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Agribusiness System Of Pomelo Citrus In Pangkajene And Kepulauan Regency

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ABSTRACT

Abstract

Keywords:

Pomelo citrus;
marketing margin;
productivity;
r/c ratio

Pomelo citrus is a leading commodity in Pangkajene and Kepulauan Regency (Pangkep), yet its production has declined in recent years. The decline in pomelo production and productivity is suspected to be due to an inadequate agribusiness system. This study aims to analyze the agribusiness system in order to enhance the effectiveness of pomelo orchard management. Respondents were selected using purposive sampling, comprising 47 farmers spread across several farmer groups. Interviews were conducted with farmers and buyers, while questionnaires were administered to farmers, collect, and pomelo traders. The analysis included farm business analysis to determine the R/C ratio, marketing margin analysis, and farmer's share analysis using Microsoft Excel. The results showed that Ma'rang District possesses the most comprehensive subsystems compared to other districts, consisting of input subsystem, production/farming subsystem, agricultural product processing subsystem, marketing subsystem, and support subsystem. The R/C ratio analysis indicates that farming in Ma'rang (1.39), Labakkang (2.47), and Segeri (1.86) remains economically feasible. Five marketing chains were identified, with Marketing Chain 5 (farmer-consumer) being the most efficient, and Marketing Chain 4 (farmer-middleman-trader-consumer) the least profitable. The agribusiness system serves as a guide to enhance the efficiency and effectiveness of government efforts in developing and sustaining pomelo productivity as a flagship commodity in Pangkep Regency.

INTRODUCTION

The agricultural sector serves as a key pillar supporting Indonesia's national economy, with the horticultural sub-sector playing a particularly vital role. According to the Minister of Agriculture Decree No. 141/KPTS/HK.150/M/2/2019 of 2019, there are 60 prioritized fruit commodities. The diversity of horticultural commodities represents one of the most promising potentials in accelerating agricultural economic growth (Direktorat Jendral Hortikultura Indonesia, 2020). Among these, citrus fruits are considered a leading commodity with strong development potential, particularly in Pangkajene and Kepulauan Regency (Pangkep), due to their favorable environmental conditions (Dahlia *et al.*, 2021).

Pamelo citrus (*Citrus maxima* (Burm.) Merr.) is identified as a flagship commodity in Pangkep Regency. Based on data from the Badan Pusat Statistika Provinsi Sulawesi Selatan (2023), Pangkep is the largest producer of pomelo citrus in the region, with a total production of 271,995 quintals. Further, according to the Badan Pusat Statistika Kabupaten Pangkajene dan Kepulauan (2023), the leading production districts in 2022 were Ma'rang (223,615 quintals), Labakkang (44,012 quintals), Segeri (1,780 quintals), and Mandalle (312 quintals). However, in recent years (2015–2022), overall production has declined by 9,776.5 quintals. This decline has posed challenges to pomelo farming, resulting in many farmers shifting to other crops perceived to be more profitable (Irawati & Sugiarti, 2020). The issues surrounding pomelo production and productivity in Pangkep are believed to be due to inefficiencies in production processes and insufficient capacity among farmers to effectively manage pomelo agribusiness (Marhawati, 2019).

At present, information regarding the feasibility and challenges of pomelo farming in Pangkep Regency remains limited. Previous research efforts, such as those by Urianti *et al.* (2017); Marhawati (2019); Taufik *et al.* (2015) and Marhawati *et al.* (2021), have supported pomelo production but have primarily focused on a single dimension—namely, farm business analysis—without addressing other agribusiness subsystems. A comprehensive agribusiness system analysis, encompassing all subsystems, is essential to guide pomelo development efforts toward achieving high productivity, product quality, and competitiveness. Therefore, the present study aims to analyze the pomelo citrus agribusiness system to enhance the effectiveness of orchard management through improvements across relevant subsystems.

RESEARCH METHODS

This study was conducted from May to August 2024 in Pangkep Regency, covering four districts: Mandalle, Segeri, Ma'rang, and Labakkang. The research location is illustrated in Figure 1.

