

# Exploring the value chain of organic pineapple of Assam, India

Naba Kumar Das, Arup Roy and Saurabh Kumar Srivastava  
Department of Business Administration, Tezpur University, Tezpur, India

## Abstract

**Purpose** – The global organic market is expanding, and India is in an advantageous position with the highest number of organic producers worldwide. Although many articles have been published on the value chain of organic products from India, no significant studies were found related to the value chain analysis of organic pineapple. This study aims to know the various aspects of the organic pineapple value chain, i.e. network structure, value addition at various stages of chain actors, value chain upgradation and governance structure.

**Design/methodology/approach** – The study is explorative in nature, and primary data from various actors involved in the chain is collected and analyzed. Primary data through a structured schedule and interviews are collected from farmers and traders. A multistage sampling plan has been adopted. A sample of 75 farmers was randomly selected from the study area. For traders, snowball sampling is used due to the nonavailability of the sampling frame. A total of 10 commission agents, 10 wholesalers and 20 retailers were thus selected for the study. For objectives 1 and 4, descriptive statistics are used. For objective 2, a modified formula described by (Murthy *et al.*, 2007) is used to calculate farmer's net price and marketing margin. For objective 3, Garrett's ranking technique is used to identify various constraints in upgrading the organic pineapple value chain in Assam.

**Findings** – This study shows that the value chain of organic pineapple is in the initial stage and proper value addition is required to have a complete regulated value chain. Six marketing channel is identified, and products are sold through farmer producer company only in case of export and trade with distant buyers. The marketing efficiency for channels II and III is 1.69 and 0.99, respectively. The degree of value addition for channel II in the hands of the commission agent, wholesaler and retailer is 11.65%, 4.56% and 12.60%, respectively. In the various constraints in upgrading the value chain, farmers rank "policy support" as a major constraint. In the governance structure, trade with distant traders and exports is done formally and through written contracts.

**Research limitations/implications** – The study performs value chain analysis of organic pineapple in Cachar district of Assam, India for the year January 2022–January 2023. Future studies are encouraged related to various aspects of the supply chain and value chain of organic pineapple from various northeastern states of India and other states.

**Practical implications** – The study will help policymakers and key actors to know the existing chain and frame a well-coordinated and regulated value chain.

**Originality/value** – This study is one of the first study to explore the value chain of organic pineapple of Cachar district of Assam, India. Implementation of these findings can help various actors to strengthen the existing value chain.

**Keywords** Organic pineapple, Value chain analysis, Network structure, Value addition, Value chain upgradation, Governance structure

**Paper type** Research paper

## 1. Introduction

The global organic food and beverage market is expanding with growing awareness about the health benefits associated with organic product consumption. The global organic food and beverage market was valued at US\$188.35bn in 2021 and is expected to grow at a compound annual growth rate of 13.00% for the period 2022–2030 (*Organic Food And Beverages Market Report, 2022–2030, 2021*). The global organic food market is about €106.4bn, with the USA being the largest share with €44.7bn followed by Germany and France with 12.00 and €11.30bn for the year 2019. India is in an advantageous position as the world's highest organic producer, with around

13.66 lakhs (Willer *et al.*, 2021). During the year 2020–2021, India produced around 3.496 million metric tonnes of certified organic products, including a variety of processed and non-processed foods. The total export volume during the year 2020–2021 was 8.88 million metric tonnes, with total revenue of US\$1,040.95m. The major export destination for Indian organic products is the USA, European Union, Canada, Great Britain, Korean Republic, Israel, Switzerland, Australia, etc. (*Organic Products, 2021*).

Pineapple (*Ananas comosus*) is an important commercial fruit with immense health benefits. India ranks sixth in pineapple production globally with 1,799 metric tonnes succeeded by the Philippines, Costa Rica, Brazil, Indonesia and China (Shahbandeh, 2022). In India, West Bengal ranks first in terms of pineapple production with a share of 20.20%, followed

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by Assam with a share of 17.38%. Northeast India shares about 52.00% of the total pineapple production in the country (Horticulture Statistics Division, 2018). As the global organic food market is expanding, there is a spurt of demand for fresh organic and processed pineapple products in the domestic and global markets. Northeast India with fertile land is known for its organic farming technique. Organic pineapples are cultivated widely in Assam, Nagaland, Tripura, Manipur and Meghalaya. Moreover, pineapples produced in these states are rich in quality and are said to be among the “Best in the world as they are very sweet (high total dissolved solids) and have less fiber” (Sema *et al.*, 2011). Considering its demand, Agricultural and Processed Food Products Export Development Authority (APEDA), in association with various farmer producer companies (FPCs), is exporting pineapple from these states to various countries. Tripura was the first north-eastern state to export its “queen variety” of pineapple to Dubai and Doha in 2018, followed by Assam in 2019, where pineapple is being exported to Dubai (Kalita, 2022). Mostly the organic pineapple from these states is being exported in fresh form without any major value addition. The value-added products from pineapple, like canned pineapple, pineapple pulp, pineapple juice, frozen pineapple concentrate, etc., have a huge opportunity to capture the market. To develop a complete value chain for various organic products in north-eastern states, a Central Sector Scheme entitled “Mission Organic Value Chain Development for the North-eastern Region” (MOVCD-NER) was implemented in the year 2015–2016. The scheme aims at the production of certified organic crops and the development of necessary infrastructure for value chain development. As a part of the same, the Lakhimpur area of Cachar district, Assam, is selected for organic pineapple cultivation with a land size of over 500 hectares (Mission Organic Value Chain Development in Assam (MOVCD) | Department of Agriculture and Horticulture | Government of Assam, India, 2022).

This study aims to perform a value chain analysis of organic pineapple in Assam. The study will be beneficial to various stakeholders and policymakers in the organic food industry to know the present condition of the organic pineapple value chain and will encourage further research and action plans to strengthen the same.

## 2. Review of literature

Many articles are published covering various aspects of the value chain like value chain mapping, analysis of margin, chain upgradation and governance structure. Value chain mapping covers the entire range of activities from input to output among various chain actors and particularly covers the flow of products, services and information (M4P 2008, 2023). The horizontal and vertical linkage, support services and flow of information on organic products in East-West Economic Corridors provide a cost-efficient transportation linkage (Lord and Tangtrongjita, 2012). The study by Ríos Guayasamín *et al.* (2016) discusses the flow of organic products in various municipalities of Rio de Janeiro in Brazil and identifies three primary value chain that reaches consumers. In the study by O'Donoghue *et al.* (2018) in Ireland identifies the leakage in the marketing chain of the organic beef sector and focuses on framing new policies and

schemes to prevent the same. With a strong and efficient value chain, producers give special attention to exploring the global organic market as per standards set by various countries. Producers having United States Department of Agriculture or European Union organic certification and accreditation are in an advantageous position to enter the global trade, as these are widely accepted. In the context of global standard and certification, studies by Arora *et al.* (2013), Bernzen (2013); Bernzen and Braun (2014), Lyons (2019); Mook and Overdevest (2021), Mutersbaugh (2005) focus on standards and certification of organic products in global trade. The adoption behavior of organically certified products and green foods among consumers is discussed in studies by Bhaskaran *et al.* (2006) and McCarthy *et al.* (2016).

The majority of studies published in the field of economic analysis revealed that the profitability rate of organic farming is higher than that of conventional farming due to the price premium. However, the rate of profitability may vary between products. In various research studies, it was found that organic farming is profitable to farmers as proper value addition to the products helps the farmers to earn more income. Atreya and Kafle (2016) researched the cost and margin of organic apples in Jhumla, Nepal, and the price spread was discussed. There is a significant difference between farm gate and consumer prices, and it was discovered that organic apple producers receive only 16.77% of the price paid by the end consumer. For large landholders, organic farming is emerging as the best choice which gives more production, and the study (Naik and Nagadevara, 2010) finds that clustered production enables better quality control and reduction in average cost. In most of the study, it is found that organic farming is a sustainable farming practice as yield and net profit are higher in comparison with conventional farming, and proper technical guidance, quality of bio inputs at an affordable price and forward linkage will increase agricultural productivity and improve farmer's livelihood (Reddy and Mundinamani, 2013; Poyyamoli and Padmavathy, 2011). However, it was found that the yield in organic crop production is low as compared to conventional farming; however, the cost per hectare selling price was greater (Urfi *et al.*, 2013).

