International Journal of Economic, Finance and Business Statistics (IJEFBS)
Vol. 3 No. 4 2025: 211-230

Conventional VS Digital Marketing Channels for Hydroponic Vegetables in Kendari City, Indonesia: A Comparative Efficiency Analysis

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A R T I C L E I N F O
Keywords: Digital Marketing, Efficiency, Hydroponic Vegetables, Margin, Profit

Received: 19, June
Revised: 20, July
Accepted: 30, August

A B S T R A C T
This study analyzes the marketing channels for lettuce (*Lactuca sativa*) and pakcoy (*Brassica rapa* subsp. *chinensis*) in Kendari City, comparing conventional direct/offline channels with emerging digital platforms. A census of 16 hydroponic producers and a snowball sample of 6 marketing intermediaries were used to identify marketing channel structures and evaluate economic performance through marketing margin, cost and profit distributions, marketing efficiency, and farmers' share. Results show that conventional marketing involves two channels, whereas digital marketing extends to three channels. Hydroponic product marketing via digital platforms achieved substantially higher sales volumes than through conventional outlets. All observed channels are economically efficient. The shortest channel (direct producer-to-consumer) is most efficient under both methods, while longer chains have higher but still acceptable EP and reduced farmers' share. Producers retain 83–89% of the consumer price in the two-level channels and 63–73% in the three-level digital channel. These findings underscore that shorter distribution channels yield the highest returns to farmers and the lowest marketing costs. The study contributes empirical evidence that digital marketing can expand market reach and maintain high marketing efficiency for urban agribusiness.

DOI: https://doi.org/10.59890/ijefbs.v3i4.129
ISSN-E: 3025-9959
https://dmimultitechpublisher.my.id/index.php/ijefbs

INTRODUCTION

The horticulture sector is expanding rapidly in Indonesia and plays a vital role in agricultural development by ensuring food and nutritional security. Vegetables, in particular, are essential for human diets due to their rich content of vitamins (A, C), minerals, antioxidants, and fiber (Nasrida et al., 2023; Ülger et al., 2018). Rising health awareness and urban population growth have fueled increased demand for vegetables produced without pesticides or synthetic inputs (Saediman et al., 2024). Hydroponic cultivation has emerged as a promising solution to meet this demand in urban areas, as it allows efficient year-round production of high-quality vegetables in limited spaces (Saediman, Gafaruddin, et al., 2021; Saediman et al., 2024). Since around 2018, consumer interest in hydroponically grown vegetables in Indonesian cities has been growing by an estimated 10–20% per year. These products are now not only purchased by households but also supplied to supermarkets, restaurants, and hotels, indicating a broadening market reach.

Kendari City, the capital of Southeast Sulawesi, reflects this national trend. In recent years, small-scale urban farmers in Kendari have increasingly adopted hydroponic systems to cultivate leafy greens (Saediman et al., 2024; Sarfan et al., 2024) like lettuce and pakcoy. By 2024, there were 16 active hydroponic vegetable producers in Kendari. However, the success of these urban farms depends heavily on efficient marketing strategies to deliver produce from producers to consumers at competitive costs. Traditionally, smallholder farmers relied on conventional marketing channels, such as selling directly to consumers at local markets or through nearby retailers. This conventional approach involves face-to-face transactions where buyers meet sellers and negotiate prices. Such direct/offline marketing is limited in geographic reach but often valued for personal interaction and trust (Saediman, 2021). In contrast, the digital era has introduced digital marketing channels that leverage online platforms and communication technologies (Dwi Rahmadania et al., 2024; Saediman, 2021). Digital marketing in agriculture refers to promoting and selling farm products via internet-based media, for example, through social media (WhatsApp, Facebook, Instagram) or e-commerce apps, to reach a wider audience (Mboe et al., 2024; Saediman, 2021). These platforms enable producers to advertise and transact with consumers remotely, offering potential to shorten supply chains by "disintermediating" traditional middlemen and optimizing marketing efficiency (Farmonaut, n.d.).

The rise of digital marketing channels offers both opportunities and challenges for hydroponic vegetable supply chains. On one hand, digital channels can connect urban farmers directly with consumers, potentially increasing farmers' share of the final price and reducing marketing costs (Todor, 2016). Studies in other regions have found that when farmers bypass multiple intermediaries using direct marketing (including online sales), they tend to retain a higher proportion of the consumer price. For example, Prasetiyo et al. (2021) report that millennial hydroponic farmers in East Java actively use WhatsApp social media groups to market vegetables, enhancing information flow and customer outreach while minimizing intermediary involvement. On

the other hand, implementing digital marketing requires farmers to adopt new skills and may introduce new kinds of intermediaries (such as online aggregators or delivery services) into the chain.

Marketing efficiency in agribusiness is commonly evaluated by examining the distribution of costs and margins along the supply chain. A classic measure is the marketing margin, farmer's share (FS), and marketing efficiency percentage (EP). In Indonesian agribusiness literature, a channel is generally considered efficient if EP < 50%. Equivalently, some authors use Farmer's Share > 50% as an efficiency criterion, since a high FS implies relatively low combined costs and margins for intermediaries (Iswahyudi & Sustiyana, 2019; Taridala et al., 2013). Prior studies on horticultural marketing often find that longer supply chains involving more intermediaries tend to increase the total marketing margin and costs, thereby lowering farmer's share and efficiency. For instance, Suswatiningsih et al. (2021) observed that in the sugar market of East Java, producers received nearly 94% of the consumer price in the shortest channel, but only 58% in the longest channel, reflecting the greater cost build-up in longer chains. Similarly, Septiadi & Nursan (2024) noted that the complexity of the marketing chain is inversely related to the farmer's share in a study of crop marketing in Lombok.

