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Applying Policy Analysis Matrix (PAM) in Agricultural Policy an Empirical Study of Tuong-Mango in The Southern Vietnam

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Abstract

The aim of the study is to apply policy analysis matrix (PAM) to identify macroeconomic policy efficiency, and establish policy scenarios. The study investigated 849 sampling observation of eight main actors in chain. The results prove that the export channels 1, 2, and 3 have comparative and competitive advantages (PRC, DRC less than one and SBC more than one), and the domestic channel 4 is competitive advantage (PRC less than one). In addition, channels 1, 2 and 3 are supported the production and business by the output protection policy (NPCO <1). In particular, channel 1 is supported by added value increase policy form government (EPC 0.14 and SRP -0.17). The channel 4 is subsidized tradable input price (NPCI <1) compared to the channels 1, 2 and 3. Overall, macroeconomic policies influence remarkably on economic efficiency and competitiveness of the export channels (protection of output price, exchange rate, and subsidization of domestic cost). Channel 1 adapts well to change of macroeconomic policies, and it still maintains economic efficiency and international competitiveness in all scenarios. The FOB price policy's specifications have a significant influence on Channel 2. One may postulate that the economic feasibility or competitive edge of the product may be compromised in the event that the DRC surpasses a threshold of 1, resulting in a reduction of 20% in FOB pricing of the product. Channel 3 exhibits a significant degree of responsiveness when faced with a 20% surge in tradable cost. Indicators of this phenomenon include inefficiency, a high exchange rate (EPC, and DRC > 1), and responsiveness. Moreover, this phenomenon of sensitivity becomes evident when there is a rise in the currency rate, leading to a subsequent reduction in export attempts. A frequently used approach involves augmenting the FOB price while simultaneously reducing the exchange rate by 20% (SRP <0).

Keywords: PAM, Tuong-mango, policy, efficiency, Southern

1. Introduction

Mangoes are among the four most widely eaten tropical fruits worldwide. The mango, formally identified as *Mangifera indica*, is often acknowledged as a superior fruit. Mango trees have historically shown robust growth in regions characterized by warm and humid climatic conditions, mostly found in tropical and subtropical areas. Mango trees are cultivated in over one hundred countries. In relation to other prominent tropical fruits, mangoes constitute around 29% of the whole global trade, including both volume and value. According to the Food and Agriculture Organization, mangoes, avocados, and pineapples are the three primary

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tropical fruits cultivated for commercial reasons (FAO, 2021). India produces more than 25.6 million tons of mangoes, accounting for around 45.9% of the global yield. Indonesia is positioned in the second place, accounting for 3.3 million tons, which corresponds to 5.9% of the total. China and Mexico follow closely, with 2.4 million tons each, or 4.3% of the whole quantity. Thailand, Egypt, and Bangladesh each account for 2.6% of the total, whilst Pakistan, Malawi, and Brazil each make a contribution of 4.1%. Vietnam and Nigeria emerge as significant suppliers, each holding a production share of 2%. Asia is the leading global exporter, accounting for a significant proportion of the world's mango supply, namely over 47.3%. The region of Central America and the Caribbean is the second biggest in terms of land area, behind South America. It encompasses about 20.8% of the total land area. In contrast, it is worth noting that around 8.2% of the total mango production in Africa is allocated for export purposes. From 2016 to 2020, the United States emerged as the foremost importer of mangoes, accounting for a substantial 25% share of the total mango imports over the aforementioned period. It is anticipated that China would see a surge in its proportion of worldwide mango imports, rising from 9.9% in 2016 to 22.2% in 2020, therefore securing the second position. From 2016 to 2020, the European Union (EU) held the position as the third-largest global importer of mangoes, accounting for almost 20% of the overall mango import volume. According to the Food and Agriculture Organization, the global importation of mangoes in the year 2020 amounted to more than 2.13 million metric tons (FAO, 2021).

Based on projections, it is expected that global mango output will increase from its present state to an estimated 58 million tons by 2024, followed by a high of 61 million tons in 2028. In comparison to the production levels seen in 2018, there has been a significant increase of more than 9 million tons. It is projected that the proportion of global production attributed to Asia, which is both the origin and current front runner, will decline from 71% in 2019 to around 68% by the year 2028. According to projections, India, which is the largest producer in Asia, is expected to see a decline in its market share from 38% during the reference period to 35% by the year 2028. Mango cultivation is used both in commercial and non-commercial settings across India. According to expert projections, it is anticipated that the entire volume of mango exports will reach 2.2 million metric tons by the year 2028. It is anticipated that exports will see an annual growth rate of 3%; nonetheless, their contribution to the entire output remains relatively small. At now, around 65% of imports are sourced from developed nations. Nevertheless, as commercial interactions with and among other regions expand, it is anticipated that this proportion will decrease. The rapid ascent of Mexico as the foremost global exporter is anticipated to result in a commensurate rise in the market share of exporters hailing from Latin America and the Caribbean, reaching a projected figure of 62% (FAO, 2020).