One of the important aspects of the value chain development is upgradation and innovation in the chain. Upgrading refers to “the acquisition of technological capabilities and market linkages that enable firms to improve their competitiveness and move into higher-value activities” (Kaplinsky and Morris, 2001). Studies by Hernandez-Aguilera *et al.* (2018) and McCarthy *et al.* (2016) discuss innovation as a way to strengthen the organic food industry and strategy followed by smallholders to upgrade the value chain. In chain upgradation, vertical integration among various stakeholders is of utmost importance for upgrading and increasing chain efficiency (Baker and Russell, 2017; Prasertwattanukul and Ongkunaruk, 2018). The governance structure of the value chain covers various aspects like relationships, trust, rules and regulations that exist in the chain. A strong governance structure is of utmost importance to have an efficient and regulated organic value chain. Studies by Guptill (2009) and Ha *et al.* (2012) discuss the relationship, linkage and power relation among various chain actors. For equal distribution of power, gender equity in the organic food value chain enables women to access network benefits and to have greater control over firm practices

(Bullock *et al.*, 2018; Lyon *et al.*, 2010). The pricing policies in the chain and price spread among various actors in many organic value chains in different countries are uneven and discussed in the studies by Arfini and Bellassen (2019), Sanders *et al.* (2017) and Yan *et al.* (2017).

Many studies have been performed relating value chain of the organic fruits and vegetables segment. In the organic fruit-specific studies, the study by Ouma *et al.* (2013) discusses the export of organic mangos from Ghana. The study (Das and Roy, 2021) discusses the value chain of organic pumpkin in India, and the study by Atreya and Kafle (2016) focuses on various aspects of the value chain of the organic apple of Jumla. Marketing channels, value addition and margin of organic bananas are discussed in the studies by Garming *et al.* (2011), Kilian *et al.* (2005) and Vagneron and Roquigny (2011). The study by Mook and Overdeest (2021) and Milić *et al.* (2018) discusses the marketing chain of organic citrus and organic raspberry. The vegetable segment studies by Arfini and Bellassen (2019), Deleuran (2011); Groot Kormelinck *et al.* (2019), Kini *et al.* (2020); Lord and Tangtrongjita (2012) and Wang (2012) cover the various aspects of value addition and value chain of organic vegetables. The study by Mbapila *et al.* (2019) discusses the production and transaction costs of the value chain of organic tomato and sweet pepper.

### 2.1 Research gap

Despite the huge demand for value-added products of organic pineapple, a meagre amount of literature is published on the value chain of organic pineapple. To know the quantum of articles published in the organic pineapple value chain, an overall search was made in the advanced search option of Google Scholar. Only three articles with a keyword search of “Value chain” OR “Value chain Development” and “Organic pineapple” are found in Google Scholar. Out of these, one article was published in Nagaland, India, and the other two were published in Uganda. The study by Ao *et al.* (2018) discusses the value chain in the marketing of organic pineapple in Nagaland. Products are categorized into four categories according to the harvesting stage which is H1 (fully matured but no color development), H2 (1/8th color development), H3 (1/4th color development) and H4 (1/2 color development). Similar to these, packaging containers are categorized as P1 (wooden boxes), P2 (bamboo boxes), P3 [Corrugated fiberboard (CFB) boxes] and P4 (used cartoon boxes). It was found that H4 categories had the best physiochemical qualities and P3 (CFB boxes) had higher fiber contents, shelf life, sweetness and lower postharvest. The best combination in terms of benefit–cost ratio is H1P4. The study by Kalibwani *et al.* (2018) discusses the multistakeholder partnership in the value chain of organic pineapple in Western Uganda. Special emphasis is given to a careful selection of partnerships, as they are integral to the value chain. Partners should be involved in upgrading farmers’ knowledge, skills and technologies, improving margins for farmers and improving the overall efficiency of the chain. The study by Kwikiriza *et al.* (2016) discusses the value chain of organic pineapple in Uganda using the Global Value Chain Analysis framework. Due to the poor processing capacity of exporters, competition from conventional buyers and few local organic consumers, only 45% of the organic pineapple produced by the farmers reaches

consumers. To improve the same, increased use of soil amendments, strengthening horizontal coordination among exporters, favorable investment environment and legislations are suggested to improve the global value chain.

Apart from the study by Paul *et al.* (2017) which discusses the economic efficiency and cost benefits of organic pineapple in Northeast India, no significant studies were found related to the value chain analysis of the same. To fill the gap, the present study aims to perform a value chain analysis of organic pineapple in India’s Northeast. Organic pineapple is cultivated on more than 500 hectares of land under MOVCD, and for the year 2021, approximately 2.50 crores of organic pineapple is produced from Cachar district, Assam, India.

### 2.2 Objectives of the study

- To identify the network structure of the value chain of organic pineapple;
- To find the value addition at each phase by all chain actors;
- To identify and examine various constraints tied to upgrading the value chain of organic pineapple; and
- To analyze the governance and institutional features of the value chain of organic pineapple.

## 3. Research methodology

The purpose of this study is to analyze the value chain of organic pineapple in the Cachar district of Assam, India. The study is explorative in nature, and primary data from various actors involved in the chain is collected and analyzed. Depending on the situation and goal, various authors and institutions have developed guidelines for value chain analysis. The study by Donovan *et al.* (2015) compared and reviewed 11 guides (International Potato Center (CIP), 2006, Food and Agriculture Organization 2007, International Center for Tropical Agriculture (CIAT) 2007, Department for International Development (DFID) 2008, International Institute for Environment and Development (IIED) 2008, M4P 2008, Deutsche Gesellschaft für Technische Zusammenarbeit 2008, International Labour Organization 2009, United Nations Industrial Development Organization 2011, World Bank 2011, United States Agency for International Development) for value chain analysis and development based on various parameters. Each guideline has a specific objective, context and outcome. For instance, some guides (CIP, 2006, CIAT 2007 and IIED 2008) are particularly suited to developing value chains that link smallholders to local markets, while others (World Bank, 2011) are particularly suited to developing linkages to export markets. As the organic agricultural sector in Assam is in its infancy, it is difficult to use a specific value chain guideline for this study. The present study follows a mixed approach from DFID, IIED and M4P value chain guidelines as the same considers and improves the smallholder’s and other actors’ participation in the agricultural value chain. Further, the guides identify ways to improve smallholder chain involvement by changing the political, legal and business climate and connecting smallholders to promising markets (Donovan *et al.*, 2015). The description and analysis of the value chain of the present study are only limited to the organic pineapple chain in the Cachar District of Assam, India, and do not attempt to compare organic and inorganic value chain. Variables considered for the present study are shown below:



- O1. Product flow, service flow and information flow.
- O2. Farmer's gross and net income, marketing margin, marketing efficiency and price spread.
- O3. Product upgradation, process upgradation and functional upgradation.
- O4. Nature of contract and trust.

### 3.1 Study area and research context

Cachar district of Assam is located at 25° 05'N 92° 55'E, and organic pineapple is cultivated particularly in the Lakhimpur subdivision covering more than 1,500 hectares of land (Time8, 2021). The history of pineapple cultivation in this area can be traced back to 1932, when James Robert, a Welsh Baptist Pastor, bought saplings from Tripura. The sugar content of the pineapple in the Lakhimpur subdivision is between 16 and 18%, which is highest in Northeast India (Ghosh, 2012). To strengthen the value chain of organic crops in the Northeastern region of India, a central sector scheme, MOVCD, was passed in the year 2015–2016. As part of the scheme, the 500 hectares of land where organic pineapple is cultivated in the Cachar district are selected to build a complete value chain to explore the domestic and global pineapple markets. Under the MOVCD scheme, a FPC named "Hmar Agro Organic Producer Company Ltd" was established in the year 2017 for the benefit of cultivators and to develop a complete organic value chain with proper market linkage (Hmar Agro Organic Producer Company Limited, 2023). Kew variety of pineapple is being produced and categorized into three groups, i.e. big size (above 14 inches diameter), medium size (14 inches–10 inches diameter) and small size (below 10 inches diameter) (Pineapple Supplier in India - buy pineapple, 2023). Although the Cachar district is known for its organic pineapple, growers primarily sell the products in fresh form at local markets. The authors were interested in examining the organic pineapple value chain by identifying various existing channels, calculating the marketing margin, studying the governance structure and pinning down various constraints in the chain.

The authors were interested in investigating the value chain of organic pineapple by identifying various existing channels, computing the marketing margin of each channel, analyzing the governance structure and identifying various constraints in the chain.

### 3.2 Data collection

Both primary and secondary data are used. Primary data through structured schedules and interviews is collected from farmers and traders. Two separate schedules are used for farmers and traders to collect the necessary information. The schedule consists of dichotomous, multiple-choice and scaling and ranking questions. The ranking method is used to identify and rank various constraints faced by various stakeholders in the chain. The schedule comprises five parts, which include demographic profile, mapping of the value chain, value addition at various stages of the chain, value chain up-gradation and governance structure. For the convenience of the author and the respondents, the schedule was converted into the local language (Assamese), and data were collected. Secondary

information was collected from various sources, including journal articles, websites and newspapers.