Research specifically focusing on hydroponic vegetable marketing in Indonesia has begun to document the structure and performance of these supply chains. Azhari (2019) identified three marketing channels for hydroponic lettuce in Lamongan, East Java, and reported that all three channels were efficient by conventional criteria (marketing cost ratios well below 50%). In North Sumatra, Lubis et al. (2021) analyzed hydroponic vegetable marketing at a community farm and similarly found multiple channels with low efficiency ratios (on the order of 1–2%) and high farmer's shares. These findings suggest that hydroponic supply chains, which often operate on a relatively small scale and serve niche urban markets, can achieve high operational efficiency, especially when producers engage in direct sales or limit the number of intermediaries. However, comparative evidence on the role of digital marketing within these systems is still limited. The present study addresses this gap by examining how digital marketing channels compare to conventional channels in the context of hydroponic vegetables in Kendari City, both in terms of structure and efficiency outcomes.

This research aims to: (1) identify and describe the marketing channels used for hydroponic vegetables in Kendari City, distinguishing between conventional and digital marketing methods; (2) analyze the differences in channel structure and participant roles between conventional and digital channels; and (3) evaluate the marketing efficiency of each channel type using marketing margins, cost-profit analyses, efficiency percentages, and farmer's share indicators. By integrating these objectives, the study seeks to determine whether digital marketing provides a significant efficiency advantage over traditional channels for hydroponic farmers, or if both approaches yield similar performance.

LITERATURE REVIEW

Marketing Channels and Distribution in Agribusiness

A marketing channel is the path a product takes from producers to end consumers, including all intermediaries involved in the transfer, processing, and sale of the product (Saediman et al., 2004; Saediman, Helviani, et al., 2021). In agricultural markets, common intermediaries are collectors (wholesalers who aggregate produce) and retailers (who sell to final consumers). The structure of a marketing channel can be described by its length (number of intermediary levels) and the functions performed by each actor (such as transportation, storage, packaging, and retailing). Conventional marketing channels for fresh produce in developing countries often involve multiple tiers, such as farmer to village trader, to wholesaler, to retailer, and to consumer (Saediman, Helviani, et al., 2021). Each additional tier can increase the final price due to markup, and potentially reduce the share of that price returning to the farmer. Kohl's and Uhl's classic theory of agricultural marketing posits that efficient channels are those that deliver products to consumers at minimum cost, consistent with the service provided (Kohls & Uhl, 2002). This concept aligns with Mubyarto (1989) A definition of an efficient marketing system moves goods from producer to consumer with the least expenditure of resources while meeting consumer requirements.

Marketing Efficiency Metrics

Following common practice in agribusiness studies, we use the ratio of total marketing cost to the consumer price as a percentage, denoted as EP (Efficiency Percentage), to quantify marketing efficiency. Formally, EP = (Total Marketing Cost ÷ Consumer Price) × 100%. A lower EP indicates a higher efficiency; for example, EP = 10% means only 10% of the consumer's payment goes to covering marketing costs (90% of the value is either the farmer's price or the intermediaries' profit), whereas EP = 60% would imply a very costly channel. A channel is efficient if EP < 50%, and inefficient if EP > 50%. Many recent studies continue to apply this benchmark. Alternatively, efficiency can be inferred from Farmer's Share (FS), computed as (Producer Price ÷ Consumer Price) × 100% (Padangaran et al., 2019). If farmers receive more than half of the final price (FS > 50%), the channel is typically deemed efficient, whereas a low FS (considerably below 50%) signals that intermediaries take the majority, often due to high costs or exploitative margins. These two criteria (EP < 50% and FS > 50%) usually coincide since FS = 100% – (margin ÷ consumer price × 100%), and margin includes both costs and intermediary profit. For instance, Iswahyudi & Sustiyana (2019) and Safitri et al. (2019) asserts that a marketing system can be classified as efficient if the farmer's share exceeds 50%, reflecting reasonable marketing costs. It should be noted that these are rule-of-thumb thresholds. In high-value modern supply chains, even an EP of 60% might be acceptable if it corresponds to value-adding services, but for staple or commodity markets, the 50% benchmark is a useful guideline.

Digital vs. Conventional Marketing Strategies

Conventional marketing strategies in agriculture rely on physical marketplaces, personal selling, and direct interactions. Indana & Beni (2021) describe conventional marketing as buyers coming to meet sellers in person,

with bargaining often occurring face-to-face. This strategy can build trust and allows tactile inspection of produce, but limits market size to local geography and operating hours of markets. Conversely, digital marketing strategies deploy internet and communication technologies to expand market reach and engage customers virtually. Musnaini et al. (2020) define digital marketing as the use of digital media to market a brand or product. In the context of hydroponic produce, digital marketing might include social media advertising, online storefronts, and coordination of deliveries through apps. A key theoretical benefit of digital marketing in agriculture is disintermediation, meaning that farmers may sell directly to consumers (D2C) or to retail clients via online channels, thus reducing the need for traditional middlemen (Farmonaut, n.d.). This can shorten the supply chain and potentially increase efficiency by cutting redundant transport or handling costs. Additionally, digital channels can improve price transparency and reduce information asymmetry; farmers can better gauge consumer demand and prices, while consumers can access information on product origin and quality (Agriculture Institute, 2024; Kanellos et al., 2024). On the profitability side, recent studies indicate that strategic use of digital marketing can boost agribusiness profitability despite high production costs, by expanding the customer base and reducing advertising or market transaction costs (Kanellos et al., 2024). For example, an agri-food enterprise that successfully drives online sales may achieve higher margins by avoiding fees taken by physical marketplace intermediaries (Kanellos et al., 2024). However, some paradoxes are noted: businesses might sell at premium prices yet thrive by leveraging digital marketing to create strong consumer demand and perceived value (Kanellos et al., 2024).

