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Comparative Advantage Analysis of HoaLoc-Mango Production in the Mekong Delta Region, Vietnam

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Abstract

The objective of this research is to determine the comparative advantage of the HoaLoc-mango export routes in terms of social price. This is assessed by calculating the domestic resource cost per shadow exchange rate (DRC/SER). A total of 457 sample observations were gathered from various stakeholders in the agricultural sector, including farmers, cooperatives, collectors, wholesalers, export enterprises, and processing firms, via the use of questionnaires. The findings suggest that the three export channels of HoaLoc-mango distribution channels exhibit a comparative advantage, as shown by a DRC/SER ratio of less than one. In the first export channel, the DRC/SER ratios for seasons 1, 2, and 3 are 0.56, 0.55, and 0.51, respectively. In export channel 2, the values for seasons 1, 2, and 3 are 0.45, 0.43, and 0.36, respectively. The DRC/SER ratios for seasons 1, 2, and 3 in export channel 3 are 0.46, 0.44, and 0.32, respectively. Season 3 is regarded as a beneficial cropping season within the year, since it demonstrates the maximum comparative advantage across all three export channels. Channels 2 and 3 provide a superior comparative advantage in comparison to channel 1. It is recommended that policy makers and government entities implement incentive policies aimed at enhancing product quality, eliminating both border and non-tariff barriers, and effectively leveraging the comparative advantage derived from favorable climatic, soil, and water conditions. These factors play a crucial role in fostering the sustainable development and economic advancement of HoaLoc-mango.

Keywords: *Comparative advantage, HoaLoc-mango, economic efficiency, Mekong Delta.*

1. Introduction

In terms of mango production, Vietnam is presently the seventh-largest producer in Asia and the twelfth-largest producer in the world. According to the 2019 edition of the Food and Agriculture Organization Statistical Yearbook for Asia and the Pacific (FAOSAT), Vietnam ranks third in Southeast Asia for mango output. After Thailand and Indonesia, Vietnam is the third largest producer of mangoes in Southeast Asia. The export value of fruits and vegetables is expected to fall in 2019 and 2020 compared to 2018 levels due to the Covid-19 epidemic. Mango exports from Vietnam have skyrocketed in value, with Khoi (2021) estimating that they would jump from USD 68 million in 2016 to USD 279 million in 2020. The Vietnamese General Statistics Office found that mangoes were grown in every single province in the country in 2022. Mangoes were grown over a massive area of land in 2019, totaling 100,000 hectares, resulting in a huge national production of almost 815,200 tons.

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It has been determined that the Mekong Delta (MD) is the principal region responsible for over half (46.3%) of Vietnam's total mango growing area and a hefty portion (62.2%) of the country's total mango production volume. Multiple estimations were used to arrive at the study's findings. Typically grown on plots of land between 0.5 and 1.0 ha in size, mangoes are a staple crop for low-income farmers. There are several challenges that smallholder farmers face that prevent them from embracing new technologies and establishing solid ties to markets. These factors are the driving force behind the extensive web of linkages between producers and markets. One of the greatest difficulties in agriculture is translating market signals about demand, diversity, quality, and food safety into actual improvements (Peter, 2020; William, 2014). The value chain for fresh produce in Vietnam has several challenges, as noted by Pilar et al. (2021). The lack of adequate cold storage facilities, customer data, market information transfer, connectivity among companies, and adequate logistical infrastructure are only a few of the problems that occur in this setting. One of Vietnam's primary goals is to increase and diversify its export activities. According to research done by Anh et al. (2020), the export market is where most commodity processing takes place. It is also important to note that around 60% of all Chu-mango exports are destined for the Chinese market (William, 2014).

As a strategy to increase agricultural exports, the Vietnamese government is actively engaged in bilateral and multilateral Free trade agreement (FTA) discussions. Vietnam has reaped benefits from its FTAs with 13 nations thus far, and talks are now underway with 3 more. Farmers and agricultural product exporters in Vietnam now have access to global value chains and may compete for foreign investment as a consequence. Free trade agreements (FTAs) such as the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), the Europe-Vietnam Free Trade Agreement (EVFTA), and the United Kingdom-Vietnam Free Trade Agreement (UKVFTA) all have a noticeable impact on the mango trade dynamics. Mango exports are boosted by the existence of another FTA, the ASEAN Economic Community (AEC). According to studies by Brian et al. (2021) and Thang (2018), fresh mangoes and mango-related items supplied from Vietnam to countries with whom it has Free Trade Agreements (FTAs) are not subject to tariffs in those countries. Mangoes exported to countries with active Free Trade Agreements (FTAs) are eligible for this reduction in tariffs. There is a lot of room for growth in Vietnam's mango export business, as seen by the country's presence in the top 10 list of global mango importers among the likes of the United States, the United Kingdom, Canada, and Malaysia. The rising demand for mangoes in the United States and China may account for much of the significant rise in the import value of mangoes from Vietnam in 2020. FAO (2021) reports that both exports and imports have increased over the previous year, with exports increasing by 5.1% and imports by 7.7%. Using the available information, we can deduce that the worldwide mango trade has continued its increasing trend and is now at a high point. Mango exports throughout the world are expected to grow by an average of 2.9% each year over the next decade. Predictions were used to compile the data displayed. By 2029, the world's mango production is predicted to amount to 72.8 million tons, with Asia accounting for around 71% of that total. Increasing from 9.8 kilos in 2019 to 12.1 kilograms in 2020, this is the predicted increase in average annual food intake (OECD-FAO, 2020).