According to projected data, it is anticipated that the proportion of market share represented by Asia will decline from 35% in 2019 to 28% in 2028. The primary focus of this discussion is on the exports originating from Thailand, since Thailand now holds the position of being the leading exporter in the area. It is anticipated that these exports would see a future increase, but at a somewhat slower rate than the general growth of international trade. It is anticipated that the expansion of India's exports would continue. Significantly, it is anticipated that this development would not have a substantial impact on Asia's proportion of the global mango market. By the year 2028, it is projected that India would represent around 12 percent of the global mango trade. According to projections, it is anticipated that by the year 2028, the average member of the FAO (2020) would have ingested around 7.8 kg of mangoes. It is anticipated that Asia would maintain the highest per capita consumption, with an estimated 10.7 kg per individual, and Latin America is projected to have the lowest per capita consumption at an

estimated 8.4 kg per person. The consumption of mangoes in developed nations is seeing an upward trend, with the current average per capita consumption being less than one kilogram (FAO, 2020). Between the years 2016 and 2020, there was a substantial increase in mango exports, amounting to a total value of 211 million dollars. The increase may be attributed to a compound annual growth rate of 60%. In contrast to the figures seen in 2016, the same data for 2017 showed a significant increase of 129%. The anticipated decline in the export value of fruits and vegetables in 2019 and 2020 may be attributed to the repercussions stemming from the Covid-19 pandemic. The export value of mango had a significant increase throughout the period from 2016 to 2020, and it is anticipated that further development would propel it to reach a value of USD 650 million by the year 2030 (Khoi, 2021).

Usually, scholarly investigations have often overlooked the ramifications of marketing, trade, and macroeconomic considerations, instead focusing primarily on the microeconomic conduct of producers. The interconnections between trade, macroeconomic policy, and production levels need a deeper understanding among governments, economists, and policymakers. This enables individuals to establish practical regulations and frameworks for their own communities. Hence, it is imperative that we do not disregard the significance of macroeconomic policies and instead accord them the appropriate level of consideration. The tracking and analysis of publicly accessible policies play a crucial role in evaluating the influence of institutional and regulatory factors on the commercial and operational aspects of the Tuong-mango value chain. This study aims to enhance the competitiveness of the Tuong-mango value chain by examining the impacts of macroeconomic policy measures and proposing feasible policy alternatives. The evaluation and quantification of revenue, costs, and net profit of marketing channels may be conducted by using an analysis matrix, which enables the assessment of their effects in relation to macroeconomic policy. The evaluation of domestic marketing channels often involves the use of market pricing, but social price is frequently employed in the assessment of overseas marketing channels. The findings of this study provide empirical evidence in favor of the fundamental premise posited by the PAM framework, namely that trade policies pertaining to tropical fruits and vegetables provide optimal outcomes when they effectively use the comparative advantages possessed by producers.

2. Methodology

2.1. Sampling technique

Multiple iterations of sampling were undertaken to determine the appropriate location for the final investigation. The research focused on the Mekong Delta and its adjacent area in Vietnam because of the advantageous conditions present for the development of mangoes. The aforementioned areas account for 75% of Vietnam's aggregate mango production and include 72% of the nation's total mango cultivation area. Based on statistical data presented by the General Statistics Office in 2022, it is seen that the provinces of Dong Thap, An Giang, Tien Giang, Hau Giang, Vinh Long, and Tra Vinh together account for 71% of the total volume and area of the Mekong Delta region. The province of Dong Nai accounted for almost 55% of the entire volume of production in the country, as well as 54% of the land area dedicated to production in the southern region. The study sample had a total of 849 observations that were collected, in which 732 for mango grower, 10 for cooperatives, 32 for collector, 25 wholesalers, 12 enterprises, 30 retailers, and 8 supermarkets/ fruit shops.

2.2. Literature Review

The government often uses agricultural policy as a means to exert control over the dynamics of the agricultural market. To ensure a consistent supply of food, industrial raw materials, and labor for the industrial sector, governmental intervention is actively used within the agricultural market. According to Tsakok (1990), the inflow of foreign currency may be further augmented by the taxation of income and the facilitation of exports. Efforts have been undertaken by governments to prioritize the growth of agriculture in this region. A number of developing nations have implemented a strategy characterized by high taxation and insufficient investment in their agricultural sectors. This approach is predicated on the notion that levying taxes on agriculture would have negligible impacts on agricultural productivity. Furthermore, proponents of this policy advocate for redirecting any surplus funds towards the industrial sector, which is widely regarded as the primary driver of economic advancement. The policy pertaining to pricing served as a mechanism for the elimination and redistribution of agricultural overproduction. Nevertheless, the presence of modest input price subsidies did not completely erase the incentives generated by negative output prices. The preexisting drawback within the agricultural sector was further intensified by the macro-environmental factors and the trading system. The issues pertaining to agriculture have permeated several sectors, hence exacerbating wider economic, trade, and governmental financial difficulties in numerous nations. Many governments were compelled to reevaluate their comprehensive development goals when it became apparent that an underperforming agricultural sector was incapable of sustaining a thriving industrial sector.