Empirical evidence on digital marketing's impact on small-scale farming is still emerging. Nwachukwu & Eze (2021) report growing adoption of digital platforms even in commodities like palm oil, suggesting farmers use social media and e-marketplaces to improve market access and efficiency. In Indonesia, Prasetiyo et al. (2021) found that WhatsApp-based networks helped hydroponic farmers in Situbondo coordinate marketing, indicating that younger farmers, especially, are adept at utilizing digital tools to enhance sales. Nonetheless, digital marketing does not eliminate intermediaries; rather, it can give rise to new intermediaries such as online aggregators or delivery service providers. Harahap et al. (2024). In studying a hydroponic vegetable cooperative's marketing, identified that even when using online promotion, an intermediary (collector or aggregator) might be involved in consolidating produce and managing customer orders. Their study in Deli Serdang showed that three channels existed (direct, one-intermediary, and two-intermediary) and all were efficient (each channel's EP < 2%), but the presence of extra intermediaries slightly lowered the farmer's share in longer channels.

METHODOLOGY

Study Area and Subjects

The research was conducted in Kendari City, Southeast Sulawesi, Indonesia. Kendari is a coastal urban centre where hydroponic vegetable

farming has gained popularity. We selected 16 registered, active hydroponic vegetable producers as respondents. The main vegetables produced were lettuce and pakcoy (Chinese cabbage) under hydroponic systems. All 16 producers were surveyed to capture data on their marketing practices, sales volumes, and prices. In addition, marketing intermediaries involved in the distribution of these hydroponic vegetables were sampled using a snowball sampling technique. This yielded a sample of six intermediary respondents, consisting of two collector traders (wholesalers who gather produce from farmers) and four retailers. Collectors in this context often operate via digital channels (e.g., taking orders online and sourcing from producers), whereas retailers include both traditional market vendors and online resellers.

Data Collection

Primary data were collected through structured interviews and record analysis in early 2025. Producers provided information on their monthly sales volume (in kg) for lettuce and pakcoy, prices received, marketing method, and any marketing costs they incur. Intermediaries provided corresponding data on the volumes and prices at which they purchase and resell the produce, as well as their incurred costs. Secondary data were obtained from relevant sources to contextualize the findings, including population and agriculture statistics of Kendari, and literature on hydroponic marketing.

Marketing Channel Identification

Using the survey data, we mapped out the marketing channels for hydroponic vegetables in Kendari under two broad categories, namely (1) Conventional marketing channels: those where transactions occur through direct physical contact or traditional marketplaces without significant use of internet platforms, and (2) Digital marketing channels: those where producers or intermediaries utilize online platforms (social media, e-commerce, messaging apps) to market and arrange the sale of produce. For each channel, we documented the sequence of actors involved. The channel structures were labelled as Channel I, II, III, etc., for each category, ordered by increasing length.

Data Analysis

The analysis combines descriptive and quantitative approaches. A qualitative approach is used to describe the characteristics of each channel and compare conventional vs digital channels. Quantitative approaches used include marketing margin and profit, marketing efficiency, and farmer share.

1. Marketing Margin and Profit Analysis: For each channel, we calculated the marketing margin at each stage and for the channel as a whole. At the channel level, total marketing margin = (price paid by the final consumer) – (price received by the producer). This margin is then broken down among the intermediaries. For this purpose, we computed the producer's selling price, intermediary purchase price, and selling prices, margin per intermediary for each intermediary in the chain, and marketing costs for each actor. Marketing profit for each actor is the margin minus marketing costs. This represents the net income that the intermediary or producer earns from the marketing function (on a per-kg

basis). These calculations were done separately for lettuce and pakcoy, recognizing their different price levels.

2. Marketing Efficiency (EP) and Farmer's Share (FS): Using the cost and price data, we computed the Efficiency Percentage (EP) for each channel as:

$$EP = \frac{Total\ Marketing\ Cost\ per\ kg}{Consumer\ Price\ per\ kg} \times 100\%$$

Total Marketing Cost aggregates all costs incurred by all intermediaries (including the producer if they incur marketing costs) to deliver 1 kg of product to the consumer. We also computed the Farmer's Share (FS) for each channel:

$$FS = \frac{Price\ received\ by\ producer}{Consumer\ Price} \times 100\%$$

We evaluated these against the efficiency criteria discussed (EP < 50% for efficiency, corresponding to FS > 50%).

3. Comparative Analysis: Finally, we compared results between conventional and digital channels. This included examining differences in producers' reach (volume sold) and prices under each method, differences in cost structure, and outcomes in terms of margins, profits, EP, and FS.

RESULT AND DISCUSSION

Marketing Channels for Hydroponic Vegetables in Kendari

1. Identified Channels

The marketing of hydroponic lettuce and pakcoy in Kendari City proceeds through a small number of distinct channels. Figure 1 conceptually illustrates the structures, while Table 1 (conventional) and Table 2 (digital) provide the quantitative details of volumes and prices transacted through each channel. Under conventional marketing, two channels were observed, namely (1) Conventional Channel I (Producer → Consumer), and Conventional Channel II (Producer → Retailer → Consumer). Conventional Channel I is a direct-sales channel in which producers sell hydroponic vegetables directly to end consumers through farm-gate sales or at local farmers' markets. In Conventional Channel II, producers sell to a retailer who, in turn, sells to consumers. The retailer is the sole intermediary.