### 3.3 Sampling plan

For sampling allocation, a multistage sampling plan has been adopted for adequate representation of samples from each farmer interest group (FIG). A sample of 75 farmers was selected from various farmer's interest groups in the study area. At first, a list of organic pineapple growers was obtained from the Hmar Agro Organic Producer Limited. A sample of three organic farmers has been randomly selected from each farmers interest group (from 25 FIGs) for the study. For traders, snowball sampling is used due to the nonavailability of the sampling frame. A total of 10 commission agents, 10 wholesalers and 20 retailers were thus selected for the study.

### 3.4 Sampling unit

Certified organic farmers are considered as sampling elements for farmers. Commission agents, wholesalers and retailers who are part of the chain to trade finished products from the organic farmers are considered as sampling elements for "commission agents," "wholesalers" and "retailers."

### 3.5 Data analysis

The primary data obtained from the survey was tabulated and sorted into different categories. Descriptive statistics is performed to know the various aspects of the chain, i.e. network structure, chain upgradation and governance structure. For objective two, the cost of cultivation of organic farmers is computed by using the ABC cost measures according to the Manual on Cost of Cultivation Survey, Ministry of Statistics and Programme Implementation, Government of India (Ministry of Statistics and Programme Implementation, 2008).

#### 3.5.1 Estimation of farmer's net price, marketing margin and marketing efficiency (objective 2)

A modified formula described by Murthy *et al.* (2007) is used to calculate Farmer's Net Price and Marketing Margin. The value of postharvest losses is also included in the margin calculation at various stages of marketing.

**3.5.1.1 Farmer's net price.** The farmers' net price was calculated as the difference between the gross price received and the total marketing costs incurred, including postharvest losses at various stages of handling the produce. The farmer's net price is expressed mathematically as follows:

$$NP_F = GP_F - \{C_F + L_F \times GP_F\} \quad (1)$$

where:

$NP_F$  = Net price received by the farmers (Rs/Quintal or per piece);

$GP_F$  = The gross price received by farmers or the wholesale price received by the farmer;

$C_F$  = The cost incurred by the farmers during marketing (Rs/quintal or per piece); and

$L_F$  = The physical loss in produce from harvest till it reaches the market (quintal or per piece).

**3.5.1.2 Marketing margin.** The profits and returns that market intermediaries receive for storage, capital interest and establishment after adjusting the marketing losses due to

handling are included in their margins. The general expression for estimating the margin of the intermediaries is given below:

Intermediaries margin: Gross price (sale price) – purchase price (cost price) – cost of marketing – loss in value during trade.

The formula for the wholesaler's net marketing margin is as follows:

$$MM_{W/C/R} = GP_{W/C/R} - GP_{F/W/C/R} - C_{W/C/R} - (L_{W/C/R} \times GP_{W/C/R}) \quad (2)$$

where:

$MM_{W/C/R}$  = Net Margin of the wholesaler/commission agent/retailer (Rs/per pineapple);

$GP_{W/C/R}$  = Wholesalers selling price or purchase price of the retailers/commission agents;

$C_{W/C/R}$  = Cost incurred by wholesalers/commission agent/retailer during marketing;

$L_{W/C/R}$  = Physical loss of the products at the wholesale/commission agent/retail level; and

$GP_{F/W/C/R}$  = Gross price received by farmers, wholesalers, commission agents and retailers.

**3.5.1.3 Marketing efficiency.** The marketing efficiency in the study is calculated by using Acharya's modified marketing efficiency index (MMEI) as follows (Acharya and Agarwal, 2001):

$$MMEI = FP / (MC + MM)$$

where FP = price received by the farmer; MC = marketing cost; MM = marketing margin.

**3.5.1.4 For objective 3.** Garrett's ranking technique was used to identify various constraints in upgrading the organic pineapple value chain in Assam. Respondents were asked to rank several factors (in order of severity), and the ranks were converted into scores using Garrett's table:

$$\text{Percent position} = \frac{100 - (R_{ij} - 0.50)}{N_j}$$

where:

$R_{ij}$  = Rank given for  $i^{\text{th}}$  item by  $j^{\text{th}}$  individual.

$N_j$  = Number of items ranked by  $j^{\text{th}}$  individual.

Using Garrett's Table, the estimated percent position is converted into scores using the table provided by (Garrett and Woodworth, 1969). The factor with the highest Garret mean score is ranked as most important, and the factor with the lowest Garret mean score is ranked as least important.

## 4. Findings

The findings of the paper are synthesized in four heads, comprising socioeconomic information of the farmers, mapping of the value chain, value addition at each phase, constraints in value chain up-gradation and governance structure.

### 4.1 Demographic profile of the organic farmers and pineapple production

In the demographic profile of the respondents, it was found that the majority, i.e. 82.70% of the farmers are male, and around 38.70% of the farmers have educational qualifications up to secondary level. Every farmer engaging in organic pineapple cultivation received training from various sources like agricultural extension officers, non-governmental organization (NGOs), FPCs, Farmers Association and KVKs (Krishi Vikash Kendra

under Assam Agricultural University). In the landholding pattern, 92% of the farmers inherited their land from their ancestors, and 49.33% of the farmers bought land to cultivate organic pineapple. The average years of involvement in organic farming is found to be 7.04 years, and the average distance from the market is 7.21 km.

#### 4.1.1 Source of vermicompost

All the farmers have a small vermicompost plant supported by Govt. scheme.

Only 41% of the farmers buy organic manure from open market, and only 5% buy it from other farmers.

#### 4.1.2 Organic pineapple production and grades

The flowering season of the organic pineapple starts in the months of January and February. The harvesting and selling start in the mid-June and continue until August. Moreover, off-season flowering for some pineapple plants started in the month of September, and products are mostly sold in the local market due to low production and demand. Organic pineapples are mostly sold in fresh form without any value addition. Farmers segregated the pineapple into three grades, i.e. A (14 inches and more), B (10–14 inches) and C (less than 10 inches), and the price is set accordingly. From the survey, it was found that farmers fetch the highest price (Rs. 28.4) for A-grade organic pineapple in the month of June, and the price decreases over the month as supplies flow in the market. The average price decreases when the same is sold to commission agents and wholesalers. The details of the price of A, B and C grade pineapple received by farmers from direct sales, sales through commission agents, and wholesalers are shown in Table 1.

Most of the farmers enter into contract agreements with wholesalers during flowering time on some financial terms and thus cannot avail the benefit of market price during harvesting. Farmers sell pineapple mostly in three ways i.e. direct sales, sales through commission agents and direct sales to wholesalers. The majority of the pineapples are sold to wholesalers on contract agreements. The details of sales value with the contribution in total sales with all grades in the month are shown in Table 2.

## 4.2 Mapping of the value chain of organic pineapple (product, service and information)

### 4.2.1 Marketing channel

From the survey, six marketing channels are identified for organic pineapple in the Cachar district of Assam. Products are labeled under the FPC name "Hmar Agro Organic Producer Limited" and are mostly sold to wholesalers and directly by farmers in the street or local market. Only in the case of exports and supplies to distant traders, trades are executed through FPC, and the channel is fully organic. Organic pineapples are sold as raw materials to the local food processing industry, and the resulting processed products are sold without any organic certification logo. The details of the six marketing channels are shown in Figure 1. Channels (ii), (iii) and (vi) are partly organic, whereas channels (i), (iv) and (v) are organic.