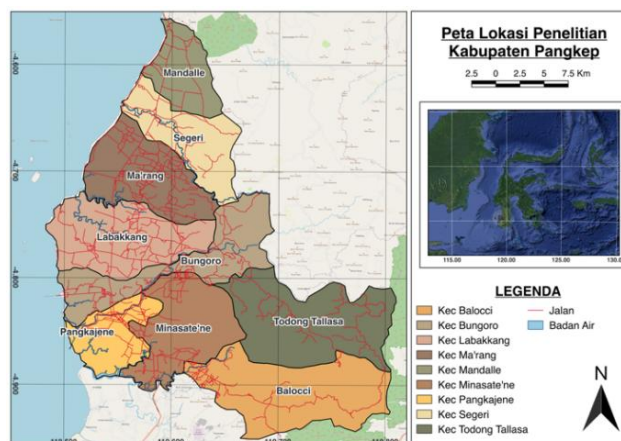


Figure 1. Research Location

Source: Dinas PUPR 2024 (processed)

Secondary data were obtained from the Pangkep Regency Agricultural Office, specifically lists of pomelo citrus farmer groups. Primary data were collected through ground checks to analyze site characteristics, cultivation techniques, and the pomelo agribusiness system. Interviews were conducted with buyers, while questionnaires were completed by farmers, middlemen, and traders. The questionnaires covered: (1) productivity, (2) marketing chains, (3) sources of capital, (4) buying and selling prices at each marketing stage (distribution flow), (5) total production costs, (6) variable costs, and (7) post-harvest processing.

Respondents were selected using purposive sampling, including farmers from various farmer groups as well as actors from each marketing chain. Sampling considered the representativeness of orchard locations and the use of all available marketing channels. The sample size was determined using the Slovin formula with a 10% margin of error, based on active pomelo citrus farmer groups across the four districts. Details of the sampling are presented in Table 1, and the sample size calculation is as follows (Bartlett *et al.*, 2001):

$$n = \frac{N}{1+N(e^2)} \quad n = \frac{89}{1+89(0.01)} \quad n = 47.08 \approx 47$$

where:

n = sample size

N = population size (number of farmer groups)

e = error

Table 1 Sample Details

District	Total Production (kw)	Farmer Groups	Sample Size
Ma'rang	223,615	75	34
Labakkang	44,012	12	9
Segeri	1,780	1	2
Mandalle	312	1	2
Total	269,719	89	47

Source: Pangkep Agricultural Office, 2022 (processed)

a. Farm Business Analysis

The feasibility of pomelo cultivation is assessed using the R/C ratio analysis, based on the average values from the entire sample of farmers. This involves a comparison between production costs (C) and revenues (R) for each sample. The profit-to-cost ratio indicates the extent of expenditure required by farmers to generate profits. A marketing system is considered efficient if the R/C ratio is greater than 1. The R/C ratio is calculated using the following formulas (Asmarantaka, 2012):

- Revenue:

$$R = Py \times Y \dots \dots \dots (1)$$

where:

R = Revenue (Rp)

Py = Selling Price (IDR/Unit)

Y = Production volume (Kg/Unit)

- Profit:

$$\pi = TR - TC \dots \dots \dots (3)$$

where:

π = Net Profit for Farmers (IDR/Unit)

TR = Total Revenue (IDR)

TC = Total Cost (IDR)

- Cost:

$$C = FC + VC \dots \dots \dots (2)$$

where:

C = Total cost (IDR)

VC = Variable Cost (IDR/Unit)

FC = Fixed Costs (IDR/Unit)

- Profit and cost ratio:

$$\frac{R}{C} = TR/TC \dots \dots \dots (4)$$

b. Marketing Margin Analysis

Marketing margin analysis is based on the difference between consumer expenditures and the income received by farmers. It is calculated by subtracting the purchase price from the selling price at each level of the marketing channel. The total marketing margin is the sum of the margins at all intermediary institutions. A higher marketing margin indicates lower

marketing efficiency. The marketing margin is calculated using the following formulas (Asmarantaka, 2012):

$$M_p = P_r - P_f \text{ or } M_p = B_r - K_p \dots\dots\dots(5)$$

where:

M_p = Marketing Margin (IDR/Kg)

P_r = Consumer-level Price (IDR/Kg)

P_f = Farmer-level Price (IDR/Kg)

B_r = Marketing Costs (IDR/Kg)