Under digital marketing, three channels were documented, namely Digital Channel I (Producer → Consumer), Digital Channel II (Producer → Collector → Consumer), and Digital Channel III (Producer → Collector → Retailer → Consumer). Digital Channel I is analogous to Channel I above but facilitated by digital media. For instance, a consumer places an order through WhatsApp or an Instagram page, and the producer arranges delivery. In Digital Channel II, a collector (aggregator) acts as an intermediary who purchases produce from the producer and then sells it directly to consumers (often via online means). Digital Channel III is the longest channel in which producers sell to a collector, who then supplies a retailer, who finally sells to consumers. Essentially, it adds

an extra link beyond Channel II, namely a retailer, between the collector and the end consumer.

2. Channel Participation and Volume Distribution

All 16 producers participated in both direct and intermediary-based sales to varying extents. Table 1 shows that in the conventional system, the majority of produce was sold directly to consumers. Over one month, the combined producers sold 948 kg of lettuce and 495 kg of pakcoy directly (Channel I), compared to 180 kg each of lettuce and pakcoy via retailers (Channel II). This indicates that traditional retailers handled a relatively small portion of hydroponic vegetables, likely because hydroponic produce in Kendari is a niche product often sold through pre-order or at farm stands. Conventional retailers may also be hesitant to carry large volumes of these premium-priced greens. The direct conventional sales occurred at average prices of Rp 40,000/kg for lettuce and Rp 25,000/kg for pakcoy, which reflect the premium quality and local availability of hydroponic produce.

In the digital marketing system (Table 2), overall volumes transacted were significantly higher, demonstrating how digital channels broadened the market. Producers were able to sell 2,280 kg of lettuce and 1,520 kg of pakcoy per month directly to consumers via digital orders (Channel I digital), roughly 2–3 times the volumes achieved in conventional direct sales. This substantial increase suggests that digital outreach enabled producers to tap into a larger customer base, potentially beyond their immediate neighbourhood. In addition to these direct online sales, the collector-mediated channels also moved considerable quantities. In Digital Channel II, collectors purchased 655 kg of lettuce and 280 kg of pakcoy from producers. Digital Channel III volumes were smaller, with collectors forwarding 20 kg of lettuce and 20 kg of pakcoy to retailers. The Channel III volume is relatively minor, indicating that the longest chain was the least utilized.

Table 1 and Table 2 detail the prices at each stage. Under conventional Channel II, producers sold to retailers at Rp 40,000/kg (lettuce) and Rp 25,000/kg (pakcoy), identical to the price they charge consumers directly. This implies producers did not give a wholesale discount to conventional retailers. Retailers then resold to consumers at Rp 45,000 and Rp 30,000 per kg, respectively, indicating a retailer margin of Rp 5,000/kg on both products. In digital channels, producers consistently charged Rp 40,000/kg for lettuce and Rp 25,000/kg for pakcoy regardless of whether the buyer was a consumer or a collector. This again signals that producers maintained their desired base price. Collectors in turn sold to consumers (Channel II) at Rp 45,000 and Rp 30,000 (mirroring the retailer prices in conventional channels). In Channel III, the retailer sold lettuce at Rp 55,000/kg and pakcoy at Rp 40,000/kg to consumers. This highest price reflects cumulative mark-ups by both collector and retailer. In percentage terms, the final consumer prices in Channel III were 37.5% higher for lettuce and 60% higher for pakcoy than the producer's price, whereas in the shorter Channel II, the increase was 12.5% and 20%, respectively. Thus, longer channels led to higher consumer prices, as expected.

Table 1. Conventional Marketing Channel Volumes, Purchase Prices, and Selling Prices for Hydroponic Vegetables in Kendari City (Per Month)

Actor	Lettuce		Pakcoy	
	Lettuce: Volume (kg)	**Lettuce: Price Received (Rp/kg)**	**Pakcoy: Volume (kg)**	**Pakcoy: Price Received (Rp/kg)**
Channel I – Producer (sells to consumer)	948 kg	40,000	495 kg	25,000
Channel II – Producer (sells to retailer)	180 kg	40,000	180 kg	25,000
→ Retailer (sells to consumer)	180 kg	45,000	180 kg	30,000

Source: Survey data (processed), 2025

Table 2. Digital Marketing Channel Volumes, Purchase Prices, and Selling Prices for Hydroponic Vegetables in Kendari City (Per Month).

Actor	Lettuce			Pakcoy		
	Volume (kg)	**Purchase Price (Rp/kg)**	**Selling Price (Rp/kg)**	**Volume (kg)**	**Purchase Price (Rp/kg)**	**Selling Price (Rp/kg)**
Channel I – Producer (sale to consumer)	2,280 kg	–	40,000	1,520 kg	–	25,000
Channel II – Producer (sells to collector)	655 kg	–	40,000	280 kg	–	25,000
→ Collector (sells to consumer)	655 kg	40,000	45,000	280 kg	25,000	30,000
Channel III – Producer (sells to collector)	20 kg	–	40,000	20 kg	–	25,000
→ Collector (sells to retailer)	20 kg	40,000	45,000	20 kg	25,000	30,000
→ Retailer (sells to consumer)	20 kg	45,000	55,000	20 kg	30,000	40,000

Source: Survey data (processed), 2025

From Tables 1 and 2, one can observe the consistency of producer prices across all channels. However, the intermediaries' margins differ by channel.

These price dynamics already suggest that the longer the channel, the higher the final price and the smaller the proportion returned to the farmer. Yet, all channels have a role. Direct channels allow farmers to capture the full price but require effort in marketing and delivering to many customers. Intermediary channels (especially digital ones) help aggregate demand and may reach customer segments that producers alone cannot (such as larger retail outlets or customers requiring home delivery and variety).