A surge in demand from both local and international markets bodes well for the future of Vietnam's mango sector. There's a lot of room for improvement and expansion. In order to maintain a competitive edge over other businesses in the same industry, it is essential to take a methodical approach to ensuring high quality at every stage of production and distribution. Another important factor is the deliberate choice of policies that promote the supply chain's

long-term viability. The major purpose of this study is to further our understanding of the dynamic nature of Vietnam's mango export industry by exploring its numerous facets, comparative advantage, and underlying factors. This research provides useful information that might be used to improve Vietnam's international competitiveness by increasing its export of mangoes.

2. Methodology

2.1. Sampling technique

The data collection process was conducted with careful organization and attention to detail. The decision to use the Mekong Delta as the research site was based on its superior mango production system. Vietnam plays a substantial role in this particular industry, as it has a dominant position with a production volume share of 63.5% and a production area share of 50.1%. The selection of Dong Thap, An Giang, Tien Giang, and Vinh Long provinces was based on their significant contributions to the development of the Mekong Delta region. The combined land area and population of these provinces together represent 64% and 73% of the Mekong Delta region, as reported by the General Statistics Office (GSO, 2022). A total of 457 sample observations were picked using the random sampling approach to conduct a study on the comparative advantages of the hoaloc-mango. The sample included individuals from several groups, including farmers (n=389), cooperatives (n=6), collectors (n=30), wholesalers (n=20), exporters (n=7), and processing firm (n=5).

2.2. Literature Review

Two distinct standards of adjudication have vied for preeminence throughout history. There are two primary research methods used in the study of international commerce. The Ricardo's approach, which is the foundation of mainstream economics, will serve as the initial point of debate. The second method, popularized by Balassa in 1965 and now known as the Balassa methodology, centers on the idea of recognized comparative advantage. Profit, specialization, factor endowment, and technological advancement are the cornerstones of the traditional strategy. In many situations, it is helpful to have access to indicators of technical intensity, unit costs of manufacturing inputs, and local and international output prices. Balassa's method is predicated on the idea that fluctuations in non-price elements and relative costs affect economic activity. This method relies on the following key premise. According to Zawalinska (2002), this method takes into account the cyclical changes in economic ratios. Balassa's theory of revealed comparative advantage suggests that a country's actual export performance may be used to evaluate the "export competitiveness" of that country. The basic concept behind this is as follows. Improving the country's export capacity in fields where it has demonstrated export proficiency is the primary policy recommendation gleaned from this strategic approach. When a company develops a strategy that enables it to outperform its competitors, it gains a competitive advantage. Because of this, the company may expand more quickly than its competitors. When a business's clients see the work it does with a rival as being of higher quality and offering more benefits, that company has a significant competitive advantage. The term "competitive advantage," which is synonymous with "competitiveness," is used in the field of financial analysis to determine whether or not a venture or private gain is financially viable in light of the current market value. Despite the undeniable importance of competition, Porter (1990) argues that the idea of competition is often oversimplified in the corporate world.

Assessing a country's global competitiveness might be aided by looking at how open its markets are to foreign commerce. Thus, competition may be seen as a "zero-sum game," in which one country's benefits come at the expense of another's.

Ex-ante studies often utilize DRCs to evaluate competitive advantage. This method, which has been in use for quite some time, has its roots in the ideas expounded upon by Ricardo (1817). One popular metric used to evaluate a product's comparative advantage is the DRC. It is crucial to include in the prices at which economic activities utilize resources when evaluating national production. These factors either directly or indirectly contribute to economic activity, which is why they are being used. These costs might be used as a baseline against which to measure the social price of obtaining a further foreign currency unit. The potential cost of producing net FX via the production of more export commodities, or lowering the demand for FX by employing local resources for import substitution, is referred to as the "domestic resource cost" (DRC). The opportunity cost of a rise in net foreign exchange must be accounted for in both cases. The notion of comparative advantage, which is central to the study of international commerce, is inextricably tied to the idea in issue. Therefore, the notion of comparative advantage is intrinsically linked to this view. Certain assumptions must be made in order to carry out the DRC analysis. Therefore, it is possible to categorize inputs and products as domestic or international based on where they were produced. In addition, it is presumed that it is possible to ascertain the shadow prices of the system's inputs and outputs. The reliability of this assumption is ultimately dependent on the availability of cost data for similar components. Government efforts to enact laws and establish policies are crucial to ensuring a steady flow of output. In turn, these actions affect the commodity transaction that is the subject of the inquiry as well as the value of the currency.