### 4.2.2 Product flow

In the month of June, around 67% of the products were sold to wholesalers, followed by 19.20% to commission agents, and around 13% as direct sales to consumers. The details of product flow for the months of June, July and August are shown

**Table 1** Price spread of organic pineapple (grade and month wise) among various actors (approx. figure)

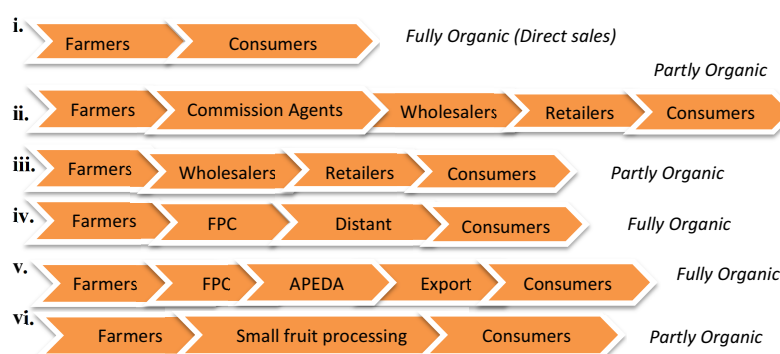
Actors	June (Rs. per piece)			July (Rs. per piece)			August (Rs. per piece)		
	A	B	C	A	B	C	A	B	C
Farmers to consumer (direct retail sale)	28.4	25.4	22.5	24.92	22.53	20.15	18.25	16.12	13
Farmers to commission agents	23.81	20	17.62	21.71	19.28	17.14	14.71	12.57	10.71
Farmers to wholesalers (contract agreement)	20.36	17.85	15.67	16.41	14.08	11.65	12.06	9.65	7.25
Farmer to FPC (based on demand from the distant trader and export supplies)									
Karnataka: Rs. 20 per kg									
Dubai: Rs. 23 per kg									

Source: Authors' own work

**Table 2** The volume of organic pineapple sold to various stakeholders (grade and month-wise) with contribution in total sales (approx. figure)

Months/grade	Farmers to consumer (direct retail sale)		Farmers to commission agents		Farmers to wholesalers (contract agreement)	
	Sales (In no.)	Contribution in total sales (%)	Sales (In no.)	Contribution in total sales (%)	Sales (In no.)	Contribution in total sales (%)
<b>June</b>						
A	53,968	14.50	63,096	16.95	255,050	68.54
B	29,200	14.21	39,500	19.23	136,650	66.54
C	18,056	12.52	30,900	21.42	95,240	66.04
<b>July</b>						
A	80,520	14.46	50,000	8.98	426,132	76.55
B	52,900	17.41	29,000	9.54	221,945	73.04
C	40,580	19.46	20,000	9.59	147,875	70.93
<b>August</b>						
A	29,996	8.65	35,000	10.10	281,426	81.23
B	15,200	7.50	22,000	10.86	165,280	81.52
C	14,960	9.79	18,800	12.31	118,906	77.88

Source: Authors' own work

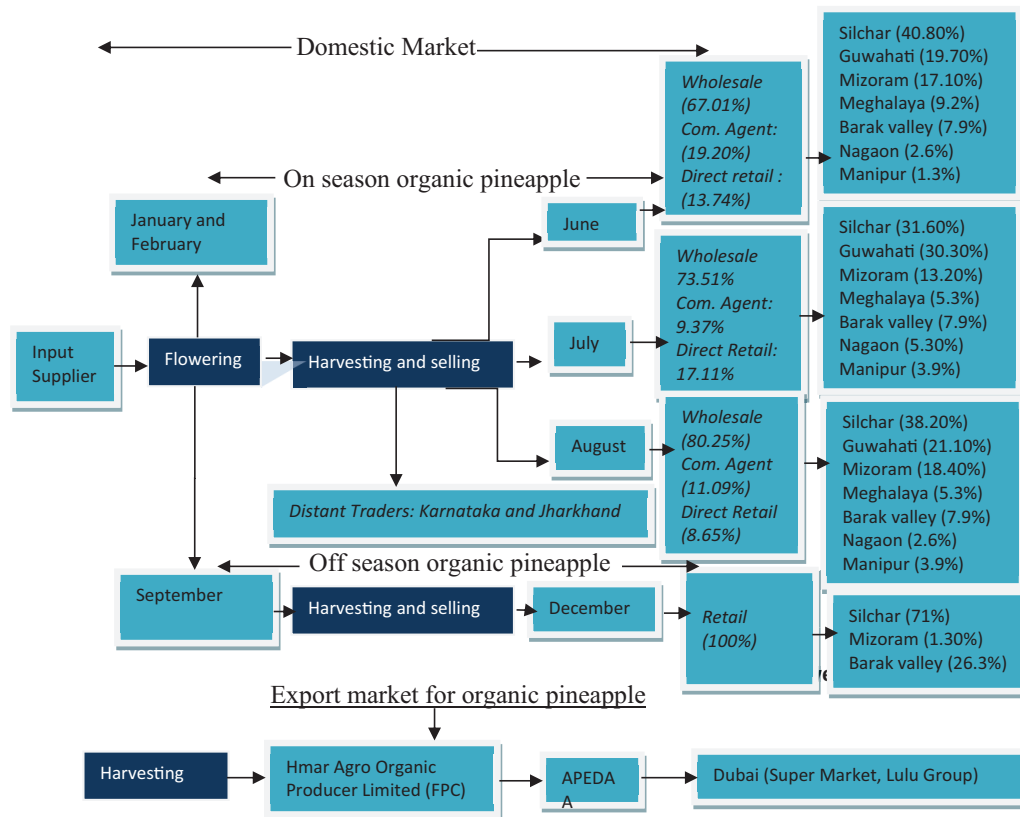
**Figure 1** Marketing channels of organic pineapple in Assam

Source: Author's own work

in Figure 2. In the domestic market, products are sold mostly in Silchar, Guwahati and other North-eastern states. For special orders from distant states, organic pineapple with proper refrigerated containers is parceled to various parties by FPC. For the export market, organic pineapples are sent to Dubai (Lulu groups) for the year 2022 in collaboration with FPC and APEDA. The details of the product flow are shown in Figure 2.

Off-season pineapples are sold mostly in retail and local markets at low prices as compared to the on-season organic pineapple. Trades with distant traders and export are dealt with by FPC, and only around 10,000 pieces of organic pineapple are sold to distant trader (Bangalore), and 2,000 pieces are exported to Dubai in compliance with organic standards through APEDA and FPC.

Figure 2 Product flow of organic pineapple



Source: Author's own work

#### 4.2.3 Price spread inflow of organic pineapple

As discussed in Tables 1 and 2, farmers got a premium price in the early harvest of the pineapple, and the selling price is high on direct sales as compared to when trades are executed through commission agents and wholesalers. However, farmers are fetching handsome prices for fresh pineapple in the regional market and are not very inclined to go for the B2B market. Wholesalers and retailers sell the product and receive good returns due to word-of-mouth promotion of "Lakhipur organic Pineapple." The details of the price spread from producers to the consumer through various channels are shown in Figure 3.

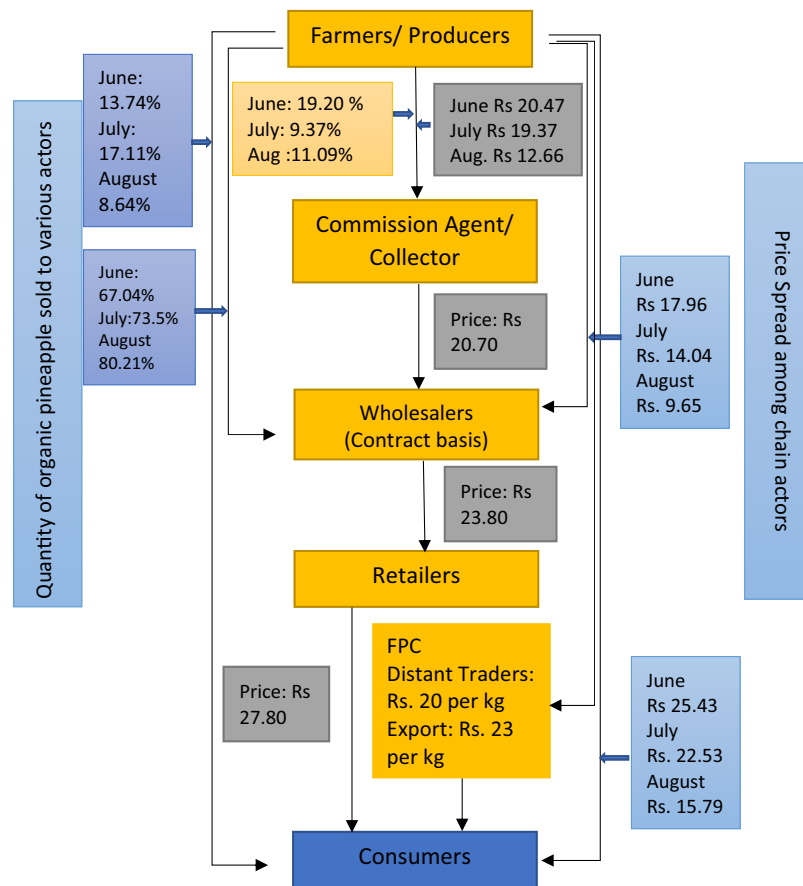
As shown in Figure 3, it was found that farmers receive the maximum price in direct sales to consumers in local markets/streets. As farmers enter contract agreements with wholesalers in advance, they have to sell their harvest to wholesalers at a lower price than the market price. However, the product flow from farmers to commission agents, wholesalers and retailers is not in the organic chain as the trades did not maintain a separate chain for organic products.