Marketing Costs, Margins, and Profits by Channel

The breakdown of marketing costs and profits for each actor in the supply chain provides information on how value is added and earnings are distributed. Table 3 shows these details for the conventional channels, and Table 4 for the digital channels. The cost components explicitly tracked in this study were packaging, labor, and (where applicable) transportation. Packaging costs include the materials (plastic bags, cartons, etc.) used per kg of produce. Labor costs represent the time spent by the producers or traders in marketing activities (selling, handling, delivering) valued at the local wage rate. Transportation costs were only significant in digital marketing, where producers or collectors delivered goods over distance. In conventional marketing within the city, producers and retailers typically did not report separate transport costs (selling was done at the farm or market with minimal travel).

Conventional Channels (Channel I and II)

In Conventional Channel I (Producer–Consumer), the producer performs the only marketing function, which involves preparing the produce for sale and interacting with customers. The producer's net marketing profit is Rp 39,309 per kg on lettuce and Rp 24,309 per kg on pakcoy. These figures can be interpreted as the return to the producer's production and marketing efforts per kg, after covering marketing expenses. Notably, the profit per kg is much higher for lettuce than pakcoy because of lettuce's higher price, even though the marketing cost is comparable. In Channel I, no other actors are taking a share, and thus the entire consumer payment goes to the producer. This channel clearly maximizes the farmer's revenue per unit sold, but the farmer also expends effort in retailing the product.

Table 3. Marketing Margin, Costs, and Profit Per Kg in Conventional Marketing Channels (Kendari City)
(All values in Rp per kg)

Channel & Actor	Selling Price (Rp/kg)	Buying Price (Rp/kg)	Marketing Margin (Rp/kg)	Packaging Cost (Rp/kg)	Labor Cost (Rp/kg)	Total Marketing Cost (Rp/kg)	Marketing Profit (Rp/kg)
Channel I – Producer	L: 40,000 P: 25,000	–	*Margin:* 0	L: 44.51 P: 44.04	L: 646.80 P: 646.80	L: 691.32 P: 690.84	L: 39,309 P: 24,309
Channel II – Produce	L: 40,000 P:	–	*Margin:* 0	L: 44.51 P: 44.04	L: 646.80 P:	L: 691.31 P: 690.84	L: 39,309 P: 24,309

r	25,000				646.80		
→ Retailer	L: 45,000 P: 30,000	L: 40,000 P: 25,000	L: 5,000 P: 5,000	L: 336.11 P: 333.33	1,736.00 1,736.00	L: 2,072.11 P: 2,069.33	L: 2,928 P: 2,931
Totals (Channel II)	L: 45,000 P: 30,000	L: 40,000 P: 25,000	L: 5,000 P: 5,000	–	–	L: 2,072 P: 2,069	L: 42,237 P: 27,240

Note: L = Lettuce, P = Pakcoy

Source: Survey data (processed), 2025

Conventional Channel II involves both producers and retailers. The producer's marketing activities are slightly reduced compared to Channel I because the producer only needs to market to a few retailers rather than many consumers. The producer's marketing profit in Channel II is the farmgate price minus those costs. The retailer then adds their margin. The retailer's marketing costs are higher on a per-kg basis than the producers', because retailers handle smaller quantities per outlet and have overhead costs associated with running a stall or shop. The retailer's profit comes to roughly Rp 2,928 per kg for lettuce and Rp 2,931 for pakcoy. This profit is an order of magnitude smaller than the producer's profit per kg.

As seen in Table 3, Conventional Channel I is extremely profitable for producers on a per-kg basis, with negligible marketing costs relative to the price. Channel II introduces a modest margin for the retailer, but the producer still secures the same high net return per kg by setting a high farmgate price. The total marketing margin in Channel II is Rp 5,000/kg, and the farmer's share is 89% for lettuce and 83% for pakcoy. This indicates that even with a retailer, the majority of the final price still goes to the producer. This is a sign of a producer-advantaged chain, likely due to the limited supply of hydroponic produce and strong direct consumer demand giving farmers pricing power.

Digital Channels (Channel I, II, III)

Table 4 displays the breakdown for each actor in the three digital channels. In Digital Channel I, the producer essentially takes on the role of a direct seller as in conventional Channel I, but with some differences in cost structure. The table shows that producers incur slightly higher packaging costs for digital sales, likely because of additional packaging needed for delivery. The labor cost per kg in digital sales appears lower than in conventional direct sales. This could be attributed to efficiency gains, because producers might spend less time per unit sold on marketing by consolidating orders via online means. It is also possible that because volumes sold are higher, the labor cost distributed per kg is lower. Additionally, a transportation cost averaging Rp 56 per kg was recorded for producers in digital Channel I, reflecting that many direct online sales involve delivering the product to the consumer. Summing these, the producer's total marketing cost in Channel I digital is around Rp 464 per kg. This is actually lower than the Rp 691 per kg in conventional direct sales. It might be that producers optimized delivery routes or handled larger orders at once online. The producer's net profit per kg in digital direct sales comes to

Rp 39,536 for lettuce and Rp 24,537 for pakcoy. These are almost the same as in conventional direct sales, indicating that the producers' profitability remained extremely high and even marginally improved via digital direct marketing. The improvement is due to a combination of high volume and a slight reduction in per-unit costs.