The DRC is often studied as part of a variety of research and development projects. Successful business and production systems can be distinguished from inefficient ones with the help of the methodology presented by Gorton et al. (2000). The need to develop and enforce concrete plans to save production costs is emphasized. As a result, the concept of comparative advantage, a cornerstone of international trade, is highly correlated with the DRC index. The advantages of fruit and vegetable exports have been studied in depth in the past, with the DRC serving as a case study in this regard. Many students and researchers in the academic world are committed to learning more about agriculture in all its forms. Gao et al. (2012), in the course of their extensive research, analyzed the worldwide competitiveness of China's fruit sector in great detail. The whole industry as well as the seven most important fruit species in China were evaluated. The results showed that just one of the seven fruit species studied (the pear) had a substantial competitive advantage in global markets. Jiang's (2011) research analyzes the competitiveness of China's export market for fresh vegetables. The Chinese are the market leaders here. The author achieves this goal by developing a theoretical framework whose central concern is the evaluation of relative strengths and weaknesses. The study of international competitiveness relies on this paradigm. The results suggest that Chinese companies involved in the export of apples and pears to international markets may have a competitive advantage over their competitors due to their ability to charge lower prices. Recent research suggests that China's fresh food exports are less competitive than those of other countries.

Soetriono et al. (2019) found that growing snake fruit in the city of Pronojiwo resulted in a DRC value of 0.20, which is considered successful since it is less than one. This finding provides evidence that the cultivation effort was successful. Previous studies have demonstrated that China needs to improve its export competitiveness in the citrus, banana,

grape, orange, and peach sectors, and this requirement has been brought to light by Hu et al. (2008). Studies in the past have drawn attention to this occurrence. Li (2011) examined statistics from 1996–2010 to probe the Hebei province's worldwide competitiveness in the apple industry. The author acknowledges Hebei Province's apple industry's significant competitive advantage inside China's domestic market. However, the author's research shows that the United States' progress in this area is far less than that of other countries. Mao and Chen (2011) performed research to better understand the worldwide competitive landscape of China's agricultural industry. The research results suggest that the Chinese fruit business is distinctive from the export sectors of other leading countries across the globe. China's exports of fresh and dried fruits aren't quite as unique as those of its rivals.

In the Kanagarian Koto Tingg area in Indonesia, the Siamese orange (a type of citrus fruit) has a significant competitive advantage (DRC 0.11). Possible explanations for the advantage seen include the existence of good agroclimatic conditions and the strategic use of a broad variety of local resources. Several studies have offered methods to improve export arrangements, raise awareness, improve quality, strengthen inspection systems, and implement other procedures in order to obtain a competitive edge (Wei et al., 2010; Han et al., 2008; Hui and Yin, 2011). The various variables that affect China's fruit export are the topic of this research. As a result, a major chunk of the study focuses on investigating these elements. To analyze the peculiarities of the Chinese fruit export market, Yang (2011) makes use of the trade gravity model as a theoretically sound conceptual framework. The study set out to analyze the export patterns of fifteen different Chinese fruit types between 1992 and 2010. In this study, we used panel data analysis. Many relevant considerations have been taken into account while evaluating the potential effects of Chinese fruit exports. There are several factors to consider, such as the importing country's GDP, China's agricultural production, transportation distance, APEC membership, and bilateral real exchange rates. According to the research done by Khan et al. (2006), the government of Pakistan should put more effort into achieving sugarcane self-sufficiency than it does in pursuing exportation goals. Exporting domestic resources has a DRC of 1.31, according to the research, which is higher than the minimum criterion of 1. If this is the case, then the potential benefits of exporting sugarcane are outweighed by the costs and risks involved. The DRC has a low import dependency ratio of 0.59, despite greater local production costs compared to importing sugarcane. This comparison indicates that import substitution is a less important part of the DRC's overall strategy for achieving food security. Despite the fact that the cost of importing sugarcane surpasses the cost of producing sugarcane domestically, this option is still being considered. The export of Chinese fruit is affected by a number of variables, as revealed by Liu et al. (2006). This decline is attributable to a number of causes, including the dwindling competitive advantage of labor cost, poor fruit quality, an insufficient export system, a limited selection of exportable species, and international restrictions on green trade. Food security legislation has been found to have a minor effect on Chinese fruit exports to the United States, Japan, and the European Union when compared to other factors such as tariffs, technical trade barriers, and product conformity standards and certifications, according to research conducted by Li et al. (2008). Research by Olayinka et al. (2014) suggests that using both the feeder and crown systems might increase yields in pineapple farms in Nigeria. The flexibility of pineapple growth techniques may be responsible for the potential benefits indicated. A DCR of 0.27 was found for the feeder method, whereas a DCR of 0.22 was found for the crown method.