The implementation of government initiatives aimed at enhancing the agricultural sector has the potential to provide significant and wide-ranging impacts on overall economic development. In developing nations, the agricultural sector typically accounts for around 30-45% of the country's Gross Domestic Product (GDP) on average. According to World Bank (2003), the agricultural sector employs a larger workforce compared to any other industry. Given the significant role that agriculture assumes in the majority of impoverished nations, governments often see it as a strategic tool for achieving desired outcomes. Governments are anticipated to consistently engage in substantial intervention in agricultural markets via various means, including trade policy, macroeconomic policies, and sector-specific measures. The development process is significantly influenced by agricultural pricing strategy because of its impact on the relative costs faced by individuals, families, and the industry. Prices serve as indications of both costs and revenues, eliciting responses from persons in their many capacities as producers, intermediaries, and consumers. According to Shultz (1978), the impact of pricing incentives on economic development, income distribution, and social welfare is significant. Policymakers use agricultural policy analysis to assess the potential impact of various policies on agricultural markets, including both anticipated and unanticipated outcomes. Additionally, an assessment may be conducted to determine the impact of these market-specific responses on the overall viability of the growth plan. This dataset may be used by policymakers to engage in discussions on the advantages and disadvantages of alternative choices since it effectively demonstrates the inherent trade-offs between various objectives and methodologies. The prioritization of pricing approaches and markets for investigation will be determined by considering concerns and available resources. The evaluation of agricultural pricing policy, which is a crucial component of macro trade policy, incorporates several macroeconomic variables such as currency rates and interest rates, trade-related prices including export and import prices, as well as sector-specific prices like production and input

prices. The analysis may be categorized using several dimensions, including static, dynamic, partial, general, single market, multiple markets, sectoral, inter-sectoral, and macro.

The policy analysis matrix technique is a contemporary approach used to assess the impact of governmental agricultural policies on the agricultural sector. This method involves the identification of specific indicators and the establishment of a baseline for study. The vertical system comprises the whole production process, spanning from agricultural operations through primary procurement, processing, and marketing. This comprehensive system was first examined extensively by Monke and Pearson in 1989. This analysis uses the PAM (Babiker, 2012) to evaluate the influence of government policies on horticultural crop yield.

According to Bushara et al. (2018), the agricultural sector has significant importance in the economy of developing nations. It often constitutes a significant portion, ranging from around 30% to 50%, of the GDP. The agricultural sector employs a larger workforce compared to any other industry. In recent years, a significant transformation has occurred in the relationship between agriculture and industry. It is now widely acknowledged that agriculture plays a crucial role in supplying labor, resources, and sustenance to support the growth and advancement of industry. The presence of a robust agricultural sector is clearly associated with the growth of industry and the economy. Multiple nations often and substantially engage in interventions within the agricultural market via the use of instruments at the sector level, macroeconomic policies, and trade agreements. This study aims to conduct an analysis of macroeconomic aspects, including the whole economy, individual firms, and entire industries. Within the realm of macroeconomics, the elements included are the interest rate and exchange rate. In the domain of commerce, the variables encompassed are import and export activities. Lastly, within the industrial sector, the variables encompassed are output and input levels. The figure illustrates the interconnectedness of production, processing, distribution, wholesale, and retail activities. As a result of this, individuals possess enhanced capabilities to recognize issues and execute remedies. The significance of doing research on agricultural policy is in its ability to provide decision-makers with valuable insights into the potential impacts of various policies on agricultural markets, as well as to provide them with a range of possible alternatives.

According to Soetrisno et al. (2019), the DRC (0.20) and PCR (0.13) values below one suggest the presence of comparative and competitive advantages in snake fruit cultivation within Pronojiwo village. It is noteworthy to mention that the allocation of government funds towards the production of snake fruits is little or nonexistent. The Siamese orange, a citrus cultivar, has a notable competitive advantage (DRC 0.11) within the geographical region of Kanagarian Koto Tingg in Indonesia. This advantage may be attributed to the region's abundant domestic resources and favorable agroclimatic conditions. Enhancing connectivity to remote regions via investments in transportation infrastructure is a potential strategy for citrus exporters to get a competitive advantage in global markets (Romdhon, 2018). América and José (2011) used the PAM to leverage Mexico's competitive advantage in guava production. A nominal protection coefficient on tradable output (NPCO) value of 0.66 suggests that the legal assurance of guava cultivation is not assured. Fertilizers and agrochemicals are permitted to be freely purchased and traded as commodities in the context of free trade. The Nominal Protection Coefficient on Tradable Input (NPCI) has a rating of 1.00.

Familusi et al. (2015) conducted a study which revealed the absence of governmental safeguards aimed at ensuring the availability of essential commodities required for the cultivation of tomatoes. The cultivation of tomatoes in South Africa and Mozambique has higher levels of efficiency compared to the DRC. During the summer season, consumers are subject to an indirect tax of

about 48.9 percent as a result of output pricing rules. Likewise, a negative NPCO value indicates an implicit imposition of around 24.2% on the production of fresh-season tomatoes. A recommendation was made for Pakistan to reconsider its ambitions in the export sector (DRC 1.31 and SBC 0.84, indicating a comparative disadvantage) subsequent to a study conducted by Khan et al. (2006) on sugarcane production. Alternatively, the nation might consider using an import substitution strategy, as seen by the comparative advantage demonstrated by the DRC (0.59) and SBC (1.50), in order to achieve economic self-reliance. Further comparisons and contrasts between the two production systems are conducted using the PAM.