Digital Channel II introduces a collector intermediary. The producer's transaction here is selling to the collector, not to the final consumer. Yet, as the data showed, producers still charged their standard price (Rp 40k/25k) to the collector. The producer's cost structure for supplying a collector is similar to supplying a consumer. Indeed, Table 4 indicates the same total cost for producers in Channel II as in Channel I, and thus the producer's profit per kg is again Rp 39,536 (lettuce) and Rp 24,537 (pakcoy). This suggests that from the producer's perspective, selling to a collector or directly to a consumer yields the same immediate financial outcome per kg. The difference, however, is in scale and convenience. Dealing with a collector might involve larger bulk sales and fewer transactions, which can reduce marketing hassle even if profit per kg is the same. Further, the collector's profit in Channel II is Rp 2,328 per kg for lettuce and Rp 2,031 for pakcoy. These profits are smaller than the retailer's profit in conventional Channel II, indicating that the collector's higher cost structure ate into their margin more. Still, it's a positive profit, and presumably, collectors rely on volume and perhaps delivering multiple items to achieve business viability.

Digital Channel III is the longest chain. The producer and collector parts mirror Channel II. The collector in Channel III then sells to a retailer at 45k/30k (identical intermediate prices as Channel II's consumer prices). Thus, the collector's margin in this leg is Rp 5,000, the same as earlier. However, Table 4 shows identical cost figures for the collector under the Channel II and III columns. This likely assumes the collector's cost structure per kg did not change significantly for the small 20 kg batch. As a result, the collector's profit for Channel III is about Rp 2,323 (lettuce) and Rp 2,031 (pakcoy), roughly the same as in Channel II. Finally, the retailer in Channel III gains a margin of Rp 10,000 per kg.

Table 4. Marketing Margin, Costs, and Profit Per Kg in Digital Marketing Channels (Kendari City)
(Values in Rp per kg)

Channel & Actor	Selling Price (Rp/kg)	Buying Price (Rp/kg)	Margin (Rp/kg)	Packaging (Rp/kg)	Labor (Rp/kg)	Transport (Rp/kg)	Total Cost (Rp/kg)	Profit (Rp/kg)
Digital Channel I – Producer	L: 40,000 P: 25,000 (	–	–	L: 59.08 P: 57.66	L: 349 P: 349	L: 55.85 P: 55.85	L: 464 P: 463	L: 39,536 P: 24,537
Digital Channel II –	L: 40,000 P:	–	–	L: 59.08 P: 57.66	L: 349 P: 349	L: 55.85 P: 55.85	L: 463.97 P:	L: 39,536 P:

Producer	25,000						462.55	24,537
→ Collector	L: 45,000 P: 30,000	L: 40,000 P: 25,000	L: 5,000 P: 5,000	L: 381.68 P: 678.57	L: 1,955 P: 1,955	L: 335.20 P: 335.20	L: 2,672 P: 2,969	L: 2,328 P: 2,031
Digital Channel III – Producer	L: 40,000 P: 25,000	–	–	L: 59.08 P: 57.66	L: 349 P: 349	L: 55.85 P: 55.85	L: 464 P: 463	L:39,536 P:24,537
→ Collector	L: 45,000 P: 30,000	L: 40,000 P: 25,000	L: 5,000 P: 5,000	L: 381.68 P: 678.57	L: 1,955 P: 1,955	L: 335.20 P: 335.20	L: 2,672 P: 2,969	L: 2,323 P: 2,031
→ Retailer	L: 55,000 P: 40,000	L: 45,000 P: 30,000	L:10,000 P:10,000	L: 250 P: 250	L: 7,500 P: 7,500	L: 125 P: 125	L: 7,875 P: 7,875	L: 2,125 P: 2,125
Totals (Channel III)	L: 55,000 P: 40,000	L: 40,000 P: 25,000	L: 15,000 P: 15,000	–	–	–	L: 10,547 P: 10,844	L: 4,453 P: 4,156

Note: L = Lettuce; P = Pakcoy

Source: Survey data (processed), 2025.

From Table 4, we observe that digital direct sales (Channel I) are the most cost-effective for producers, slightly more so than conventional direct sales, likely due to better consolidation of orders. The presence of a collector in Channels II and III introduces additional costs but also performs valuable aggregation and distribution functions in the digital marketplace. The collector's profit per kg (Rp 2,000–2,300) is comparable to the profit of a conventional retailer (Rp 2,900) in absolute terms, but the collector in Channel II handled a much larger volume. The retailer in digital Channel III took the smallest profit per kg (Rp 2,125) but also dealt with a very small volume.

Marketing Efficiency and Farmer's Share

1. Efficiency of Conventional Channels

Using the total marketing cost and consumer price from Table 3, we compute EP for the two conventional channels. In Conventional Channel 1, EP is 1.7% for lettuce and 2.8% for pakcoy. These extremely low percentages reflect the minimal resources expended in marketing. Both values are far below the 50% efficiency threshold, indicating an efficient marketing channel. In fact, 1.7% and 2.8% are so low as to be negligible, implying that marketing adds almost no cost to the product's value in direct sales. This is not surprising, since the producer directly captures the value, and the only costs were minor packaging and time.

In Conventional Channel II, EP is 4.6% for lettuce and 6.9% for pakcoy. These percentages are slightly higher than in Channel I due to the retailer's involvement, but still well under 50%. By standard criteria, Channel II is also

efficient. The EP for pakcoy is higher than for lettuce primarily because the same absolute cost is a larger share of pakcoy's lower consumer price. Nonetheless, even 6.9% is a very low marketing cost ratio by any measure.