#### 4.2.4 Support services and information flow

4.2.4.1 Source of credit. All the pineapple growers receive financial assistance from the central govt. under MOVCD – NER to construct a micro vermicompost plant. Among the

farmers, 76% of the farmers receive finance from various sources like mutual fund institution (MFI), Banks, etc., and 24% of the farmers did not receive any credits. Among the farmers who received financial assistance, 61.30% of financial assistance was from MFI, 4% from self-help group (SHG) and 13.3% from commercial banks. From the list of growers who obtain financial assistance, 42.7% use land as security, and 33% use savings as collateral. Among the respondents who did not take any credit, five respondents (6.7%) agreed that credit is not required and they invest their cash. Of the respondents, 16.00% did not obtain credit from various sources due to not favorable credit terms.

4.2.4.2 Information flow. All the growers received information from various sources. Around 13.30% of growers received information from print media, 97.30% of growers received information from extension officers, 24.00% of respondents received information from the internet, 18.70% received it from various NGOs, 92% of the growers received it from various traders (wholesalers/retailers), 98.70% received information from the FPC and farmers association and only 2.7% of growers received some information from the exporters. From the survey, it was found that farmers show a strong flow of information related to organic crop prices, which is obtained from the extension officers. The details of the information type, source of information and farmers' understanding and knowledge level related to various type of information are shown in Table 3.

**Figure 3** Price spread flow of organic pineapple among various chain actors

Source: Author's own work

### 4.3 Value addition at each phase by all chain actors

#### 4.3.1 Cost of cultivation

For the second objective, in the first step, the cost of cultivation of organic pineapple per farmer and per hectare is computed by using the ABC cost concept (Table 4). The average cost of production per organic pineapple is found to be Rs. 6.97. The

per unit cost of pineapple is found in gross income, which is calculated as shown in Table 5 by adjusting the postharvest losses and by-product (sucker). The income per rupee was found to be Rs. 2.86 per farmer and Rs. 2.93 per hectare, which indicates that the farmer's income per hectare is almost thrice against as compared to cost.

**Table 3** Information types and farmers understanding and knowledge level related to various information

Information types	Sources of information	Min	Max.	Mean	SD
Organic crop prices	Extension officers	3	5	4.33	0.553
Market price of inputs	Farmers Association and FPC	3	5	4.14	0.553
Market place information	Farmers Association and FPC	3	5	4.14	0.511
Location of input providers	Farmers Association and FPC	3	5	3.98	0.667
Organic crop processing	Farmers Association and FPC	3	5	3.65	0.667
Technical Training	Farmers Association and FPC	2	5	3.52	0.600
Information about production	Farmers Association and FPC	2	5	3.41	0.659
Organic crops marketing	Farmers Association and FPC	2	5	3.62	0.631
Standard of organic production	Farmers Association and FPC	2	5	3.36	0.670
Grading and delivery of products	Farmers Association and FPC	2	5	3.40	0.677
Packaging and labeling	Farmers Association and FPC	2	4	3.13	0.684

Source: Authors' own work



Table 4 Cost of cultivation of organic pineapple by farmers

Sl. no.	Particulars	Per farmer (Rs)	Per hectare (Rs)
1	Hired labor (1.i. + 1.ii.)	16,719.97	9,451.28
	1.i. Hired men's labor	13,905.3	9,425.85
	1.ii. Hired women's labor	2,814.67	25.43
2	Hired/owned machine labor	160	108.45
3	Suckers*	10,634.3	7,208.04
4	Farm yard manure	55,269.3	37,464.8
5	Green manure	13,794.7	9,350.83
6	Vermicompost	21,112	14,310.9
7	Biofertilizers	42,918	29,092.3
8	Biopesticides	37,469.3	25,398.9
9	Irrigation	–	–
10	Mulching	442.66	300.06
11	Interest on working capital	1,287.5	872.74
12	Land revenue	1,102	747
13	Depreciation	1,168	791.72
	Cost A <sub>1</sub> : (1–13)	218,797.70	144,548.30
	Rent paid for the leased in land	1,076	729.37
	Cost A <sub>2</sub> : (Cost A <sub>1</sub> + a)	219,873.70	145,277.67
	Interest on fixed capital	1,594.67	1,080.96
	Cost B <sub>1</sub> : (Cost A <sub>2</sub> + b)	221,468.37	146,358.63
	Rental value of the owned land	13,293.3	9,011
	Cost B <sub>2</sub> : (Cost B <sub>1</sub> + c)	234,761.67	155,369.63
	Imputed value of family labor (di + dii)	2,041.33	1,383.73
	d.i. Imputed value of family men's labor	1,882.67	1,276.18
	d.ii. Imputed value of family women's labor	158.667	107.55
	Cost C <sub>1</sub> : (B <sub>1</sub> + d)	22,3509.70	147,634.81
	Cost C <sub>2</sub> : (Cost B <sub>2</sub> + d)	236,803.00	156,753.36

**Notes:** \*Assumption on sucker: As pineapple is a perennial crop (give yield for longer time), cost of sucker used during initial plantation is considered for cost computation. In the study by Paul et al. (2017), it was found that the mean age of pineapple plant in Northeast India is 20–25 years. However, it was found that the pineapple yield is highest in 6–12 year category. Considering the average years of farmers practising organic cultivation and yield, we took 12 years as optimum yield year as the farmers used to plant new suckers by replacing the old suckers. So, for the study, the sucker cost is computed with the assumption given below and charged to cost of production; Sucker plant required per bigha = 6,000, Therefore, Sucker plant per hectare = 6,000 × 7.47 = 44,820 Price of sucker = Rs. 1.93 (average price of the sucker is considered); Sucker cost: 44,820 × 1.93 = Rs. 86,502.60. By this, sucker cost per hectare per year = Rs. 86,502.60/12 which is Rs. 7,208.55 per year

**Source:** Authors' own work

#### 4.3.2 Gross income and net income of farmers

The gross income and net income of the farmers per hectare after adjusting the by-products and postharvest loss are found to be Rs. 0.459m and Rs. 0.302m, respectively. The income per rupee per hectare is Rs. 2.93 which is much above the standard (2:1), indicating that farmers' income is favorable and has positive cash flow. The details of income computation are shown in Table 5.

Although the existing value chain is partly organic, an attempt is made to know the quantum of value addition and margin shared by various chain actors. From the survey highest margin (Rs. 13.90) is found when the fresh pineapples are sold directly to the consumer. Farmer's margin when trading with commission agents and wholesalers is found to be Rs. 10.15 and Rs. 6.53, respectively. As mentioned earlier, organic pineapples are sold in fresh form, and apart from grading, storage and transportation, no additional value addition took place at the farmers' and trader's level. Net cost per pineapple at commission agent, wholesaler and retailer level is Rs. 1.16, Rs. 0.86 and Rs. 1.00, respectively. The details of production cost

at the farmer's level, margin of farmers from different channels, value addition by commission agents, wholesalers and retailers and margin are shown in Table 6.

#### 4.3.3 Degree of value addition, marketing efficiency and price spread of channels

From the study, marketing efficiency for channels II and III is found to be 1.69 and 0.99. In channel II, the retailer margin is higher as compared to commission agents and wholesalers. Organic pineapple is sold mostly in fresh form and without any value-added products. The value addition in the hands of traders is done in terms of storage, grading, assembling and transportation. Commission agents purchase the pineapple from farmers in cash/credit, and sold to wholesalers with some margin. Similarly, wholesalers sold the same to retailers with some margin and retailer to end consumer. In many cases, farmers sell the product directly to consumers, and the majority of the products are sold directly to wholesalers on a contract basis. The degree of value addition for channel II in the hands of the commission agent, wholesaler and retailer is 11.65%,