According to the study conducted by Olayinka et al. (2014), the Sucker approach (PCR 0.31) was shown to be more competitive than the Crown strategy (PCR 0.40) in the Nigerian pineapple-producing industry, while taking into account market price and a PCR value below one. Both the feeder and crown approaches demonstrate varying levels of economic effectiveness when cultivating pineapples. The DRC for the suction technique is specifically 0.22. The proportion of producers whose earnings are reallocated to the government and taxpayers due to policy distortions is 16% according to the Crown methodology (SRP -0.16), and 14% according to the Sucker approach (SRP -0.14). In their study, Bushara et al. (2018) used the Participatory Action Mapping (PAM) methodology to investigate the growth and characteristics of onion, melon, mango, and banana crops. The majority of nominal protection coefficient on tradable outputs (NPCOs) exhibited sizes more than 1, however the size of the melon's NPCO was just 0.62. The government provides subsidies for the exportation of bananas, mangoes, and scallions, while imposing taxes on the exportation of melons. Values of the nominal protection coefficient on tradable inputs (NPCIs) that are less than one indicate the use of export subsidies to financially support the expenses associated with the production inputs. Each onion, mango, and banana contains several effective protection coefficients (EPCs). It is evident that there exists potential for increasing the production of these commodities. On the other hand, melons are subjected to a substantial tax burden at their point of origin. The DRC has comparative advantages below unity in the cultivation and production of onion, melon, mango, and banana.

In short, a comprehensive examination of agricultural policy is crucial in order to enable policymakers to get insights into the ramifications of future policy changes on agricultural markets and to contemplate viable alternatives. Monke and Pearson (1989) provide a framework consisting of three analytical tiers that may be used in the examination of agricultural policy: macroeconomic linkages, marketing and trade, and microproduction variables. Nevertheless, previous research has tended to overlook the significance of marketing, trade, and macroeconomic connections, instead focusing on the microeconomic behaviors of producers. It is essential for governments, agricultural economists, and policymakers to possess a comprehensive understanding of the intricate interdependencies between farming systems, local and worldwide markets, and macroeconomic policy. This enables individuals to formulate practical rules and policies. Hence, it is essential to assess quantitative trade restrictions related to trade, real effective exchange rates, and fertilizer response functions utilizing approaches derived from the discipline of agricultural policy analysis.

2.3. Empirical model

The PAM offers a comprehensive framework for evaluating the effects of government policy intervention on producers, consumers, and the overall economy throughout all phases of a vertical commodities chain. The policy analyst has two alternatives for effectively and succinctly conveying information:

To gauge the extent of governmental intervention and manipulation of prices, as well as to analyze the effectiveness of alternative policies.

The objective is to assess the feasibility of different farming, processing, and marketing strategies for one or several commodities.

This study examines the impact of policy interventions in the agricultural sector on market prices and social pricing. By using the PAM analytical framework, the research aims to evaluate the effectiveness of these interventions. The first investigation of this phenomenon was conducted by Monke and Pearson in 1989, with further contributions to the existing body of material made by Masters and Winter-Nelson (1995) two years afterwards. The PAM diagram consists of three columns, namely revenue, costs (including both tradeable and domestic expenses), and profits. The first segment presents indicators that have been calculated using market pricing. The indicators in the second column are derived via the use of the social cost calculation. The calculation of the third row, which corresponds to policy intervention, is derived by subtracting the values of the prior two rows. The matrix serves as a valuable instrument in assessing a nation's global competitiveness across several aspects, such as economic efficiency in relation to comparative advantage, policy implications, and the level of protection provided to agricultural areas (Gonzales et al., 1993). Table 1 presents the PAM for each marketing channel, with three rows and four columns. The first column of the table displays revenue, which is calculated by multiplying the quantity of units sold by the price per unit. The second column of the table enumerates the products that have the potential to be exchanged and used as a direct means of payment for imported commodities. Domestic factors (third column) include several factors, such as the cost of leasing natural resources and the remuneration provided to domestic laborers. The fourth column of the financial statement displays the profits, which are derived by deducting the total cost of domestic and tradable inputs from the total revenues.

Table 1. Policy Analysis Matrix (PAM)

Items	Revenues	Costs		Profit
		Tradable Inputs	Domestic Factors	
Market Prices	A	B	C	D
Social Prices	E	F	G	H
Policy effects	I	J	K	L

Source: Monke and Pearson, 1989

The cost structure of PAM in the Tuong-mango value chain is significantly impacted by several stakeholders, such as producers, suppliers, and distributors. The comprehensive cost of PAM encompasses several expenditures, including as investments in fundamental resources, workforce, and machinery, in addition to promotional expenses. When examining market and social pricing, it is possible to distinguish between two categories of expenses: tradable input costs and domestic components. This research categorizes input expenditures into two distinct categories: tradable components and domestic components. Among these expenses are root, leaf, paclobutrazol, herbicide, insecticide, and fungicide. The allocation of a percentage to each item is contingent upon its ability to satisfy a proportionate portion of the domestic commodity demand. The total domestic expenses associated with agricultural marketing include several components, including energy costs, packing charges, transportation fees, contractual labor expenditures, equipment depreciation, family labor contributions, and land rent. The calculation of domestic factor costs in market pricing does not include opportunity costs such

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as equipment depreciation, family labor, or land rent. The shadow exchange rate (SER) is obtained by aggregating the FOB price of marketable products and the CIF price of tradable inputs.

