

Bridging Supply Inefficiencies and Consumer Demand: A Farm-to-Consumer Value Chain Analysis of Bangladesh's Fruit Sector

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Abstract

Fruits play an important role in Bangladesh's agriculture and are a significant part of the daily lives of its people. They also help to support the livelihoods of a large number of families in rural areas and make a major contribution to domestic trade. However, the process of getting fruits from the farmer's field to the consumer's table is generally complicated. During this process the fruits go through many hands and encounter problems concerning procurement, transportation, storage, handling and post-harvest losses. Such problems can reduce the amount that farmers receive while at the same time raising prices and having an effect on the quality and availability of the fruit in the market. The present study looks at the main difficulties in the fruit supply chain with a specific focus on procurement, post-harvest management, storage, transportation, the role of intermediaries and consumer preferences. Primary data were obtained via a structured survey and supplemented by secondary information from research articles, government publications, industry reports and relevant news sources. The study also looks at possible methods of improving coordination among the various participants in the supply chain. On the basis of the findings, a number of practical measures are proposed to cut down on losses, improve market efficiency and strengthen the entire fruit supply chain in Bangladesh.

Keywords

Fruit supply chain, Bangladesh, fruit procurement, post-harvest loss, storage, transportation, intermediaries, consumer preference, seasonal demand, agricultural marketing.

1.Introduction

Importance and Significance of Fruits

Fruits are a part of daily meals in Bangladesh and play a major role in the country's food traditions. They deliver nutrients like vitamins, minerals, dietary fibre and antioxidants making them essential for a healthy diet. Different fruits offer tastes, textures and health benefits. From the sweet taste of mangoes and bananas to the crisp freshness of oranges, pineapples and guavas. This wide range makes fruits popular among people of all ages and preferences. For consumers fruits are also seen as a better choice than processed snacks or sugary desserts. Their natural goodness, flavours and seasonal cycles help make them a favourite across households. Fruits such as mango, jackfruit, guava, litchi and pineapple have importance in both culture and economy. Fruits are not about nutrition. They are an important part of home eating local farming and the overall food system in Bangladesh.

Why Fruits Matter

Fruits are important for health because of their rich nutrient content and they benefit people of all ages. Here are some of the reasons why:

Nutritional value: Fruits contain vitamins, minerals, fibre and other nutrients that support good health.

Dietary fibre: Many fruits are high in fibre, which helps digestion and keeps the body balanced.

Alternative: Fresh fruits can be a healthier option than sugary treats or heavily processed snacks.

Variety of flavours: Sweet sour, tangy and refreshing tastes make fruits appealing to kinds of eaters.

Hydration: Fruits with water content help meet daily fluid needs especially during hot months.

Seasonal appeal: When certain fruits come into season demand often rises sharply creating excitement in markets.

Cultural importance: Fruits like mango, jackfruit, litchi and guava are deeply connected to Bangladeshi customs and meals.

Significance: Fruit farming supports farmers, traders, haulers, wholesalers, retailers and others involved in the supply chain.

Consumer preference: The taste, freshness and health image of fruits make them a regular choice in homes.

Bangladesh's Fruit Industry

The fruit industry in Bangladesh is diverse with production happening throughout the year and during seasons. Mango, jackfruit, banana, guava, papaya, pineapple, litchi, watermelon, lemon and various native fruits are grown across areas. Among these mango, jackfruit and banana are the commonly consumed domestically. The country produces millions of tonnes of fruit each year most of which are eaten within the country. The supply chain usually moves from farmers to collectors, aratdars, wholesalers and finally to retailers who sell to consumers. This creates steps between farm and table. Imported fruits also play a role in the market. Apples oranges, grapes, pears and pomegranates are examples of fruits that cannot be grown in large quantities locally. In year 2024 Bangladesh spent around US\$300 million on importing fresh fruits showing how vital imports are in meeting domestic needs.

Exports remain small compared to what's produced inside the country. Mango is the export fruit from Bangladesh but only a tiny fraction of the total harvest goes abroad. In year 2025 exports reached 2,194 tonnes. Weaknesses in cold-chain systems, -harvest practices, quality control, certifications, transport and coordination limit the industry's ability to reduce losses and grow into higher-value domestic and global markets.