K_p = Marketing Profit (IDR/Kg)

• Trader Profit:

$$P = M - C \dots\dots\dots(6)$$

where:

P = Trader Profit (IDR/Kg)

M = Trader Price (IDR/Kg)

C = Marketing Costs (IDR/Kg)

c. Farmer's share Analysis

The farmer's share represents the proportion of the final consumer price that is received by the farmer. A higher farmer's share indicates greater benefits received by the farmer. If the farmer's share exceeds 40%, the agricultural supply chain is considered efficient (Downey & Erickson, 1992) whereas a share below 40% indicates inefficiency. The formula is as follows (Asmarantaka, 2012):

$$\frac{P_f}{P_r} \times 100\% \dots\dots\dots(7)$$

where:

F_s = Farmer's share

P_f = Price Received by Farmers

P_r = Price Paid by Consumers

RESULTS AND DISCUSSION

The agribusiness system concept is divided into five subsystems (Suparta, 2005) including (1) input subsystem, (2) production subsystem, (3) processing subsystem, (4) marketing subsystem, and (5) supporting subsystem. The interrelationship among these subsystems is illustrated in Figure 2.

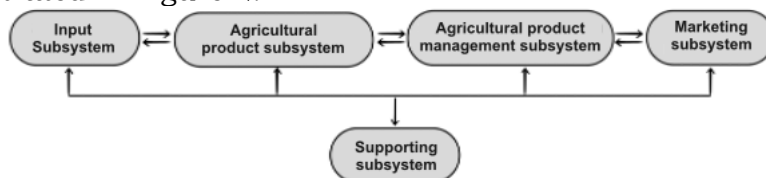


Figure 2. Interrelation Diagram of the Pomelo Agribusiness System

Source: Processed Primary Data

INPUT SUBSYSTEM

a. Seedling Locations

The input subsystem refers to all activities related to the provision of production facilities (Krisnamurthi, 2020) such as seedlings, fertilizers, pesticides, agrochemicals, and production machinery and tools. Figure 3 presents pomelo seedling locations.



(a)



(b)



(c)

Figure 3. Pomelo Seedling Location (a&b) Padanglampe Village, Ma'rang District; (c) Kanaungan Village, Labakkang District

The three seedling sites shown in Figure 3 are privately owned and independently managed. However, the seedlings are not certified. Their packaging lacks essential information as required for certified seedlings in accordance with the Minister of Agriculture

Regulation No. 380/Kpts/HK.150/D/IX/2023 concerning Technical Guidelines for Horticultural Seed Certification. These uncertified seedlings are sold and distributed due to limited infrastructure and insufficient knowledge regarding seed certification procedures.

b. Facilities and Infrastructure

The availability of agricultural infrastructure and pomelo cultivation systems varies across districts. Among the four, Ma'rang District has relatively better facilities, including seedling centers, production houses, sorting houses, complete fertilizer usage, post-harvest processing, and marketing centers. One critical facility in pomelo cultivation is the irrigation system, which significantly affects the plant's growth and productivity (Castrena *et al.*, 2018). Pomelo farmers in Pangkep Regency rely primarily on wells and water pumps during dry seasons, while others depend solely on rainwater. Figure 4 shows the irrigation facilities used by pomelo farmers.



Figure 4. (a) Watering Well in Attangsalo Village, Ma'rang District; (b) Water Container for Irrigation & (c) Water Reservoir in Taraweang Village, Labakkang District; (d) Water Pump Machine and Hose in Lekosewa Village, Labakkang District

In addition to the use of wells (Figure 4a), water reservoirs (Figure 4c), and water pumps (Figure 4d), one farmer in Taraweang Village (Figure 4b) has implemented an uncommon irrigation method. The irrigation system utilizes a container with perforations at the bottom, allowing water to drip slowly and directly at the base of the pomelo tree, commonly referred to as a drip irrigation system. This method, employed in Taraweang Village, Labakkang District—an area frequently affected by drought—allows farmers to optimize water use, reduce irrigation costs, and slow the rate of water evaporation during the dry season (Witman, 2021).

c. Fertilizer

The types and dosages of fertilizers applied vary across individual farmers. The average amount of fertilizer use is presented in Table 2.