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

$$\text{SER} = \text{OER} * (1 + \text{FX premium})$$

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 within the theoretical construct of a perfectly functioning labor market, whereby it is juxtaposed against the tangible expenses incurred by households throughout the process of production. The estimation of future land expenses is conducted by using data pertaining to the present land rental prices that are being paid by coffee producers inside the nation. When doing a valuation of land, it is crucial to include the cost associated with internal resources. Lorenzo (2013) employs the premises of consistent efficiency throughout time and annual devaluation of worth in order to estimate the prospective expenses associated with agricultural machinery.

$$\text{Output transfers: } I = A - E$$

$$\text{Input transfers: } J = B - F$$

$$\text{Factor transfers: } K = C - G$$

$$\text{Market profits (Actual Profitability): } D = A - B - C$$

$$\text{Social profits (Economical Profitability): } H = E - F - G$$

$$\text{Net profit transfers: } L = D - H = I - J - K$$

$D > 0$, the domestic channel at market price generates profit under the current policy and market conditions and is competitive.

$H > 0$, the export channel at social price would be able to make a profit even without benefiting from a subsidy or being constrained by taxes, and is said to have a comparative advantage.

Relative competitiveness indicators

Private cost ratio (PCR): $C/(A - B)$

$\text{PCR} > 1$, it means that the domestic channel utilizes a greater value of domestic factors than the value added, and is not profitable.

$\text{PCR} < 1$, the system is profitable.

Domestic Resource Cost (DRC): $\text{DRC} = G/E - F$

$\text{DRC} = 1$, the export channel is not conducive and foreign currency savings is not equal to domestic production (products produced beneficial neutrality).

$\text{DRC} < 1$, the value of domestic resources for smaller production value net foreign savings (products with a competitive advantage on the international market), vice versa.

DRC > 1, the value of domestic resources for greater production value net foreign savings (product no competitive advantage on the international market).

DRC/SER < 1, the product has a comparative advantage.

DRC/SER > 1, the product does not have a comparative advantage.

Social benefit-cost (SBC): $SBC = E/(F+G)$

SBC > 1, the export channel is an efficient business channel,

SBC < 1, the export channel is not profitable for the exporting business.

Nominal protection coefficient on tradable outputs (NPCO): $NPCO = A/E$

NPCO > 1, it indicates that the domestic channel at market price is benefiting from protection.

NPCO < 1, it indicates that the policy intervention occurs for incentive of the export channel at social price.

Nominal protection coefficient on tradable inputs (NPCI): $NPCI = B/F$

NPCI > 1, it indicates that the domestic channel at market price is paying higher than for tradable input cost (promotion for the export channel at social price).

NPCI < 1, it indicates that the domestic channel at market price is benefiting from protection by subsidization of tradable inputs cost.

Effective protection coefficient (EPC): $EPC = (A - B)/(E - F)$

EPC > 1, the domestic channel at market price is a protection with higher added value than the export channel.

EPC < 1, the domestic channel at market price receive lower added value than the export channel at social price (incentive to export activities).

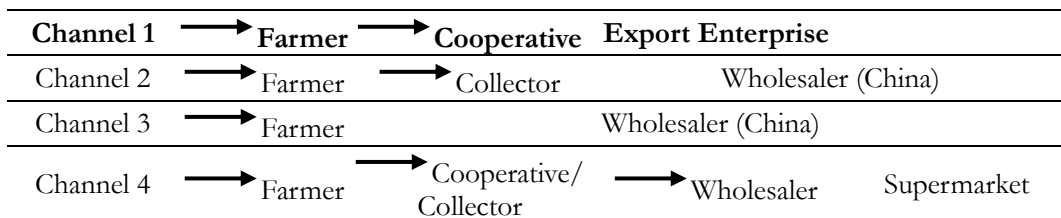
Subsidy ratio to producers (SRP): L/E

SRP > 0, indicate the overall transfer profit from the export channel to the domestic channel, and limited export.

SRP < 0, it indicates overall transfer profit from the domestic channel to the export channel, and export incentive.

3. Result and Discussion

The distribution system of the Tuong-mango supply chain consists of two main routes via which the fruit is transported. The local market is served by marketing channel 4, while foreign operations are supported by marketing channels 1, 2, and 3.



Lorenzo (2013) posits that the distinction between competitive advantage and comparative advantage may be attained via the use of Value Chain Analysis (VCA) and Policy Analysis Matrix (PAM) in the realm of policy formulation. The pricing strategy considers market circumstances, with a specific focus on the company's domestic distribution network. This confers a notable advantage to the firm in relation to its competitors in terms of competitiveness. The concept of comparative advantage may be traced back to economically interconnected vertical chains that are assessed via the lens of social pricing, particularly with respect to export channels. The analysis known as the PAM is derived by integrating data pertaining to various marketing channels within the agricultural systems under investigation. Cultivation, direct sales to export firms, direct sales to processors, and direct sales to wholesalers are all illustrative instances of these pathways. The determination of prices for products and services in the marketplace is used to assess the worth of Channel 4, subsequently facilitating a comparative analysis with the pricing structures of other export channels, namely Channels 1, 2, and 3. This is conducted in order to provide a comprehensive social pricing comparison between Channel 4 and other export channels.