Table 5 Income computation of organic pineapple

Particulars	Per farm (Rs.)	Per hectare (Rs.)
<b>Gross income: (main product + price of main product + by product + price of by product) – post harvest losses</b>	677,756.00	459,422.00
= (Total revenue from sales of organic pineapple in June, July, August and December + revenue earned from selling of sucker) – post harvest losses.		
<b>G.I. (per farm)</b> = $((T_{JA} \times P_{JA} + T_{JB} \times P_{JB} + T_{JC} \times P_{JC} + T_{JUA} \times P_{JUA} + T_{JUB} \times P_{JUB} + T_{JUC} \times P_{JUC} + T_{AA} \times P_{AA} + T_{AB} \times P_{AB} + T_{AC} \times P_{AC} + T_{DX} \times P_{DX}) + T_S \times P_S - T_{PH} \times P)$ / 75		
= (110,294 + 53,154.7 + 33,157.5 + 1,36313 + 65,105.10 + 3,83333.4 + 57,755.1 + 27,793.9 + 16,286.6 + 32,400 + 119,911) – 12,748.70		
<b>G.I. (per hectare)</b> = $((T_{JA} \times P_{JA} + T_{JB} \times P_{JB} + T_{JC} \times P_{JC} + T_{JUA} \times P_{JUA} + T_{JUB} \times P_{JUB} + T_{JUC} \times P_{JUC} + T_{AA} \times P_{AA} + T_{AB} \times P_{AB} + T_{AC} \times P_{AC} + T_{DX} \times P_{DX}) + T_S \times P_S - T_{PH} \times P)$ / 110.643		
= (77,214.9 + 37,866.1 + 23,912.2 + 92,401.3 + 44,132 + 25,984.6 + 39,149.8 + 18,840.3 + 11,040 + 21,962.6 + 81,282) – 8641.87	440,953.00	302,668.64
<b>Net income: (gross income – Cost C<sub>2</sub>)</b>	458,958.30	314,873.70
<b>Farm business income: (gross income – Cost A<sub>1</sub>)</b>	457,882.30	314,144.33
<b>Own farm income: (gross income – cost A<sub>2</sub>)</b>	442,994.33	304,052.37
<b>Farm labor income: (gross income – cost B<sub>2</sub>)</b>	2.86	2.93
<b>Income per rupee: (gross income/cost C<sub>2</sub>)</b>		
<b>Notes:</b> Whereas, T <sub>JA</sub> , T <sub>JB</sub> , T <sub>JC</sub> = Total pineapple produce in the month of June for A, B and C category; P <sub>JA</sub> , P <sub>JB</sub> , P <sub>JC</sub> = Price of pineapple produce in the month of July for A, B and C category; P <sub>JUA</sub> , P <sub>JUB</sub> , P <sub>JUC</sub> = Price of pineapple produce in the month of August for A, B and C category; T <sub>AA</sub> , T <sub>AB</sub> , T <sub>AC</sub> = Total pineapple produce in the month of August for A, B and C category; P <sub>AA</sub> , P <sub>AB</sub> , P <sub>AC</sub> = Price of pineapple produce in the month of August for A, B and C category; T <sub>S</sub> = Total suckers sold; P <sub>S</sub> = Price per sucker; T <sub>PH</sub> = Post harvest losses; P = Average price of pineapple in month wise and grade wise; Computation of per pineapple cost, Average cost of production per organic pineapple = average production cost per hectare/average organic pineapple production per hectare; Average organic pineapple production per hectare = Rs. 156,753.36; Average cost of production per organic pineapple = 156,753.36/22,488.50 = Rs. 6.97		
<b>Source:</b> Authors' own work		

Table 6 Value addition of organic pineapple by various chain actors

Category	Particulars	Amount in Rs (piece)	
I Organic chain	Total production cost (Cost $C_2$ ) of farmers ( $n = 75$ )	6.97	
	Post production cost		
	Total farm level costs	6.97	
	Postharvest loss (due to damage of organic pineapple)	0.38	
	<i>I. Net production cost (a + b)</i>	7.35	
	<i>Margin 1: (farmers sold to commission agents), (Ili -I)</i>	10.15	
	<i>Margin 2: (farmers sold directly to wholesalers), (Ilii-I)</i>	6.53	
	<i>Margin 3: (farmers sold directly to consumer) (Iliii -I)</i>	13.90	
	<i>II. Producer's price:</i>		
	i. Producers price for commission agents	17.50	
	ii. Producer's price for wholesalers (direct sales to wholesalers on contract basis)	13.88	
	iii. Producer price for consumers (direct sales)	21.25	
	II Conventional chain (organic pineapple is mixed with the nonorganic)	Commission agents (Paikars) ( $N = 10$ )	
		Purchase price	17.50
Assembling and grading		0.16	
Transportation cost		0.27	
Loading and unloading labor charges		0.09	
Storage cost		0.07	
Other cost		0.02	
Total assembling cost (b to f)		0.64	
Losses (due to damages)		0.52	
<i>Net cost at commission agent level (g + h)</i>		1.16	
<i>Total cost (a + i)</i>		18.66	
Margin		2.04	
Commission agents price		20.70	
III Conventional chain (organic pineapple is mixed with the nonorganic)		Wholesalers ( $N = 10$ )	
	Purchase price (from commission agents)	20.70	
	Transportation cost	0.11	
	Loading and unloading labor charges	0.10	
	Storage cost	0.10	
	Other cost	0.01	
	Total wholesale level cost (b + e)	0.32	
	Losses (due to damages)	0.54	
	Net cost at wholesale level (f + g)	0.86	
	Total cost (a + h)	21.56	
	Margin	2.24	
	Wholesaler's price	23.80	
	Category IV Conventional chain (organic pineapple is mixed with the nonorganic)	Retailers ( $N = 20$ )	
		Purchase price	23.80
Assembling and grading		0.03	
Transportation cost		0.16	
Loading and unloading labor charges		0.10	
Storage cost		0.05	
Other cost		0.03	
Total assembling cost (a to f)		0.37	
Losses (due to damages)		0.63	
Net cost at retailer's level (g + h)		1.00	
Total cost (a + i)		24.80	
Margin		3.00	
Retailers price/price paid by consumers		27.80	

Source: Authors' own work

4.56% and 12.60%, respectively. The majority of consumer prices are shared by farmers (62.94%) followed by retailers (14.38%), commission agents (11.52%) and wholesalers (11.16%).

In channel III, products are sold directly to wholesalers on a contract basis. Marketing efficiency is found to be 0.99, and price spread is 49.92%, which is low as compared to channel II. The share of margin is high with wholesalers at Rs.7.76, followed by retailers at Rs. 3.00 per pineapple. The degree of value addition in wholesalers' hands is found to be 55.93%, which is mostly the margin of selling and buying price and not the actual value addition for organic products. In the same channel, the share of consumer price by farmers, wholesalers and retailers is found to be 49.92%, 35.68% and 14.38% respectively. The details of the degree of value addition, marketing efficiency and price spread for channels II and III are shown in [Table 7](#).

#### 4.4 Value chain upgradation

Mostly organic pineapple is sold in fresh form, and only 0.84% of the organic pineapple is sold to a local micro food processing factory named as "Sunny Agro Industry Pvt. Ltd" for value addition. Value-added products like pineapple squash, jam and pineapple drinks are manufactured and sold in local markets without any organic certification logo. As the farmers are getting a handsome amount by selling the pineapple in fresh form, the B2B market is not well accepted due to its low prices as compared to local market prices. Organic pineapples are sold in farm gates and markets with the organic labeling named as "Hmar Agro Organic Producer Co. Ltd." All the farmers perform basic value addition technology like cleaning, grading, transportation and labeling activities. Around 26% of the farmers sold the output by using wooden and bamboo boxes as primary packaging material, and 23% of the farmers used storage facilities. All the farmers are using basic production technologies to produce the outputs like bio-fertilizer, cutting, postharvest treatment, etc. Three forms of upgrading strategies are followed by the farmers i.e. product upgradation, process upgradation and functional upgradation. Product upgradation includes product types (variety wise), product formulation (quality aspects) and packaging. Process upgradation includes field practices, postharvest, standards, logistics, equipment and marketing.

Various marketing activities to promote sales are undertaken by around 93.30% of the farmers. Functional upgradation is taken up in the form of new activities absorbed, new market functions, new logistics performed and new management functions. Around 92% of the farmers absorbed new activities, 82.70% performed various innovative and new market functions to strengthen the value chain, 42.70% undertook new logistics functions and 41.30% undertook various new management functions. Farmers got access to technology from various sources like extension services, media, formal education, neighborhoods and ancestors. All the farmers got some form of technology knowledge from extension services and in the form of various formal training programs organized by FPC and the Department of Horticulture. The details of upgrading strategies used by farmers, FPC, wholesalers and retailers are shown in [Table 8](#).

#### 4.4.1 Constraints for upgrading the value chain

Various constraints faced by farmers, wholesalers and retailers in upgrading the value chain are identified and asked to rank those constraints. Farmers rate policy support as a major constraint in upgrading the value chain, followed by inadequate quality standards and a lack of market for organic produce. The details of the list of constraints faced by farmers, from most important to least important, are shown in [Table 9](#).