Table 2 Average Fertilizer Use (Kg/Ha/Year) in Pangkep Regency

District	Produkti on (Fruit)	Revenue (R) (IDR/fruit)	Total Cost (C) (IDR)	Total Profit (IDR)	R/C ratio
Ma'rang	978	4,164,800	3,375,537	789,263	1.39
Labakkang	1,342	3,879,167	3,071,000	8,081,667	2.47
Segeri	1,410	5,970,000	3,944,750	2,025,250	1.86
Mandalle	90	360,000	0	360,000	0

Source: Processed Primary data

Farmers in each district use various types and quantities of fertilizers. Generally, farmers find it easier to obtain macronutrient fertilizers; however, these are typically non-subsidized, requiring farmers to incur relatively high costs. This is because pomelo is not included in the list of subsidized crops. Fertilizer subsidies are regulated under the Minister of Agriculture Regulation (PERMENTAN) Number 01 of 2024 concerning the Procedures for Determining the Allocation and Maximum Retail Price of Subsidized Fertilizers in the Agricultural Sector.

The use of organic material in the form of solid fertilizer involves high application rates, particularly in Labakkang District (Table 2). Most farmers in Labakkang use only solid organic fertilizer because it is considered more affordable and easier to obtain. This fertilizer is typically sourced from nearby livestock farmers and is available at significantly lower prices, especially since some pomelo farmers are also engaged in livestock farming.

d. Pesticides and Plant Treatment

Fruit flies are a major pest affecting pomelo, particularly targeting young fruit, thus reducing fruit quality. Figure 5 illustrates a pomelo fruit damaged by fruit fly infestation.



Figure 5. Pomelo Citrus Damaged by Fruit Flies

The image shows fruit that has been attacked by fruit flies. Infestation causes young pomelo fruit to develop abnormal shapes, exhibit callus-like symptoms, and often fall prematurely. In mature fruit, the flies cause wet rot, leaving visible larval holes that are often infected by bacteria or fungi (Wijaya & Adiartayasa, 2018). The damage impacts not only the fruit's appearance but also reduces yield and marketability.



Figure 6. Fruit Fly Trap

This model is a modified *Steiner trap*, using a plastic water bottle containing an attractant, **methyl eugenol**, applied to cotton. The traps are carefully placed throughout the orchard—ideally one trap per tree—to maximize fruit fly capture efficiency. Methyl eugenol acts as an effective attractant to fruit flies, thereby preventing them from damaging the pomelo fruit (Hong Tan & Nishida, 2011).

FARMING SUBSYSTEM

The agricultural production subsystem is referred to as farming activities or farm enterprises (Krisnamurthi, 2020). Farm enterprise analysis is conducted using the R/C ratio analysis, involving variables such as revenue, cost, and income, which are analyzed based on pre- and post-production costs (Soekartawi, 1995). The R/C ratio analysis represents total production across districts by calculating all parameters. Total cost is calculated using variables such as land preparation (including planting, seedling, fertilizers, and pesticides), additional labor and wages (for watering, fertilization, maintenance, and harvesting), and transportation for sales.

Table 3 Average Pomelo Farm Enterprise in Each District

District	Producti on (fruit)	Revenue (R) (IDR/fruit)	Total Cost (C) (IDR)	Total Ptofit (IDr)	R/C ratio
Ma'rang	978	4,164,800	3,375,537	789,263	1.39
Labakkang	1,342	3,879,167	3,071,000	8,081,667	2.47
Segeri	1,410	5,970,000	3,944,750	2,025,250	1.86
Mandalle	90	360,000	0	360,000	0

Source: Processed Primary Data

The analysis indicates that pomelo farming in Segeri, Labakkang, and Ma'rang is feasible and profitable, as shown by R/C ratios greater than 1. In contrast, Mandalle has an R/C ratio of 0, which cannot be computed due to the absence of incurred costs. There is no maintenance or irrigation in this district; pomelo trees were planted but not cultivated further.

In Mandalle, only two pomelo orchards exist, with areas of 0.5 ha and 0.2 ha, respectively, producing a total of 90 fruits. Farmer group data show that while there were originally two farmer groups, only one remains. Some pomelo farmers have switched to other crops perceived as more profitable due to increased consumer demand for certain commodities (Sudarwati & Nasution, 2024). This is evidenced by land-use conversion from agricultural land to other uses, totaling 34.53 ha between 2016 and 2020 (Asmirawaty *et al.*, 2022).