Table 2. Policy analysis matrix for the Tuong-mango marketing channels 1, 2, 3 and 4

Unit: USD/ton

Channels	Revenue	Cost		Net profit
		Tradable Inputs	Domestic Factors	
The channel 1 at social price, the channel 4 at market price				
Market price	1,455.30±0	296.06±286.45	331.47±191.44	827.77±452.04
Social price	8,860.44±0	621.73±601.55	5,892.27±711.7	2,346.44±1,226.3
Policy effects	-7,405.14±0	-325.67±315.1	-5,560.81±572.98	-1,518.67±816.23
The channel 2 at social price, the channel 4 at market price				
Market price	1,455.30±0	278.56±250.78	323.22±178.51	853.52±403.13
Social price	1,926.96±0	371.04±334.04	838.99±422.30	716.92±696.99
Policy effects	-471.66±0	-92.48±83.26	-515.78±306.41	136.6±356.57
The channel 3 at social price, the channel 4 at market price				
Market price	1455.3±0	278.56±250.78	323.22±178.51	853.52±403.13
Social price	1,778.52±0	371.04±334.04	748.19±422.30	659.28±696.99
Policy effects	-323.22±0	-92.48±83.26	-424.98±306.41	194.24±356.57

Source: Field survey data in 2022

Note: Tradable input is CIF price, Tradable output is FOB price

Table 2 encompasses crucial data required for the calculation of economic indicators using market and social pricing methodologies, specifically with respect to the identification of channels 1, 2, and 3. The estimate for Channel 4 was derived using data acquired from an authentic marketing channel that specialized in the distribution of Tuong-mango within the Vietnamese market. The market profitability values of 827.77 USD/ton and 853.52 USD/ton indicate that the Tuong-mango production system exhibits competitiveness in relation to prevailing technologies, input and output prices, and policy transfers. This phenomenon may be attributed to the fact that the market profitability values fall between the range of 827.77 USD/ton and 853.52 USD/ton. It is plausible to expect that there will be a growth in the domain of manufacturing systems in the foreseeable future. Furthermore, it is noteworthy to highlight that channels 1, 2, and 3 exhibit a positive social profitability. This observation suggests that the use of these marketing channels effectively maximizes the utilization of scarce

resources, but to the detriment of societal well-being. This demonstrates that the incorporation of marketing channels 1, 2, and 3 has the capacity to facilitate the expansion of foreign currency via the exportation of Tuong-mango. This assertion might be supported by the potential advantages outlined above. The use of Tuong-mango marketing channels often yields significant economic and social pricing benefits for the organizations that adopt them.

Table 2 depicts the distribution of revenue and profit between market pricing and social pricing. The transfer of earnings has a beneficial impact on Channels 2 and 3, respectively. Based on this empirical evidence, it seems that channels 2 and 3 has the capacity to provide a financial gain even in the absence of governmental intervention or the enactment of legislation that establishes subsidies for media entities. The income generated by Channel 4's business and production structure has decreased as a result of the execution of various government policy initiatives. The objective of this effort is to cultivate and augment engagement in the exportation endeavors inside channel 1, with a specific emphasis on this particular channel. As a result of this cause-effect relationship, the income generated by channel 4, which determines its pricing based on market prices, is transferred to channel 1, which determines its pricing based on societal factors. Conversely, it can be shown that the policy impact of income and profit transfers has decreased within channel 1. These variations occur between the market price and the societal valuation of goods. This would suggest that the revenues generated by Channel 4, derived from the prevailing market price, are then reallocated to Channel 1, which is determined by the social price. Government-enacted legislation offers assistance for a diverse range of initiatives aimed at promoting exports. This support might manifest as financial aid for the registration of GlobalGAP and VietGAP, the adoption of traceability codes, instructional programs, or promotional strategies.

The assessment of the worldwide competitiveness of the mango sector may be deduced from the factors outlined in Table 3, as shown below. Based on the obtained data, it can be inferred that the PCRs for the properties under consideration are 0.69 and 0.36, correspondingly. The results may provide support for these ideals. Significantly, both ratios do not surpass the numerical value of one, which is noteworthy in its own right. Based on the findings presented, it is evident that the creation of one unit of value added by Channel 4 necessitates the use of domestic resources within the range of 0.3 to 0.64 units. This phenomenon persists even when a single unit of value added is generated. The aforementioned disclosure demonstrates Channel 4's capacity to operate autonomously from governmental regulations, implying that the firm had a competitive edge in the Vietnamese market due to its capability to replace imported products. Furthermore, the competitive nature and comparative advantage of producing and exporting Tuong-mango may be seen via three unique routes. These channels include a range of factors, such as technology breakthroughs, output values, input prices, and policy transfers. When considering societal expenditures, the DRC coefficient values for the channels under examination are found to be less than one. To provide more clarification, the coefficients associated with channels 1, 2, and 3 exhibit values of 0.73, 0.70, and 0.68, respectively. Channels 1, 2, and 3 possess SBC values of 1.40, 2.03, and 2.12, correspondingly. Furthermore, it can be inferred from the aforementioned ratios that the act of exporting mangoes has the potential to yield monetary savings that are 1.40, 2.03, and 2.12 times greater than the expenses incurred when exporting mangoes at the current prevailing rates. The export channels 2 and 3, which are now operational inside the Chinese market, possess the capacity to yield a greater volume of foreign currency as compared to channel 1 in other developed countries. This phenomenon might be attributed to the substantial size of the Chinese market.