#### 4.4.2 Constraints faced by traders in upgrading the value chain

Commission agents' rate "lack of marketing network to trade organic products" as a major constraint followed by "lack of infrastructure facilities to handle organic products." Wholesaler's rate "inadequate and untimely supply of organic products" as major constraints followed by "lack of marketing network to trade organic products." Both commission agents and wholesalers rate the lack of storage facilities and the lack of working capital as the least important factor.

From the perspective of retailers, "buyer's trust issue in buying organic products" ranked as a major constraint, followed by "inadequate labeling of the products". Buyers have a trust issue and as the labeling is not on par with organic standards, consumers are not very convinced to tag the same as organic. Farmers in the cluster, on the other hand, are benefiting from a premium price due to the cluster's strong heritage of "Cachar Pineapple," which is organic by default.

The details of the constraints faced by commission agents, wholesalers and retailers are shown in Tables 10, 11, 12 and 13, respectively.

#### 4.5 Governance structures

##### 4.5.1 Nature of contracts

All the farmers have some form of written and verbal contract with various actors involved in the chain. A written contract exists among chain actors when organic pineapple is exported and sold to distant traders through FPC. Apart from these, trades are executed with various wholesalers and retailers in verbal form. Formal rules in the form of an official legal standard set by the FPC are adhered to by the farmers. The details of the nature of the contract with various actors are shown in [Table 13](#).

##### 4.5.2 Trust among group actors

Trust reflects the confidence of one party in a two-way relationship and is a key governance mechanism. It was found that the trust of farmers with group leaders of FIG, group members and Farmer Producer Company is much higher as compared to other actors. The details of the mean score of level of trust with standard deviation are shown in [Table 14](#).

## 5. Discussion

As indicated from the literature and confirmed from the data analysis of this study, the organic food value chain in Assam is currently in its early stages, necessitating the implementation of appropriate value-added measures to establish a comprehensive and regulated value chain (Das and Roy, 2021; Paul et al., 2017). The present study identifies six marketing channels, and only trades that are executed through FPC follow the standard organic chain. Farmers segregate pineapple into three grades A (>14"), B (10"–14") and C (< 10"), and mostly



Table 7 Degree of value addition, marketing efficiency and price spread of channels

Sl. no.	Items	Farmer	Commission agents	Wholesaler	Retailer	Consumer
<b>Channel I</b>						
1	Sale price (direct sales)	–	–	–	–	21.25
<b>Channel II (partly organic)</b>						
1	Sale price	17.50	20.70	23.80	27.80	
2	Purchase price	–	17.50	20.70	23.80	27.80
3	Price difference (1–2)		3.20	3.10	4.00	
4	Cost		1.16	2.15	1.00	
5	Margin (3–4)		2.04	0.94	3.00	
6	Degree of value Addition (5/2 * 100)		11.65	4.56	12.60	
7	Share in consumer's price	62.94%	11.52%	11.16%	14.38%	0%
		(17.50/27.80 * 100)(3.20/27.80 * 100)(3.10/27.80 * 100)(4.00/27.80 * 100)(27.80/27.80 * 100)				
8	<i>Marketing efficiency (price received by farmers/ MC + MM): 1.69</i>					
9	Price spread: (27.80–17.50) = Rs. 10.30 in percentage = 17.50/27.80 * 100 = 62.94%					
<b>Channel III (partly organic)</b>						
1	Sale price	13.88		23.80	27.80	
2	Purchase price			13.88	23.80	27.80
3	Price difference (1–2)			9.92	400	
4	Cost			2.15	1.00	
5	Margin (3–4)			7.76	3.00	
6	Degree of value addition (5/2 * 100)			55.93%	12.60%	
7	Share in consumer's price	49.92%		35.68%	14.38%	0%
8	<i>Marketing efficiency: (price received by farmers/ MC + MM) = 0.99</i>					
9	Price spread: (27.80–13.88) = Rs. 13.92. In percentage = 49.92%					
<b>Channel IV (fully organic)</b>						
1.	Sale price	20 per kg (for trade with distant traders, Bangalore) and 23 per kg (For export to Dubai).				

Notes: Price spread = price spread is the difference between price paid by the consumer and price received by the producer (Sahoo and Sarangi, 2018); PS = Pf/Pc × 100 where P.S. = price spread; Pf = Price received by the producer; Pc = price paid by the consumer

Source: Authors' own work

Table 8 Upgradation strategy used by various value chain actors

Upgradation strategy/ activities	Farmers (yes/ no)	FPC	Wholesalers (yes/no)	Retailers (yes/no)
1. Primary production functions like cleaning, grading, cutting, postharvest treatment, weighting	Yes	Grading, weighting	Grading, weighting	Grading, weighting
2. Processing	None	Under process	None	None
3. Transportation	Yes	Yes	Yes	Yes
4. Packaging/labeling	None	Yes	None	None
5.a. Product type	Yes	Yes	None	None
5.b. Quality aspect	Yes	Yes	None	None
6.a. Organic standards	Yes	Yes	None	None
6.b. Logistics	Yes	Yes	Yes	Yes
6.c. Equipment	Yes	Yes	None	None
6.d. Innovative marketing strategy	Yes	Yes	None	None
7. Functional upgradation (new activities absorbed, new market function, new logistics, new management)	Yes	Yes	None	None
7.a. Outsourcing certain activities	Yes	Yes	Yes	Yes

Source: Authors' own work

**Table 9** Constraints faced by organic farmers in upgrading the value chain

Factor	Constraints	Garrett's mean score	Rank
F1	Policy support	71.08	I
F2	Inadequate quality standard	65.88	II
F3	Inadequate supply of organic inputs	65.54	III
F4	Lack of market for organic produces	61.06	IV
F5	Lack of working capital	49.7	V
F6	Consumer unwillingness to pay premium price	49.44	VI
F7	High cost of input materials	44.74	VII
F8	Seasonality of organic crops	43.3	VIII
F9	Low yield during conversion	36.5	IX
F10	Lack of transportation	31.68	X
F11	High cost of labor	31.04	XI

Source: Authors' own work

**Table 10** Various constraints faced by commission agents ( $N = 10$ )

Factor	Constraints	GMS	Rank
F1	Lack of marketing network to trade organic products	78.8	I
F2	Lack of infrastructure facilities to handle organic products	76.8	II
F3	Lack of value-added organic products	63.4	III
F4	Lack of government policy support	63	IV
F5	Buyers trust issue in buying organic products	60.2	V
F6	Inadequate labeling of organic products	57.1	VI
F7	Certification issues	56.4	VII
F8	Compliance with organic standards	49.3	VIII
F9	Costly packaging material for organic products	46.1	IX
F10	Lack of awareness about the organic products	42	X
F11	Consumer unwillingness to pay a premium price	39.7	XI
F12	Lack of market for organic producers	39	XII
F13	Inadequate and untimely supply of organic products	37.5	XIII
F14	Lack of storage facility	21.6	XIV
F15	Lack of working capital	20.2	XV

Note: GMS stands for Garrett mean score

Source: Authors' own work

**Table 11** Various constraints faced by wholesalers ( $N = 10$ )

Factor	Constraints	GMS	Rank
F1	Inadequate and untimely supply of organic products	75.6	I
F2	Lack of marketing network to trade organic products	72.2	II
F3	Lack of value-added organic products	64.3	III
F4	Lack of infrastructure facilities to handle organic products	62.5	IV
F5	Buyers' trust issues in buying organic products	61.1	V
F6	Inadequate labeling of organic products	60	VI
F7	Lack of government policy support	53.7	VII
F8	Lack of awareness about the organic products	48.1	VIII
F9	Compliance with organic standards	46.1	IX
F10	Certification issues	43.3	X
F11	Costly packaging material for organic products	40.6	XI
F12	Consumer unwillingness to pay a premium price	38.3	XII
F13	Lack of market for organic producers	34.3	XIII
F14	Lack of working capital	29.7	XIV
F15	Lack of storage facility	17.5	XV

Note: GMS stands for Garrett mean score

Source: Authors' own work

Table 12 Constraints faced by retailers in organic pineapple value chain

Factor	Constraints	Garrett's mean	
		score	Rank
F1	Buyer's trust issue in buying organic products	72.1	I
F2	Inadequate labeling of organic products	65.9	II
F3	Lack of marketing network to trade organic products	63.95	III
F4	Compliance with organic standards	61.55	IV
F5	Lack of value-added organic products	60.95	V
F6	Consumer unwillingness to pay a premium price	59.6	VI
F7	Lack of infrastructure facilities to handle organic products (transportation, handling and grading)	57.15	VII
F8	Lack of awareness about the organic products	50.65	VIII
F9	Certification issues	49.3	IX
F10	Lack of Market for organic producers	44.5	X
F11	Lack of government policy support	43.6	XI
F12	Lack of working capital	33.18	XII
F13	Inadequate and untimely supply of organic products	29.75	XIII
F14	Costly packaging material for organic products	29.65	XIV
F15	Lack of storage facility	26.55	XV