The worldwide competitiveness of the mango produce sector is the focus of this study, which also analyzes the many elements that contribute to this phenomenon. However, it is important to note that Vietnamese academics have rarely included studies on international marketing in their analysis of Vietnam's agricultural exports.

2.3 Empirical model

Bruno (1972) introduced the concept of the DRC, which is a quantitative method used to evaluate the genuine opportunity cost associated with allocating a complete inventory of domestic resources for the production or conservation of a single unit of foreign currency. The determination of this expense is derived from the assessment of the opportunity cost associated with the allocation of domestic resources. Monke and Pearson (1989) assert that the DRC has significant importance as a resource for assessing agricultural sector policies and conducting research on comparative advantage. The fundamental emphasis of the academic inquiry is on the examination of the competitive advantages that agricultural enterprises possess. In a research conducted by Funing and Xu (2002), a team of investigators examined and analyzed the comparative benefits offered by different regions in China for grain growing. In a preliminary study, Bishnu (1983) conducted an analysis to determine the financial implications of cultivating tea in Nelap, only using locally accessible resources.

The computational technique for determining the DRC has several practical implications in real-world scenarios.

$$DRC_i = \frac{\sum_{j=k+1}^{n} a_{ij} \; V_j}{p_i^r - \sum_{j=1}^{k} b_{ij} \; p_j^r}$$

The variable Vj represents the opportunity costs associated with local production. This variable specifically represents the shadow price associated with domestic resources and non-tradable inputs. Furthermore, the variables denote the technical coefficients pertaining to non-tradable inputs and domestic resources. Here, the index j may take on any integer value ranging from k+1 to n. This range encompasses a broad spectrum of potential values. Gorton et al. (2000) established that the technical coefficient for traded inputs is represented by the symbol bij, where the value of j may range from one to k. Furthermore, the symbol P^r_i represents the price of traded inputs, often referred to as the border or reference price. In the context of the exchange, the variable denoted as P^r_j serves as a symbolic representation of the maximum threshold or benchmark price that might potentially be attained.

DRC/SER < 1, the trade system has a comparative advantage (economic efficiency).

DRC/SER > 1, the trade system does not have a comparative advantage (economic efficiency).

The shadow exchange rate can be estimated through the following formula:

SER = OER * (1+ FX premium)

Whereas:

- SER: Shadow Exchange Rate
- OER: Official exchange rate (OER—Official Exchange Rate),
- FX premium is suggested 20% (0.2) by the World Bank applying for developing countries (Minh et al., 2016)

The opportunity cost: The concept of opportunity cost is relevant in evaluating labor allocation within the manufacturing process, under the assumption of a well-functioning labor market

characterized by high efficiency. The potential cost is determined by using the real costs that households have actually spent. This study utilizes domestic land rental rates to estimate the potential land expenses for coffee growers. When doing a valuation of land, it is crucial to include the cost associated with internal resources. In his study, Lorenzo (2013) employs the assumptions of consistent efficiency throughout the duration and annual devaluation of worth in order to estimate the prospective expenditure associated with agricultural machinery.

CIF price: The term "Cost, Insurance, and Freight" (CIF) is used to delineate the value or monetary assessment of items that are imported.

FOB price: The "Free On Board" (FOB) method does not cover relocation expenses. The term "exports" refers to commodities and services that are produced inside a country's borders but are traded and sold in foreign markets.

Tradable commodities: Border pricing, international prices, and border prices are all methods used to denote the monetary value associated with a marketable item. The pricing scheme consists of three tiers: farm gate price, transportation cost price, and selling price. The use of transfer factors in the formulation of shadow pricing is an additional feasible alternative. The transfer factor refers to the proportion by which the actual sales of a product exceed or fall short of the market's anticipated sales price for that product.

Non-tradable commodities: Non-tradeable products, unlike commercial items and industrial inputs such as labor and land, have their border values determined by social pricing systems. Hence, the impact of domestic manufacturing on the economy's capacity to accumulate or allocate foreign currency remains negligible. The Democratic Republic of the Congo (DRC) is often mentioned in policy talks. The research conducted by Gorton et al. (2000) provides a definition of the distinctions between effective and ineffective production. Furthermore, the study suggests specific areas of focus for policy prioritizing and highlights the need for targeted efforts to enhance productivity.