Table 3. Synoptic view of PAM indicators in the Tuong-mango marketing channels

Indicators	Channel 1	Channel 2	Channel 3
PCR	0.69±8.69	0.36±0.56	0.36±0.56
DRC	0.73±0.15	0.70±1.01	0.68±4.95
SBC	1.40±0.21	2.03±0.91	2.12±1.05
NPCO	0.16±0.00	0.76±0.00	0.82±0.00
NPCI	0.48±0.00	0.75±0.00	0.75±0.00
EPC	0.14±0.03	0.76±0.00	0.85±1.08
SRP	-0.17±0.09	0.07±0.19	0.11±0.20

Source: Field survey data in 2022

There are differences in the values of NPCO in the export channels (0.16, 0.76, and 0.82 for channels 1, 2, and 3, respectively). NPCOs are less than one, meaning that the marketing channels 1, 2 and 3 are supported the production and business by the output price policy. This implies that the revenue of channels 1, 2, and 3 at the social price is 84%, 24%, and 18% higher than that of domestic channel 4.

The NPCI values for Channels 1, 2, and 3 exhibit significance, as they are all found to be considerably below one. The observed differences in NPCI values between Channels 1 and 2, as well as Channels 1 and 3, are 0.48 and 0.75 units, respectively. Channel 4 has favorable market pricing outcomes as it effectively mitigates the expenses incurred by tradeable commodities, resulting in a reduction of 52% compared to channel 1. In contrast, channels 2 and 3 exhibit a lower reduction rate of 25% each. Furthermore, it has been observed that the EPC coefficients corresponding to channels 1, 2, and 3 exhibit values below unity, namely 0.14, 0.76, and 0.85, respectively. Based on the available information, it seems that Channel 4 is subject to a comparatively higher tax rate on its inputs relative to its outputs, leading to a relatively lesser societal value contribution compared to Channels 1, 2, and 3. The export incentive scheme, now under revision, comprises Channels 1, 2, and 3. In contrast to Channel 4, which employs market-based pricing, Channel 1 utilizes social pricing and has a negative standardized reference price (SRP) of 0.17. This suggests that taxpayers are reallocating their profit from channel 4 to channel 1, resulting in potential advantages for channel 1. The latest discovery indicates that tax policy is used as a means to promote exports via channel 1, as it explains 17% of the observed variability. This is due to the fact that channel 1 encompasses about 17% of the overall observed variance. Channel 4 gets fiscal assistance from the government via payments that correspond to a range of 7 to 11% of the net income generated by Channels 2 and 3. The government consistently monitors and evaluates the export promotion activities implemented by Channel 1 to ascertain their effectiveness in achieving their intended goals.

Table 4. Sensitivity analysis of the Tuong-mango marketing channels

Indicators	Increase 20%			Decrease 20%		
	Channel 1	Channel 2	Channel 3	Channel 1	Channel 2	Channel 3
	DRC	0.73±0.15	0.70±1.01	0.68±14.95		
FOB price	0.59±0.11	0.50±0.45	0.51±0.56	0.93±0.23	1.07±7.25	-2.49±592.34
Tradable cost	0.74±0.18	0.71±3.22	2.88±43.86	0.71±0.13	0.58±0.50	0.59±0.61
Domestic cost	0.87±0.18	0.84±1.22	0.82±17.94	0.58±0.12	0.56±0.81	0.54±11.96
Exchange rate	0.91±0.19	0.87±1.27	0.85±18.69	0.60±0.13	0.58±0.85	0.57±12.46
	SBC	1.40±0.21	2.03±0.91	2.12±1.05		
FOB price	1.68±0.25	2.44±1.09	2.54±1.26	1.12±0.17	1.62±0.72	1.70±0.84