Food Preferences of Bangladeshi Consumers

People in Bangladesh choose food based on taste, cost, availability, culture and season. Rice is still the core of meals often served with fish, vegetables, lentils and other side dishes. Fish holds a place in everyday meals and celebrations. As incomes rise and lifestyles change there is variety in diets. Including meat, dairy, processed items, fruits and ready-to-eat foods. Seasonality has an impact on what people eat. In summer fruits like mango, jackfruit, litchi and watermelon become very common in shops and homes. Price and freshness matter a lot for people with limited income. Consumers generally want taste, freshness, quality and fair value for money. These preferences cause shifts in demand through the year affecting how farmers, traders and retailers manage sourcing, storage and distribution.

Major Factors Shaping Food Preferences

Taste and freshness: People prefer food that looks good tastes fresh and smells right.

Price: How much something costs strongly affects buying choices for those on tight budgets.

Seasonality: When certain fruits are in season demand often goes up quickly.

Habits: Traditional eating patterns continue to shape what families choose to cook and eat.

Nutritional value: More awareness of health is leading people to focus on fruits, vegetables and other nutritious foods.

Availability: Consumers pick foods that're easy to find in local markets throughout the year.

Quality and safety: Cleanliness, freshness and trust in food safety influence buying decisions more and more.

Convenience: Urban buyers particularly are looking for foods that're quick to prepare and fit modern lives.

Income and lifestyle: Increasing household income, education and urban living are gradually changing what people eat and how they buy food.

Challenges & Opportunities

Because of its climate, big domestic market and rising interest in fresh and processed fruit Bangladesh has great potential in the fruit sector. The country grows amounts of mango, jackfruit, banana, pineapple, guava, litchi and other fruits. Processors and exporters have shown that local fruit can be used to make value-added products and sold internationally. Yet much of this potential remains untapped due to problems at points in the supply chain.

Challenges

1. **Seasonal oversupply:** During harvest times huge amounts of fruit arrive at markets at once. This drives prices down. Increases the chance that some fruit will go unsold.
2. **Storage facilities:** Farmers and traders often lack proper cold storage. Without it they cannot keep fruit when prices are low or when there are issues in the market. Reports from fruit-growing regions show that growers are asking for storage options to avoid spoilage.

3. Post-harvest losses: Damage, ripening, poor handling and wrong storage conditions reduce both the amount and quality of fruit that reaches consumers. Studies have found losses in supply chains for banana, lemon, pineapple and other fruits.
4. Bad logistics: Using vehicles, poor packaging, road delays and the lack of specialized transport increase damage and spoilage risks especially for perishable fruits.
5. Access to markets: Small farmers often rely on local traders or middlemen to move their produce to bigger markets. Limited access to market information and other buyers means they may not get the price.
6. Grading and quality control: Differences in ripeness, sorting, grading and packing make it hard to keep quality consistent along the supply chain.
7. Limited processing capacity: A large part of the harvest must be sold as fruit within a short window. More processing could help use surplus and extend shelf life. Current processing capacity is too low compared to output.
8. Export barriers: International buyers need quality, traceability, phytosanitary certificates, compliance with residue limits and dependable logistics. Gaps in these areas stop Bangladesh from building a presence in global fruit trade.

Opportunities

1. Improving the cold-chain infrastructure: Building decentralised cold stores and temperature-controlled transport near production areas could keep fruit marketable longer and reduce pressure on farmers to sell immediately after harvest. Given the levels of post-harvest loss in Bangladesh this is a major investment opportunity.
2. Farmer-to-market coordination: Digital tools, farmer groups and organised buying systems could connect producers with wholesalers, retailers, processors and institutional buyers. It would also give farmers data on prices and demand before selling.
3. Better handling: Using plastic crates, cushioning materials, sorting stations and improved loading methods could lower physical damage without needing a complete overhaul of the existing supply chain.
4. Processing and value addition: Products like mango pulp, dried mango, juice, jam, fruit bars and others can absorb harvest and create demand outside the short fresh-fruit season. Existing commercial processing in Bangladesh proves this approach is possible.

5. Standardized traceability: Consistent grading by size, maturity, appearance and quality helps buyers know what they are buying and allows producers to earn prices that match product quality.
6. Expansion of organized retail and e-commerce: The growth of branded supermarkets and online shopping can help link producers and small traders with consumers beyond their areas.. This depends on reliable delivery services able to handle perishable goods.
7. Export-oriented supply chains: Better regulation, traceability, packaging, -harvest treatment and temperature control could help Bangladeshi fruit producers meet international requirements. Phytosanitary certification already sets a foundation for export chains.
8. Effective use of market information: Timely data on prices, demand, harvest volume and buyer needs could help farmers decide when and where to sell. Traders and processors could plan collection ahead of surges in supply.
9. Climate-resilient supply chains: Floods, rains and other weather events affect both growing and moving fruit. Flexible routes, alternate transport, more storage and diverse sources can make the fruit supply chain more resistant to disruptions. Recent cases involving pineapples and mangoes show how transport and demand problems can lead to losses, for farmers.
10. Bringing farmers into association with processors: By using contract farming and organized procurement processors can get a more reliable supply of fruit. At the time farmers benefit from a more stable market. The mango collection system used by PRAN shows how direct connections, between production and steady demand can be built through procurement and processing.