The efficiency results for conventional channels indicate that Kendari's hydroponic vegetable marketing in the traditional setup is highly efficient. Even the channel with an intermediary only spends at most 7% of consumer expenditure on marketing services, which is impressively low. For context, many agricultural supply chains for perishables have efficiency percentages in the range of 20–30%, or higher if the chain is long. Our results align with findings from other studies on high-value produce. For instance, Lubis et al. (2021) and Harahap et al. (2024) found conventional marketing channels for hydroponic greens in North Sumatra to have EP around 1–1.5%. The presence of a strong direct market in Kendari likely keeps overall costs down, in which producers are able to sell a lot without incurring transport or middleman expenses.

Correspondingly, the Farmer's Share (FS) in conventional channels is very high. In Channel I, since the producer sells directly, FS = 100%. In Channel II, the producer's share of the consumer price is 89% for lettuce, and 83% for pakcoy. These values confirm that farmers still capture the bulk of the consumer's dollar. The remaining 11% (lettuce) and 17% (pakcoy) of the price is what goes to the retailer.

From an efficiency standpoint, both conventional channels are excellent. Channel I is ideal from the farmer's perspective (FS 100%), but even Channel II gives FS > 80%, which is still considered efficient by the >50% rule. The slight drop in FS for pakcoy in Channel II (83%) compared to lettuce (89%) again reflects that marketing costs and margin take a bigger slice of the cheaper commodity's price. Pakcoy is less profitable to retail, so the farmer's proportion is a bit lower. However, even 83% is a very high farmer's share in general agribusiness terms.

2. Efficiency of Digital Channels

For the digital channels, we use the data from Table 4 and earlier calculations. In Digital Channel I, EP is 1.2% for lettuce and 1.9% for pakcoy. These figures are slightly lower than the conventional direct channel EP (1.7%, 2.8%), indicating that the use of digital tools did not add any burden. On the contrary, it made marketing even more efficient by reducing per-unit labor cost and enabling batch deliveries. This channel has the highest efficiency (lowest EP) among all studied, which is an important finding. It suggests that when producers can fully exploit digital marketing to connect with consumers, the marketing system operates at optimal efficiency. The farmer's share in Digital Channel I is of course 100%, identical to Conventional Channel I. So, in terms of FS and EP, digital direct selling is on par or better than traditional direct selling.

In Digital Channel II, EP is 5.9% for lettuce and 9.9% for pakcoy, so the channel is efficient. The farmer's share in Digital Channel II is 89% (lettuce) and 83% (pakcoy), identical to the conventional Channel II FS. This is an interesting result. Even though the intermediary in the digital channel is a collector delivering to the consumer, the division of the pie between the farmer and the

intermediary ended up the same. Essentially, the collector took the same Rp 5k margin that the retailer took in the conventional channel, so the farmer's share percentages are equal. This suggests that digital Channel II was as favourable to farmers as the conventional retail channel, with no loss in price share, even though the collector had to cover delivery costs in that margin.

In Digital Channel III, EP is 19.2% for lettuce and 27.1% for pakcoy. These are higher than all other channels, but they are still below 50%. By the general standard, this longest digital channel remains efficient (EP < 50%). However, relative to the other channels, it is the least efficient. The farmer's share in Digital Channel III is the lowest among all channels, namely 73% for FS lettuce and 63% for FS pakcoy. These are still above 50%, which aligns with efficiency. Yet, it illustrates that when two intermediaries are involved, the farmer's share drops considerably. This result is consistent with the general rule that the longer the channel, the smaller the portion of the consumer price accruing to the farmer. Septiadi and Nursan (2024) note that such a reduction in farmers' share is due to the complexity of the marketing chain, where each additional link adds cost.

In summary, all channels studied are efficient by the usual criteria. This indicates that hydroponic vegetable marketing in Kendari is generally cost-effective in delivering products to consumers. A combination of factors explains this outcome: (1) The high unit value of the product means even moderate absolute costs are a small percentage of value, (2) The relatively short geographic distance (within one city) and limited number of intermediaries constrain the accumulation of costs, and (3) Efficient practices by intermediaries.

Are digital marketing channels more efficient than conventional ones? The evidence shows that the most efficient channel overall is the direct producer-to-consumer channel, whether conventional or digital. Among those, the digital variant had a slight edge, likely because of volume and logistics benefits, but both are extremely efficient. The farmer's share is identical (100%). When an intermediary is involved, the conventional Channel II was somewhat more efficient than the analogous digital Channel II. However, the difference is not drastic, and both are in a similar low range. The farmer's share ended up the same in both (89/83%).

In practical terms, these results suggest that digital marketing did not inherently reduce efficiency. All digital channels remained efficient. The direct digital channel maintained maximum efficiency, and even the introduction of an online collector did not worsen the efficiency beyond what a normal offline retailer would have. The one digital scenario that showed a notable drop in performance was when both a collector and retailer were present, a scenario that might be avoidable or minimized in practice if producers can sell either directly or through a single intermediary. Indeed, in Kendari, the majority of volume went through Channels I and II, not III.

These findings corroborate similar research in other contexts. For example, Azhari et al. (2019) found that multiple channels for hydroponic lettuce were all efficient, with longer channels having somewhat lower farmer shares but still

meeting efficiency criteria. Our results go further by explicitly comparing the role of digital engagement. The fact that the digital channels did not erode the farmer's share significantly (farmers still got 83–89% in the main digital intermediary channel) is encouraging. It indicates that digital integration can be done in a way that farmers preserve their revenue, often because the digital intermediary, such as the collector here, might operate on lower margins, possibly relying on scale or complementary income.

3. Implications of Channel Differences

The above results show a clear pattern that the shortest marketing channel is the most advantageous for both efficiency and the farmer's income share. Introducing intermediaries incrementally increases costs and reduces farmers' share. However, in the Kendari hydroponic context, even the longer channels remained within efficient bounds. This suggests that the intermediaries involved were adding value at reasonable cost.