3. Result and Discussion

The export system of the HoaLoc-mango distribution channel includes the following three main export channels:

Channel 1	**Farmer**	**Cooperative**	**Export Enterprise**
Channel 2	Farmer	Cooperative	Processing Firm
Channel 3	Farmer	Wholesaler (Chinese market)	

Distribution Channel 1: It is worth noting that highly industrialized countries like as the United States, France, and Russia exhibit a substantial reliance on the importation of HoaLoc-mango. This area of the market is subject to stringent sanitary and phytosanitary restrictions. Aircraft are often used in the context of international commerce. The Hoa Loc mango may be classified as an "A" variety. The primary source of HoaLoc-mango grade 1 is mostly derived from cooperatives that rigorously comply with pesticide use regulations. These cooperatives own their own safety certificates, such as VietGAP and GlobalGAP, maintain agricultural diary books, and employ traceability codes. The grade 1 HoaLoc-mangos exhibit certain characteristics that set them apart. These characteristics include their exceptional visual appearance, with a weight of more than 350 grams, being packaged in a protective bag, displaying a flawless surface without any creases or defects, and showcasing a vibrant yellow color without any visible abscission layers. The amount of Grade 1 mangoes constituted 45%

of the total volume. As a result, the proportion of HoaLoc-mango sales on Channel 1 constitutes just 2.5% of the aggregate sales across the whole chain. The performers of the channel often engage in communication and collaboration. The results of Fernandez-Stark et al. (2011) are consistent with these findings. Intense competition characterizes the export value chain, necessitating the provision of superior goods and effective coordination among several stakeholders to meet the demands of importers throughout the whole process.

Distribution Channel 2: HoaLoc-mango is involved in the production of various processed mango products, including but not limited to juice, dried mango, frozen mango, and preserves, for the secondary market. Numerous nations, including South Korea, Japan, Australia, the United States, China, and Europe, are prominent importers, facilitated by the operations of shipping lines. On average, HoaLoc-mangoes exhibit a weight lower than 300 grams. The aforementioned characteristics are often seen among kids enrolled in the third and fourth grades. Moreover, the quality of the epidermis in this particular kind is moderate. Approximately 15% of students in the third grade and 5% of students in the fourth grade were seen to be present in the HoaLoc-mango orchard. HoaLoc-mango is cultivated in Vietnam, has a substantial processing yield, and contributes to 7.6% of the total worldwide mango export volume throughout the whole mango value chain.

Distribution Channel 3: This distribution hub is ranked third in terms of its position within the distribution network. Channel 3 places significant emphasis on the Chinese market as its primary focus. In the context of cross-border commerce, it is common for large-scale trucks to use designated border trade gateways as a means of transporting HoaLoc mangoes from Vietnam to China for the purpose of international export. Grade 2 HoaLoc-mangoes may be obtained using the third channel. The categorization of products in this category is determined by many criteria, including traceability codes, weights falling within the range of 300 to 350 grams, the presence of a packaging bag, identification of partial flaws, absence of creases, and vibrant colors. Approximately 35% of HoaLoc-mango trees were classified as the second grade. China receives 7.6% of the aggregate exports of HoaLoc mangoes. In relation to the dissemination of HoaLoc mangoes, the wholesaler assumes a crucial function, accounting for 74.2% of the total quantity. These organizations have a significant impact as both input and output partners in the value chain, influencing the overall functioning and effectiveness of all participants at both regional and national scales. Approximately 24.1% of the total quantity of mangoes is distributed to consumers by farmers, while collectors account for 62.2% of the supply. In addition, the distributor facilitates the transportation of freshly harvested mangoes to the consumer market in China. The majority of mangoes are transported to the central market and China by land transportation using automobiles. Heavy-duty vehicles are equipped with a refrigeration system that incorporates an electrical device to ensure a consistent temperature is maintained throughout the transportation of cargo to distant destinations such as Danang, Hanoi, and China. The duration of travel from Ho Chi Minh City to Danang in the central region is around 16 hours, while the journey to Hanoi in the northern region often spans between 48 and 52 hours. Moreover, the travel time to the Vietnam-China border is estimated to range from 60 to 72 hours. The transactions associated with Channel 3 are only carried out inside the borders of China or Vietnam. It is anticipated that containers with weights ranging from 25 to 30 tons, upon entry into the Chinese market, would be subject to customs processing expenses amounting to around $300 to $350.

Monke and Pearson (1989) argue that the computation of social profit via the use of social pricing is a crucial factor in assessing economic efficiency. The DRC/SER ratio is often used within the

academic community as a metric to assess comparative advantage and gauge relative efficiency. The reduction of DRC is seen as a strategic approach to enhance societal advantages. The HoaLoc-mango is distributed via five primary marketing channels, which have been categorized and examined for the purpose of market study. The data shown in Tables 1, 2, and 3 indicate that across all three seasons, the income generated by Channels 1, 2, and 3 surpasses the combined sum of their tradable and domestic expenditures. The statement implies that throughout the three growth periods of Channels 1, 2, and 3, there is an efficient allocation of scarce resources with implications for society. Furthermore, it demonstrates an upward trend in social profitability. This suggests that the HoaLoc-mango commercial system has the potential to generate revenue across Channels 1, 2, and 3 over all three seasons. The trading system of HoaLoc-mango has the potential to be successful due to its use of transparent and equitable pricing principles.

