore, one harvest cycle was assumed to be eight months. ² The total number of banana plants represents the plantation capacity required to sustain the production system (three harvests every two years) and refers to the plantation at the end of 2024. ³ Each contract worker household includes two workers. ⁴ Minimum staffing and typical monthly wages were used because of frequent labor turnover; individual variation was not considered. ⁵ Only the two major packaging materials with the highest expenditure were included; other disposable materials were excluded. ⁶ Variation in banana quality was not considered. ⁷ The standard corporate income tax rate in Cambodia was applied. ⁸ The annual average profit margin reported by CBA was applied. ⁹ Estimated as the residual after deducting all identified costs and profit

from the farm-gate selling price.¹⁰ Container cost refers to the transportation cost per 40-foot container.¹¹ Export cost refers to customs clearance and related export procedures in Cambodia.¹² Import cost includes customs duties and related import charges in China.¹³ Ripening was conducted after import into China.¹⁴ Reported cost shares represent the overall fresh food retail sector rather than the banana industry. Because no newer official data with comparable details were available, the 2018 report was used as the best available benchmark.¹⁵ CBA bananas are positioned in China's premium market segment.

Appendix B

Table A2. Intermediate calculation results and currency conversion used to derive Table 4.

No.	Item	Value	Unit
1	Seedling cost (one harvest cycle)	51,651,501.0JPY	
2	Agrochemical cost (one harvest cycle)	43,391,600.0JPY	
3	Fertilizer cost (one harvest cycle)	123,976,000.0JPY	
4	Labor cost (one harvest cycle)	240,871,885.6JPY	
5	Major production material cost (one harvest cycle)	69,736,500.0JPY	
6	Corporate income tax (Cambodia, 20%)	438,323,013.3JPY	
7	CBA profit (6%)	131,496,904.0JPY	
8	Total production cost (CBA plantation)	1,099,447,403.9JPY	
9	Carton cost (one harvest cycle)	207,628,806.0JPY	
10	Logistics cost (one harvest cycle)	556,164,513.3JPY	
11	Ripening cost (one harvest cycle)	124,113,117.3JPY	
12	Export volume	1,488,667.0	Cartons
13	Number of containers (one harvest cycle)	967.0	Containers
14	Production cost	738.5JPY	/per carton
15	Farm-gate selling price	1472.2JPY	/per carton
16	Wholesale price	2084.3JPY	/per carton
17	Final consumer price	3993.1JPY	/per carton

Notes: Currency conversion was conducted using the Sony Bank reference exchange rates as of 5 December 2025 (JPY 21.9 per RMB and JPY 155.0 per USD). Minor discrepancies between the values reported in Appendix A and Appendix B result from rounding during currency conversion and decimal calculations in Microsoft Excel for Microsoft 365 (Microsoft Corporation, Redmond, WA, USA). These minor differences have no effect on the value distribution analysis or the conclusions of this study.

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