The digital marketing approach demonstrated an ability to handle much larger volumes directly (Channel I). This is a crucial advantage. It suggests that by using online marketing, producers tapped new demand that they could not serve via conventional means. Many urban consumers who might not visit local farm stands could be reached through social media and delivery. This expansion of market size is a benefit not captured by efficiency percentages alone. It was evident in the data: 2,280 kg of lettuce sold via digital direct vs 948 kg via conventional direct in the same time frame, a roughly 2.4-fold increase. Similarly, pakcoy was 3 times more. This indicates that digital marketing enabled hydroponic producers to significantly increase sales volume, which likely also improves overall profitability and utilization of their production capacity.

Another aspect is price realization. Producers maintained stable prices across channels, but did digital marketing put any downward pressure on prices or allow higher prices? In our case, the farmgate price remained the same regardless of channel. That implies the producers set a price based on their costs and target profit, and neither digital competition nor conventional negotiation changed it. Consumers buying direct paid that price; consumers buying via a collector paid more, but that markup was taken by intermediaries. It could be that hydroponic vegetables, being a specialty product, allowed farmers to have pricing power. This is not always true in traditional markets, where farmers often accept lower prices for wholesale bulk sales. In Kendari, apparently, the hydroponic farmers did not offer a wholesale discount even to collectors, likely because demand was high enough. This decision kept farmers' share high, but also could limit how much volume retailers or collectors might want to take. However, given that collectors did purchase significant amounts, it suggests the end consumers were willing to pay the premium. This reflects an urban niche market dynamic where consumers pay for perceived quality and convenience.

From a farmer's perspective, the clear recommendation is to maximize participation in the shortest channel feasible (direct to consumer), especially leveraging digital media. Our results concur with Iswahyudi & Sustiyana (2019) dan Pangemanan et al. (2023) and others that when farmers achieve a large

portion of the final price (high FS), the channel is most beneficial. The data showed that by using WhatsApp, Facebook, or similar, farmers in Kendari can directly reach many customers and fulfill orders efficiently. For the intermediaries, the study highlights that there is still room for them, but they must operate efficiently. The collector role in the digital context is akin to a logistics provider and online marketer combined, and the collector's moderate profits indicate a competitive role. They cannot simply gouge prices because producers could alternatively sell directly. This competitive tension is healthy for efficiency. These findings support the strategic emphasis on digital marketing for agribusiness. They echo conclusions by Indana & Beni (2021) that while traditional direct selling is good, leveraging online channels can further maximize sales without sacrificing efficiency. The present study adds quantitative evidence to the argument that digital platforms can complement conventional marketing, leading to greater overall throughput and maintaining high efficiency.

CONCLUSIONS AND RECOMMENDATIONS

This study analyzed the marketing patterns of hydroponic vegetables in Kendari City, comparing conventional and digital channels in terms of structure and efficiency. Two conventional channels (direct and via retailer) and three digital channels (direct online, online collector, and online collector plus retailer) were identified for lettuce and pakcoy distribution. The results demonstrate that digital marketing channels enabled hydroponic producers to significantly broaden their market reach and sales volume without compromising marketing efficiency. All channels in both systems were found to be economically efficient, with marketing cost ratios far below 50% and farmers' share well above 50% in every case. The most efficient channel in both regimes is the direct sale from producer to consumer (especially when facilitated by digital media), which has negligible marketing costs and gives farmers 100% of the consumer price. The longest channel observed, involving both a collector and a retailer in the digital system, had the lowest efficiency and farmer's share, highlighting the cumulative cost of multiple intermediaries. However, even this channel met the standard efficiency criteria, underlining that the marketing system for hydroponic produce in Kendari is generally effective.

Comparing conventional vs digital directly, we conclude that digital marketing is at least as efficient as conventional marketing for hydroponic vegetables, and in some aspects, more so. Digital platforms allowed producers to move more product directly, leveraging economies of scale in delivery and order aggregation, which slightly lowered per-unit marketing costs in direct channels. Meanwhile, digital intermediaries operated with similar margin structures to conventional intermediaries, resulting in comparable farmers' share outcomes. Thus, the adoption of digital marketing did not dilute farmers' price share. On the contrary, it provided an avenue for farmers to access more customers while maintaining favorable returns. These findings align with recent agribusiness research emphasizing the role of digitalization in improving supply chain efficiency and producer incomes.

In practical terms, hydroponic vegetable farmers in Kendari and similar urban areas are encouraged to maximize direct-to-consumer sales via digital media, as this channel yields the highest marketing efficiency and income share for producers. Building a strong online presence through social media, e-commerce listings, and digital communities can help farmers secure orders without relying on traditional middlemen. At the same time, strategic partnerships with efficient intermediaries can complement direct sales by reaching segments of the market that prefer one-stop or institutional purchasing.

The study findings indicate that digital marketing channels offer a highly efficient and effective route for urban farmers to market premium horticultural produce, complementing conventional channels and driving growth in the urban agribusiness sector. As hydroponic farming continues to expand, maintaining such high efficiency will be crucial for its sustainability and competitiveness. Policymakers and agricultural extension services can facilitate this by providing training in digital marketing for farmers, improving digital infrastructure, and fostering networks that connect producers to consumers. Future research could build on these findings by examining consumer perspectives on digital vs traditional purchase of hydroponic produce, as well as analyzing the long-term profitability for farmers considering production costs alongside marketing efficiency.

FURTHER STUDY

This research still has limitations, so further research on this topic is still needed.

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