Table 1. The comparative advantage of HoaLoc-mango in the distribution channel 1 Unit: USD/ton

No.	Indicator costs	Season 1 (n=119)	Season 2(n=134)	Season 3(n=136)	Sig.
	Official exchange rate in 2022 (USD 1 = 23.612 VND)				
1	Tradable inputs	1,113.95^{b}	974.32^{b}	740.89^{a}	***
1.1	Root fertilizer	81.10^{b}	80.29^{b}	49.54^{a}	***
1.2	Leaf fertilizer	17.10^{b}	18.98^{b}	11.09^{a}	***
1.3	Paclobutrazol	2.91	2.60	1.94	*ns*
1.4	Herbicide	64.04^{c}	47.16^{b}	11.99^{a}	***
1.5	Pesticide	171.11	170.35	133.70	*ns*
1.6	Fungicide	595.46^{b}	524.67^{b}	400.15^{a}	***
1.7	Fuel	7.31	7.84	6.95	*ns*
1.8	Wrapping bag	100.99	85.70	84.34	*ns*
1.9	Machine depreciation	73.94^{b}	36.72^{a}	41.21^{a}	***
2	Domestic factors	1,627.03^{b}	1,545.94^{b}	1,178.33^{a}	***
2.1	Root fertilizer	180.89^{b}	179.08^{b}	110.49^{a}	***
2.2	Leaf fertilizer	38.14^{b}	42.32^{b}	24.74^{a}	***
2.3	Paclobutrazol	0.59	0.53	0.40	*ns*
2.4	Herbicide	13.09^{c}	9.64^{b}	2.45^{a}	***
2.5	Pesticide	34.98	34.83	27.33	*ns*
2.6	Fungicide	121.74^{b}	107.27^{b}	81.81^{a}	***
2.7	Fuel	37.41	40.15	35.57	*ns*
2.8	Wrapping bag	21.04	17.85	17.57	*ns*
2.9	Machine depreciation	26.41^{b}	13.11^{a}	14.72^{a}	***
2.10	Transport	7.44	8.48	7.26	*ns*
2.11	Hired labor	238.44^{b}	186.54^{ab}	153.51^{a}	*
2.12	Family labor	672.37^{b}	645.57^{b}	477.85^{a}	***
2.13	Land rent	234.49	260.56	224.63	*ns*
3	Marking cost of traders	5,889.50	5,889.50	5,889.50	*ns*
3.1	Cooperative	202.60	202.60	202.60	*ns*
3.2	Export enterprise	5,686.90	5,686.90	5,686.90	*ns*
4	Total Domestic = (2) +(3)	7,516.53^{b}	7,435.44^{b}	7,067.83^{a}	***
5	Revenue	12,403.08	12,403.08	12,403.08	*ns*
6	Domestic resource cost	0.67^{b}	0.66^{b}	0.61^{a}	***
7	Comparative advantage	0.56^{b}	0.55^{b}	0.51^{a}	***

Source: Field survey data in 2022

Note: Tradable input is CIF price, and Tradable output is FOB price. The numbers of the same row are followed by the different letters being significant at a 5% level via the statistical Ducan test. * Significant at 10% level, ** significant at 5% level, *** significant at 1% level, and ns is non-significant.

The study's outcomes are shown in Table 1, which exhibits the DRC and DRC/SER coefficients for Distribution Channel 1. Based on the given DRC values of 0.56, 0.55, and 0.51, the export business known as Channel 1 is expected to use a projected domestic factor cost of 0.44 USD in Season 1, 0.45 USD in Season 2, and 0.49 USD in Season 3, correspondingly. Furthermore, according to the DRC indices, the production cost of HoaLoc-mango accounts for 56%, 55%, and 51% of the cost of the imported fruit during seasons 1, 2, and 3, respectively. The cultivation and dissemination of HoaLoc-mango are facilitated via the use of locally available resources.

Table 2. The comparative advantage of HoaLoc-mango in the distribution channel 2 Unit: USD/ton