Source: Authors' own work

Table 13 Nature of contract with various actors

Nature of contract	Yes/no	Contract with
a. Provision for inputs (biofertilizer, biopesticides, vermicompost, etc.)	Yes	FPC
b. technical assistance for upgrading value chain.	Yes	FPC
c. Processing of organic products	No	In progress with FPC.
d. Provision storage for final output	Yes	Self-made
e. Provision for transportation	Yes	Outsourced
f. Provision of credit	Yes – 76%	MFI: 58.70%
	No – 24%	SHG: 4.00%
		Banks: 13.30%

Notes: FPC = farmer producer company; MFI = mutual fund institution; SHG = self-help group

Source: Authors' own work

Table 14 Farmers trust level with various actors

Actors	N	Minimum	Maximum	Mean	SD
Government officials	75	2.00	5.00	3.86	0.75933
Group leaders of FIG e.g. chairperson, secretary	75	3.00	5.00	3.73	0.50225
Group members	75	3.00	5.00	3.56	0.52608
Wholesalers	75	2.00	4.00	3.17	0.44641
Buyer	75	2.00	4.00	3.22	0.55928
FPC	75	4.00	5.00	4.58	0.49575

Source: Authors' own work

sold in three ways i.e. direct sales, sales through commission agents and direct sales to wholesalers (Table 2). The farmers fetch premium prices for their crops due to the widespread recognition of the organic pineapple grown in this locality. During the initial phase of the harvest season in June, farmers were able to obtain high prices for organic pineapple for early harvest. In the domestic market, organic pineapples are sold in multiple cities in the north-eastern regions of India, including

Silchar, Guwahati, Nagaon and Imphal (Figure 2). In the year 2022, organic pineapples are exported to Dubai by Hmar Agro Organic Producer Limited in collaboration with APEDA. Organic pineapples are marketed fresh in both domestic and foreign markets, with no value processing. Local micro-food processing firms perform value processing, and value-added products from the same food processing units, such as pineapple marmalade, jelly and slice, are primarily sold in local

markets without any organic logo. There exists a necessity to create a food processing facility or implement a suitable business-to-business (B2B) marketing channel to produce value-added products from organic pineapple with an organic certification logo. All farmers were provided with government subsidies to establish vermicompost plants, and in addition to this, 41% of farmers procure organic manure from the open market. In terms of credit services, it was found that 76% of farmers received credit as working capital from various sources, such as banks and microfinance institutions.

The marketing margin for commission agents, wholesalers and retailers in channel II is found to be Rs.2.04, Rs. 0.94 and Rs. 3.00, respectively, indicating a high share of margin by retailers among other intermediaries. Similarly, the degree of value addition and share in consumer price is found to be high with retailers, which is around 12.60% and 14.38%, respectively. The actors in the chain only perform the basic value-adding activities, and the margin, degree of value addition and price spread are mostly determined by the difference in selling and buying price.

The study shows that marketing efficiency for channels II and III is 1.69 and 0.99, respectively. Marketing efficiency is high in channel II due to the high price realization of farmers and other actors in the chain as pineapples are sold at market price. In channel III, products are sold directly to wholesalers on a contract basis, which prevents farmers from benefiting from market prices. In channel III, marketing efficiency is 0.99, and price spread is 49.92%, both of which are low when compared to channel II. The wholesaler has the highest margin at Rs.7.76 per pineapple, followed by retailers at Rs. 3.00. In wholesalers' hands, the degree of value addition is found to be 55.93%, which is mostly the margin of selling and buying price and not the actual value addition for organic products. Farmers, wholesalers and retailers each have a 49.92%, 35.68% and 14.38% share of the consumer price in the same channel.

In the study by Paul *et al.* (2017), the per unit cost of organic pineapple is found to be Rs. 5.85, Rs. 4.09, Rs. 4.63 and Rs. 5.59 for pineapple plants aged 0–5 years, 6–12 years, 13–20 years and 21–25 years, respectively. The average cost of organic pineapple in the present study is found to be Rs. 6.97, which indicates the cost of production has slightly increased over the year.

In value chain upgradation, all the actors undergoes some basic value-adding activities. It is found that farmers and FPC use three forms of upgrading strategies, i.e. product upgradation, process upgradation and functional upgradation strategy, to strengthen the value chain. No such form of upgrading strategy is followed by wholesalers and retailers. Among the various constraints in upgrading value chain, farmers rate “policy support” as a major constraint. From the trader's perspective, commission agents' rate “lack of marketing network to trade organic products” as a major constraints, and wholesalers' rate “inadequate and untimely supply of organic products” as one of the major constraints.

From the standpoint of retailers, the “buyer's trust issue in purchasing organic products,” followed by “inadequate product labeling,” were major constraints. Buyers lack trust, and because labeling does not meet organic standards, consumers are hesitant to label the product as organic. Farmers

in the cluster, on the other hand, are benefiting from a premium price due to the cluster's strong history of “Cachar Pineapple,” which is organic by default.

In the governance structure, agreements are made in written form when products are traded through FPC. Apart from these, farmers and other actors prefer verbal contracts and mutual trust in trade execution. Formal rules in the form of an official legal standard set by the FPC are adhered to by the farmers. In knowing trust among value chain actors, it was found that the trust of farmers with group leaders of FIG, group members and Farmer Producer Company is much higher as compared to other actors. Apart from the study by Paul *et al.* (2017) on the efficiency and economic viability of organic pineapple of Cachar, the present study is the first of its kind to investigate the value chain of the same.

## 6. Conclusion and implication

Consumers' increasing health consciousness and awareness, as well as their shifting preferences toward nutrient-rich and naturally sourced products due to their numerous health advantages, are among the primary factors driving the Indian organic food market. In addition, the increasing prevalence of numerous chronic diseases, such as cancer, diabetes and cardiovascular disease, are significant growth-inducing factors (IMARCI, 2023). India is in an advantageous position with the highest number of organic producers in the world, and a strong and efficient value chain is essential to exploring the domestic and global markets. This paper highlights the various aspects of the value chain of organic pineapple in Assam, India. The findings show that the value chain is in an infant stage and harvest is sold mostly in fresh form. Although organic pineapples are sold in fresh form, the marketing efficiency, marketing margin and price spread are favorable for the farmers, as they receive the majority share of the consumer price. As the farmers are in an advantageous position in terms of net income and margin, they are not very inclined to the B2B market due to lower prices for their harvest. However, if farmers intend to move to the full organic value chain, it will benefit them in near future, considering the increasing global organic market. A strong policy is required to transform the same into a well-coordinated and regulated organic value chain by paying farmers a fair price. As the majority of the outputs are sold through traders, FPC must emphasize improving the labeling and developing an integrated organic value chain with commission agents, wholesalers and retailers. It was found that the finished product is sold mostly in the north-eastern region of India, and a small part goes to distant traders and exports. Farmers or FPC can explore various other ways to market the organic market, like market, hypermarket, online mode, organic retail chain or with organic food industry, like Suminter India Organics, Nature Bio-Food Limited, Organic India Pvt. Ltd etc. Although India ranks sixth in terms of pineapple production, it imports sliced pineapple primarily from Thailand, indicating the existence of a supply gap that can be filled by pineapple from this region. In fiscal year 2020–2021, India imports approximately US\$0.68m of pineapples from Thailand, which is around 37.36% of total pineapple imports (Pineapple import data and price | import of Pineapple to India,



2023). The following recommendations may be helpful to strengthen the existing value chain of organic pineapple:

- Establishment of a food processing unit to supply organic pineapple pulp to various industries through the B2B market;
- Proper training of organic standards to commission agents, wholesalers and retailers in handling and selling organic products;
- Organic retail stores in various major cities;
- By improving the flow of market information among various actors, particularly on packaging and labeling, organic production norms and standards; and
- Blockchain development for organic food traceability.

This paper provides an insight into and understanding of the existing value chain of organic pineapple in Assam, India. The findings will help policymakers and various actors to know the existing value chain and to frame a strong value chain model for the flow of organic products from producer to consumer. The limitation of the study is that fieldwork is conducted in the Cachar district of Assam, India, and findings may not apply to other regions. Future research is encouraged from time to time to know the status of the value chain and ways of improvement.

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### Corresponding author

Naba Kumar Das can be contacted at: [nabakumardas90@gmail.com](mailto:nabakumardas90@gmail.com)