Indicators	Increase 20%			Decrease 20%		
	Channel 1	Channel 2	Channel 3	Channel 1	Channel 2	Channel 3
Tradable cost	1.38±0.22	1.94±0.90	2.02±1.04	1.42±0.20	2.13±0.91	2.23±1.07
Domestic cost	1.18±0.17	1.76±0.76	1.85±0.89	1.72±0.28	2.40±1.12	2.50±1.29
Exchange rate	1.14±0.16	1.70±0.73	1.79±0.85	1.65±0.26	2.33±1.08	2.42±1.24
	EPC		0.14±0.03	0.76±0.00	0.85±1.08	
FOB price	0.11±0.03	0.60±0.05	0.66±0.03	0.18±0.04	1.06±1.37	-2.25±89.85
Tradable cost	0.14±0.03	0.82±0.47	1.50±13.44	0.14±0.03	0.71±0.06	0.79±0.05
Domestic cost	0.14±0.03	0.76±0.00	0.85±1.08	0.14±0.03	0.76±0.00	0.85±1.08
Exchange rate	0.18±0.03	1.02±0.18	1.14±4.35	0.11±0.03	0.58±0.11	0.65±1.10
	SRP		-0.17±0.09	0.07±0.19	0.11±0.20	
FOB price	-0.31±0.08	-0.11±0.15	-0.08±0.17	0.04±0.12	0.34±0.23	0.39±0.25
Tradable cost	-0.16±0.10	0.11±0.21	0.15±0.23	-0.19±0.08	0.03±0.16	0.07±0.18
Domestic cost	-0.04±0.11	0.16±0.23	0.19±0.25	-0.30±0.08	-0.02±0.14	0.03±0.16
Exchange rate	0.03±0.11	0.33±0.22	0.37±0.24	-0.30±0.08	-0.10±0.16	-0.07±0.17

Source: Field survey data in 2022

According to Akter et al. (2003), the PAM did not adequately consider the potential future modifications to policy indices. Hence, it is necessary to do a sensitivity analysis with a significance level of 20% to evaluate the impact of variations in FOB prices, tradable costs, domestic costs, and currency rates on competitiveness and policy indicators (Yao, 1997; Monhanty et al., 2003). Table 4 presents the outcomes of modifying the FOB price, tradable cost, domestic cost, and exchange rate by a magnitude of 20% relative to the baseline scenario. This analysis provides insights into the DRC, SBC, SRP, and EPC scenarios.

The findings of this research indicate that changes in non-trading expenditures, such as FOB pricing, domestic costs, and currency exchange rates, have a comparatively less impact on DRC and SBC compared to changes in tradable expenses. Channels 2 and 3 witness a decline in their competitive advantage within the market due to a 20% fall in the Free on Board (FOB) pricing. The competitive advantage of Channel 3 has been diminished due to a 20% increase in trading expenses.

According to the findings of the EPC index, it is seen that export channel 2 exhibits an EPC value more than one, specifically ranging from 1.02 to 1.06. This trend occurs when there is a 20% rise in the exchange rate and a corresponding 20% fall in the FOB price. This discovery implies that instead of engaging in export-oriented endeavors inside channel 2, it is necessary to establish an internal commercial manufacturing system within channel 4. The preference for domestic Channel 4 stems from its provision of a safer environment and more value-added content compared to its counterpart, Channel 2, which operates under market pricing conditions. When both the tradable cost and the exchange rate see a 20% increase, the EPC value for channel 3 also increases to 1.50 and 1.14, both of which are more than 1. This observation indicates that there exists a discrepancy in the additional data acquired from channels 3 and 4.

In the case of channel 2, a decrease in SRP is seen when the FOB price is increased by 20%, while concurrently reducing both the domestic cost and exchange rate by 20%. The aforementioned numbers exhibit negativity, namely -0.11, -0.02, and -0.10. Based on the above statistics, it can be inferred that Channel 2 exhibits a higher level of profitability in comparison to Channel 4. Applying the aforementioned reasoning, in the event that the FOB price were to experience a 20% increase (SRP = -0.08) and the exchange rate were to undergo a 20% fall (SRP = -0.07), it would be advisable for channel 3 to intensify its export endeavors. The government in this jurisdiction has consistently supported and facilitated the export activities of Channel 3.

4. Conclusion

The domestic channel 4 (import substitution) is competitive, while export channels 1, 2, and 3 have comparative and competitive advantages.

The government has the potential to provide assistance to the corporation and its production on channel 1 by implementing rules that promote efficient production processes, incentivize value addition, and enforce taxation procedures. Nevertheless, the recommendations put out by the aforementioned institution lack any measures for the decrease of pricing for trade-related items. To promote the development of channels 2 and 3, the government pursues strategies aimed at enhancing production and increasing value addition. Channel 4 benefits from governmental financial support in order to facilitate the generation of commercial profits.

The profitability and competitiveness of export channels may be considerably influenced by various macroeconomic policies. These policies include the adoption of protective pricing mechanisms within the manufacturing industry, the sustenance of advantageous exchange rates, and the allocation of domestic cost subsidies. Channel 1 has a favorable and sanguine response to alterations in macroeconomic policy, especially in instances when the exchange rate experiences a growth of 20% or more ($SRP > 0$). Despite this exceptional event, Channel 1 remains economically viable and maintains its place in the worldwide market. The FOB price policy's specifications have a significant influence on Channel 2. In the event when the DRC of the product surpasses a value of 1, and subsequently, the FOB price of the product undergoes a reduction of 20%, it may be postulated that the economic effectiveness or competitive advantage of the product will be compromised. Channel 3 exhibits a notable degree of responsiveness when faced with a 20% rise in tradable expenses. This responsiveness is shown by inefficiency, a heightened exchange rate (EPC, and $DRC > 1$). Furthermore, this phenomenon of sensitivity is seen in the context of an appreciation of the currency rate, leading to a decrease in export endeavors. A commonly used technique involves raising the FOB price while concurrently decreasing the exchange rate by 20%, resulting in the establishment of a $SRP < 0$.

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