No.	Indicator costs	Season 1 (n=119)	Season 2(n=134)	Season 3(n=136)	Sig.
	Official exchange rate in 2018-2019 (USD 1= VND 23.612)				
1	Tradable inputs	523.02^{b}	451.85^{b}	348.37^{a}	***
1.1	Root fertiliser	38.13^{b}	37.75^{b}	23.29^{a}	***
1.2	Leaf fertiliser	8.04^{b}	8.92^{b}	5.21^{a}	***
1.3	Paclobutrazol	1.37	1.22	0.91	*ns*
1.4	Herbicide	30.11^{c}	22.18^{b}	5.64^{a}	***
1.5	Pesticide	80.45	78.05	62.86	*ns*
1.6	Fungicide	279.98^{b}	242.30^{ab}	188.15^{a}	***
1.7	Fuel	3.44	3.69	3.27	*ns*
1.8	Wrapping bag	47.48	40.63	39.66	*ns*
1.9	Machine depreciation	34.01^{b}	17.11^{a}	19.38^{a}	***
2	Domestic factors	763.92^{b}	725.17^{b}	554.05^{a}	***
2.1	Root fertiliser	85.66^{b}	84.20^{b}	51.95^{a}	***
2.2	Leaf fertiliser	17.56^{b}	19.90^{b}	11.63^{a}	***
2.3	Paclobutrazol	0.28	0.25	0.19	*ns*
2.4	Herbicide	6.16^{c}	4.53^{b}	1.15^{a}	***
2.5	Pesticide	16.45	16.38	12.85	*ns*
2.6	Fungicide	57.24^{b}	50.44^{b}	38.47^{a}	***
2.7	Fuel	17.59	18.88	16.73	*ns*
2.8	Wrapping bag	9.89	8.40	8.26	*ns*
2.9	Machine depreciation	12.21^{b}	6.17^{a}	6.92^{a}	***
2.10	Transport	3.50	3.99	3.41	*ns*
2.11	Hired labour	109.38	86.96	72.18	*ns*
2.12	Family labour	317.24^{b}	302.68^{b}	224.68^{a}	***
2.13	Land rent	110.78	122.40	105.62	*ns*
3	Marking cost of traders	727.57	726.60	726.60	*ns*
3.1	Cooperative	158.22	158.10	158.10	*ns*
3.2	Processing firm	569.35	568.50	568.50	*ns*
4	Total Domestic = (2) +(3)	1,491.49^{b}	1,451.77^{b}	1,280.65^{a}	***
5	Revenue	3,408.72	3,408.72	3,408.72	*ns*
6	Domestic resource cost	0.54^{b}	0.52^{b}	0.44^{a}	***
7	Comparative advantage	0.45^{b}	0.43^{b}	0.36^{a}	***

Source: Field survey data in 2022

Note: Tradable input is CIF price, and Tradable output is FOB price. The numbers of the same row are followed by the different letters being significant at a 5% level via the statistical Ducan test. * Significant at 10% level, ** significant at 5% level, *** significant at 1% level, and ns is non-significant.

Table 2 illustrates that the second distribution channel has DRC/SER values that are less than one. The DRC/SER ratios for Seasons 1, 2, and 3 were 0.45, 0.43, and 0.36, respectively. The Democratic Republic of the Congo has much lower values than a unitary value. This exemplifies the prospective social benefits derived from the effective use of domestic resources. Distribution channel 2 demonstrates enhanced commercial performance as a result of its competitive advantage, given the current input-output ratios and pricing. The potential acquisition of foreign currency may arise as a result of an increase in the exportation of HoaLoc-mango.

Table 3. The comparative advantage of HoaLoc-mango in the distribution channel 3 Unit: USD/ton

No.	Indicator costs	Season 1 (n=119)	Season 2 (n=134)	Season 3 (n=136)	Sig.
	Official exchange rate in 2018-2019 (1 USD= 23.612 VND)				
1	Tradable inputs	818.86[b]	716.22[b]	544.63[a]	***
1.1	Root fertiliser	59.62[b]	59.02[b]	36.42[a]	***
1.2	Leaf fertiliser	12.57[b]	13.95[b]	8.15[a]	***
1.3	Paclobutrazol	2.14	1.91	1.42	*ns*
1.4	Herbicide	47.08[c]	34.67[b]	8.81[a]	***
1.5	Pesticide	125.78	125.23	98.28	*ns*
1.6	Fungicide	437.72[b]	385.69[b]	294.15[a]	***
1.7	Fuel	5.37	5.77	5.11	*ns*
1.8	Wrapping bag	74.24	63.00	62.00	*ns*
1.9	Machine depreciation	54.35[b]	26.99[a]	30.29[a]	***
2	Domestic factors	1,196.03[b]	1,136.42[b]	866.19[a]	***
2.1	Root fertiliser	132.97[b]	131.64[b]	81.22[a]	***
2.2	Leaf fertiliser	28.04[b]	31.11[b]	18.18[a]	***
2.3	Paclobutrazol	0.44	0.39	0.29	*ns*
2.4	Herbicide	9.62[c]	7.09[b]	1.80[a]	***
2.5	Pesticide	25.71	25.60	20.09	*ns*
2.6	Fungicide	89.49[b]	78.85[b]	60.14[a]	***
2.7	Fuel	27.50	29.52	26.15	*ns*
2.8	Wrapping bag	15.47	13.12	12.92	*ns*
2.9	Machine depreciation	19.41[b]	9.64[a]	10.82[a]	***
2.10	Transport	5.47	6.24	5.34	*ns*
2.11	Hired labour	175.28[b]	137.12[ab]	112.85[a]	*
2.12	Family labour	494.26[b]	474.56[b]	351.27[a]	***
2.13	Land rent	172.37	191.54	165.13	*ns*
3	Marking cost of traders	262.40	262.40	262.40	*ns*
3.1	Wholesaler (China)	262.40	262.40	262.40	*ns*
4	Total Domestic = (2) +(3)	1,458.43[b]	1,398.82[b]	1,128.59[a]	***
5	Revenue	3,788.40	3,788.40	3,788.40	*ns*
6	Domestic resource cost	0.55[b]	0.53[b]	0.39[a]	***
7	Comparative advantage	0.46[b]	0.44[b]	0.32[a]	***