Each district demonstrates different R/C ratios. Segeri has an R/C ratio of 1.86 with a profit of Rp 2,025,250. Labakkang records the highest R/C ratio at 2.47 and a profit of Rp 8,081,667. Meanwhile, Ma'rang has the lowest R/C ratio of 1.39 and a profit of Rp 789,263. Ma'rang is the largest pomelo producer, but its lower R/C ratio may be attributed to high maintenance costs and relatively low revenue. The elevated cost is primarily due to excessive and improper fertilizer use. According to Taufik *et al.* (2015) appropriate fertilization rates for nutrient-deficient soils are 475.3 g N, 582.24 g P₂O₅, and 495.75 g K₂O, or 1.03 kg Urea and 1.62 kg SP-36. However, soil analysis is necessary to determine the correct fertilizer dosage. The availability of adequate agricultural inputs in a region can support increased productivity and farmer income—provided that farmers also possess the skills to manage their farming enterprises effectively (Soekartawi, 1987).

Table 4 Results of soil analysis in pomelo orchards

District	Nutrient Elements (cmol ⁽⁺⁾ /kg)	
	Magnesium (Mg)	Potassium (K)
Ma'rang	0.70	0.26
Labakkang	0.56	0.21
Segeri	0.54	0.12

Source: Processed Primary Data

Pomelo fruits from Ma'rang District tend to have a sweeter and juicier taste. The nutrient content of magnesium (Mg) and potassium (K) in Ma'rang, as shown in Table 4, is higher than in other districts. The sweetness of the fruit is attributed to its nutrient content, particularly magnesium, which functions as a natural sweetener. Magnesium is a principal component of chlorophyll and acts as a catalyst in photosynthesis, contributing to carbohydrate production, which in turn enhances the fruit's sweetness (Witariadi *et al.*, 2017). In addition to magnesium, potassium also contributes to the enhancement of fruit sweetness (Darwiyah *et al.*, 2021).

AGRICULTURAL PRODUCT PROCESSING SUBSYSTEM

The agricultural product processing subsystem is often referred to as agro-industrial activities (Krisnamurthi, 2020). Post-harvest facilities in Pangkep Regency are shown in Figure 8.



Figure 8 (a) Production house, post-harvest shelter, and processing facility; (b) Sorting and packaging house

Figure 8(a) depicts the production facility, while Figure 8(b) illustrates the sorting and packaging house located in Ma’rang District. The production house was established with assistance from the Directorate General of Horticulture, Ministry of Agriculture of the Republic of Indonesia, in 2022. Several post-harvest processing machines and equipment for horticultural crops, particularly pomelo, are housed within this facility. The sorting house is a private facility owned by local farmers and the Pomelo Geographic Indication Protection Society (MPIG) of Pangkep Regency. Both facilities are used according to their intended purposes, although not yet optimally.

Most pomelos are still marketed in fresh fruit form and sold either directly by farmers or by traders operating along the roads of Ma’rang and Segeri Districts. The selling price varies depending on the type (red or white) and size of the fruit, with traders' prices ranging from IDR 7,000 to IDR 20,000 per fruit. Figure 9 shows the sale of fresh pomelo fruit.



Figure 9 Sale of fresh pomelo fruit

Several value-added products have also been developed, including pomelo-based dodol (traditional toffee), noodles, candy, and beverages. These products are produced by local community groups utilizing the production house located in Ma’rang. The beverage products are distributed through pomelo fruit vendors in both Ma’rang and Segeri Districts. One of the processed pomelo products is shown in Figure 10.



Figure 10 Processed pomelo products

However, the marketing of pomelo-based beverages has not been effective or sustainable, due to quality issues—particularly a lingering bitterness in the product. This issue can be addressed by the addition of the enzyme naringinase. The incorporation of naringinase into pomelo-derived products has been shown to reduce naringin content, which is responsible for the bitter taste, thereby making the product more palatable (Seytadjit *et al.*, 2010).