Source: Field survey data in 2022

Note: Tradable input is CIF price, and Tradable output is FOB price. The numbers of the same row are followed by the different letters being significant at a 5% level via the statistical Ducan test. * Significant at 10% level, ** significant at 5% level, *** significant at 1% level, and ns is non-significant.

Table 3 provides a comprehensive breakdown of the DRC/SER ratio, elucidating the constituent elements that contribute to the competitive advantage experienced by distribution channel 3. Based on the gathered data, it can be seen that the DRC/SER ratio for the HoaLoc mango continuously remained below 1 during the three harvest years, with recorded values of 0.46, 0.44, and 0.32, respectively. This example illustrates the possible cost reduction in foreign currency by one dollar via the use of local resources with values of 0.54, 0.56, and 0.68 during the first, second, and third seasons, respectively, inside the third distribution channel. Furthermore, it functions as a paradigm for optimizing the use of scarce resources within the nation to cultivate certain varieties of crops. The competitive advantage of HoaLoc-mango is in its use of the third distribution channel, which enables commercial operations and facilitates export activities. This distinguishes the firm from local-scale products.

Every one of the three export routes has its own unique set of advantages, but they all have different DRC/SER ratios and correlate to different growing seasons. After conducting an investigation into the similarities and differences between distribution channels 2 and 3, it has become abundantly clear that Channel 1 provides a relatively small number of benefits. A bigger comparative advantage may be seen in the third cropping season in compared to the advantages seen in the previous two seasons. One important inference that may be made is that the HoaLoc-mango manufacturing system displays both economic viability and global competitiveness. This is an important finding for a number of reasons. The favorable climatic, soil, and water conditions of HoaLoc-mango play a big part in contributing to the sustainable development and economic advancement of the nation. HoaLoc-mango plays a significant role in contributing to the sustainable development and economic success of the country. Because of this, it is recommended that policymakers and the government implement incentive policies with the goals of improving the product's quality, removing both tariff and non-tariff obstacles, and successfully capitalizing on the product's comparative advantage.

Conclusion

The use of pricing methodologies at a societal level may be employed to assess the DRC/SER ratio, with the aim of examining the economic effectiveness of the HoaLoc-mango trade. This analysis can provide valuable information. Through the course of this inquiry, it will be possible to ascertain the most efficacious means of diffusion. Channel 3 has the highest level of comparative advantage in the domain of exporting, while Channel 2 showcases a modest advantage, and Channel 1 does not exhibit any discernible comparative advantage. Upon examining the DRC and the SER, it becomes evident that the economic efficiency value for all commerce across the three export channels is less than one. This phenomenon is applicable to both nations. Moreover, in comparison to preceding seasons, it can be said that Season 3 provides the most degree of advantage, with Season 2 ranking as the subsequent decision that delivers the second highest level of benefit. Conversely, Season 1 is seen as offering the least advantages owing to its poor execution.

The Domestic Resource Cost (DRC) is a methodology used to assess the economic implications of the international trading system on the domestic economy. The present study examines the comparative social pricing benefits associated with various distribution techniques. Within the realm of social pricing, the use of the CIF (Cost, Insurance, and Freight) pricing mechanism is seen in the trading of inputs, whilst the FOB (Free on Board) pricing mechanism is employed in the trading of outputs. CIF is an acronym that denotes the terms "cost, insurance, and freight." The concept of "net profit" pertains to the remaining amount

obtained after deducting production costs, promotional expenditures, foregone opportunities, and land expenses from the total income. An alternative perspective on the concept of "net profit" is to see it as the residual amount remaining after all expenses and deductions have been accounted for. The findings of this study provide support to the underlying principles of Ricardo's model in evaluating the relative competitiveness of export supply chains, specifically in the realm of global trade including tropical fruits. In the contemporary period characterized by increased globalization and liberalization, nations engage in trade and emphasize the production of products and services that effectively use their distinct comparative advantages. In order to maintain competitiveness in the global market, nations must strive to reduce the expenses associated with the manufacturing of commodities meant for international trade. The results of this research provide support for the notion of optimal value in international commerce and provide empirical evidence for Ricardo's model.

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