MARKETING SUBSYSTEM

The marketing subsystem comprises the marketing chain and marketing margins. The analysis of the pomelo marketing chain reveals five distinct chains, exceeding the number found in other regions, where typically only two to three chains exist (Gultom *et al.* (2024); Aida *et al.* (2024); Purnamasari *et al.* (2022). Table 5 presents the marketing chains and farmer’s share of pomelo in Pangkep Regency

Table 5 Marketing Chains and Farmer’s Share of Pomelo in Pangkep Regency

No	Marketing Chain	Farmer's Share (%)	Distributio n (%)	District Coverage
1	Farmer–Middleman– Trader–Consumer	23.33	49.64	Ma'rang, Labakkang, Segeri, Mandalle

2	Farmer–Trader (Outside Regency)–Consumer	38.33	4.35	Ma'rang, Segeri
3	Farmer–Trader–Consumer	55	17.03	Ma'rang, Labakkang
4	Farmer–Middleman–Major Middleman–Trader–Consumer	20	16.30	Ma'rang
5	Farmer–Consumer	78.57	12.68	Ma'rang, Labakkang

Source: Primary Data Processed

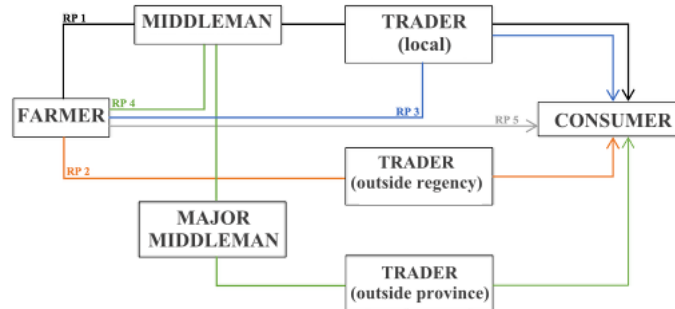


Figure 11 Pomelo Marketing Chains in Pangkep Regency

Farmer income is influenced by the marketing channel utilized, as each channel involves different costs. Farmers need to identify the most effective and efficient channel. The longer the marketing chain, the smaller the profit for the farmer, and vice versa (Baru *et al.*, 2019). Selecting an efficient and effective marketing channel is a crucial factor since each channel offers a different price structure that directly impacts the farmer's income (Arwan *et al.*, 2023).

Marketing Chain 1 (Figure 11) is the most commonly used. In this chain, farmers incur no transportation or harvesting costs because middlemen visit the farms directly. However, the profit margin for farmers is relatively low due to price suppression. Similar patterns have been observed in the Umbulsari District, Jember Regency, where middlemen dominate both the market and the marketing chain (Habibah & Yasin, 2022). Marketing Chain 5 is considered the most effective due to its short structure, offering the highest farmer's share. Nonetheless, few farmers utilize this channel, primarily because most are eager to sell their produce quickly, whereas Chain 5 typically requires a longer selling process. Furthermore, many farmers face challenges in marketing, making it difficult to attract consumers to purchase directly from them. Marketing remains a critical aspect of Chain 5 to attract consumers to directly buy from the farmers (Alfiati *et al.*, 2023), presents a significant challenge for most pomelo farmers in Pangkep Regency.

Marketing Chain 4, characterized by its length and a low farmer's share (20%), is inefficient for both farmers and consumers. This chain is found only in Ma'rang District, which has the highest pomelo production. Here, major middlemen rely on dedicated farmer-producers. Choosing the appropriate marketing pattern greatly influences farmer income and is often a core issue. The price received by the farmer determines their profit and marketing efficiency. Unfair profit distribution among marketing agents is common and frequently discourages farmers from participating in the marketing of pomelo.

Table 6 presents data on marketing and trader profits. According to Wohlgenant (2001), there are two definitions of marketing margin: first, the difference between the price paid by consumers and the price received by producers; second, the compensation provided by consumers to each node within the marketing chain. Variations in margin calculations are attributed to differences in the number of marketing channels within each marketing chain.

Table 6 Pomelo Marketing Margins in Pangkep Regency

Marketing Chain	Number of Chains	Margin (%)	Trader's Profit (%)	Highest Profit	
				Marketing Node	Value (%)
Mandalle District					
1	2	73.33	71	Local Trader	52.33
Segeri District					
1	2	73.33	68,33	Local Trader	49.67
2	1	70	69	Outside Trader	69
Labakkang District					
1	2	80	77,67	Local Trader	52.33
3	1	71.67	70	Outside Trader	70
5	0	8,70	10	Farmer	10
Ma'rang District					
1	2	75.56	70,56	Local Trader	49.67
2	1	70	69	Outside Trader	69
3	1	66.67	62,83	Local Trader	62.83
4	3	79	64,75	Major Middleman	30
5	0	5.24	5,24	Farmer	36.42

Source: Processed Primary Data

Based on Table 6, the larger the margin, the smaller the profit gained by traders. The highest margins are found in Chain 1, where local traders earn the highest profits. Conversely, the lowest margins are observed in Chain 5, particularly in Labakkang District (8.70%) and Segeri District (5.24%). The low margin in Chain 5 indicates that it is the most efficient marketing chain (Harimurti *et al.*, 2018). This condition reflects minimal marketing costs and lower trader profits, suggesting that most of the price paid by consumers is determined by the farmers. The reduced marketing costs and trader profits result in relatively lower consumer prices, thus potentially increasing consumer purchasing power and product demand.

SUPPORTING SUBSYSTEM

a. Sources of Funding

The supporting institutional subsystem, often referred to as the service subsystem (Krisnamurthi, 2020), plays a critical role in agricultural development. In Pangkep Regency, pomelo farmers primarily rely on personal capital or informal loans from family members, rather than accessing formal financial institutions. This limited financial capacity has hindered research and development efforts related to pomelo cultivation, particularly at the farmer level.

b. Research and Development

Research and development activities are currently centered around government agencies and academic researchers. A supporting institution, *MPIG* (Geographical Indication Protection Society), has been established to safeguard and enhance pomelo production. *MPIG*'s responsibilities include maintaining the quality of pomelo, increasing its market value, and collaborating with the government in proposing legal protection under Law Number 20 of 2016 on Geographical Indications. Ensuring product quality is crucial, yet it remains a frequently neglected aspect among farmers. Research by Marhawati *et al.* (2021) indicates that the quality of pomelo produced is still below market standards. Most farmers pay little attention to product specifications, opting to sell their produce immediately without sorting or processing. As a result, it becomes challenging in practice to determine product types, standards, quality, and appropriate pricing that benefits both consumers and producers.

c. Agricultural Extension Services

Extension services concerning pomelo cultivation are continually provided by local governments through Agricultural Extension Centers (BPP) at the district level. Although the government has organized several training sessions on pomelo-based product development, packaging, and storage, follow-up activities are often lacking. According to Irdiana *et al.* (2023), factors such as skills, motivation, and competence of both extension workers and farmers significantly influence the success of extension programs. The absence of specialized pomelo extension officers and the limited number of available personnel pose major challenges. Consequently, farmers frequently depend solely on their experience, with limited technical knowledge and support.

CONCLUSION

Overall, the agribusiness system in Pangkep Regency has been functioning reasonably well, although it has yet to reach its full potential. Ma'rang District has the most comprehensive agribusiness subsystems, including input supply, production/farming, post-harvest processing, marketing, and support services. In contrast, Mandalle District lacks a complete subsystem structure. The R/C ratio analysis shows that the farming businesses in Ma'rang (1.39), Labakkang (2.47), and Segeri (1.86) are viable for continued development. Five marketing chains were identified, with Marketing Chain 5 (Farmer–Consumer) being the most efficient, while Marketing Chain 4 (Farmer–Middleman–Trader–Consumer) was found to be the least beneficial.

RECOMMENDATIONS

Overall, the agribusiness system in Pangkep Regency has been functioning reasonably well, although it has yet to reach its full potential. Ma'rang District has the most comprehensive agribusiness subsystems, including input supply, production/farming, post-harvest processing, marketing, and support services. In contrast, Mandalle District lacks a complete subsystem structure. The R/C ratio analysis shows that the farming businesses in Ma'rang (1.39), Labakkang (2.47), and Segeri (1.86) are viable for continued development. Five marketing chains were identified, with Marketing Chain 5 (Farmer–Consumer) being the most efficient, while Marketing Chain 4 (Farmer–Middleman–Trader–Consumer) was found to be the least beneficial.

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