2. Literature Review

2.1 The importance of fruit supply chains in Bangladesh

Fruit farming forms a significant element of Bangladesh's agricultural economy and supports a wide range of farmers, traders, transporters, wholesalers, retailers and processors. Mangoes, bananas, jackfruit, litchi, pineapples and guavas are grown in various areas and pass through a number of market participants before getting to the consumers. Studies have indicated that intermediaries carry

out key roles such as pooling together the produce, providing financing, arranging transportation and giving access to markets. Hence, the issue is not merely the existence of intermediaries, but rather the poor coordination, the lack of information and the limitations in infrastructure throughout the chain (Dewan et al., 2016; Ahmed et al., 2019).

2.2 The problem of post-harvest losses as a supply chain issue

Post-harvest loss brings obvious results of inefficiency in the fruit supply chain in Bangladesh. According to Hossain et al. (2017), who looked at 2,050 farmer and 749 traders, the losses were estimated at 37% for bananas, 27% for pineapples, 20% for oranges, 24% for mangoes, 17% for litchi and 38% for jackfruit in the areas they studied. The reasons differed according to the stage involved, with damage being a major factor at the farm level and transportation becoming important among the traders.

Other studies have also found that losses carry on after harvesting; in Tangail banana research a total loss of 21.67% was recorded from the time of harvesting until consumption, whereas investigations into lemons and pineapples showed losses linked to handling, transportation and marketing. These results show that post-harvest loss should not be regarded as a single-stage agricultural issue since it is in fact a system-wide problem throughout the supply chain, with a weakness at one stage being able to increase losses at another.

2.3 The production of farming and vulnerabilities at the farm level

Efficiency in the supply chain starts well before the fruit leaves the farm, since the decisions made by farmers concerning the types of crops grown, the inputs used, the time at which harvesting takes place and their pest control methods have an impact on the quality of the produce that enters the market. Moreover, biological and environmental hazards can lead to serious losses. According to Hossain et al. (2017), insects, bats, squirrels and monkeys are among the main causes of losses at the farm level in areas that produce fruit.

Financial constraints together with poor market information also influence the decisions of farmers. If producers have only a limited understanding of prices, demand and other potential buyers, they may end up relying greatly on local traders and on selling their crops immediately. As a result, simply improving production is not enough; farmers also need to have better links with the market and with logistics services.

2.4 Harvesting, Handling and Packaging

We should pick fruits and vegetables at the right time for best quality and shelf life. Use clean, sharp tools to avoid damaging the crops. Handle gently to prevent bruising. Keep harvested crops out of direct sunlight and move them to a cool place. Clean and sort the produce before packing. Use proper containers to avoid spoiling the crops during transport. Label packages with the date and type of produce. Store packed crops in a cool, dry place until they are sold or processed.

Fruit quality is liable to decline quickly as a result of bad harvesting and handling; bruising, cuts, compression and incorrect separation from the plants all lead to a deterioration in both look and shelf life. Studies carried out on litchi showed that losses occurred during harvesting and when the fruit was transported from the orchard to the place where it was sold, although formal grading was mostly not carried out. Traditional methods of packaging also offer only limited protection against physical damage.

Other studies on the subject also point to harvesting, sorting, grading and handling as major causes of loss. International evidence backs up these conclusions by showing that defective packaging, inadequate handling, transportation and storage are interconnected reasons for losses of fruit and vegetables (Magalhães et al., 2021). It therefore follows that relatively simple measures such as using the right crates, carrying out careful sorting and improving loading practices could lead to significant benefits.

2.5 Transportation and Logistics

Transportation serves both as a cost and as a means of preserving quality; over long distances, the use of inappropriate vehicles, poor road conditions, delays, and rough handling can all lead to greater physical damage and deterioration. Studies concentrating on Bangladesh have on several occasions regarded transportation as a major cause of loss and marketing inefficiency (Hossain et al., 2017; Miah et al., 2018).

It does not follow that the cheapest method of transport is also the most efficient; if the logistics cost is only a little higher, this could still be an economically sound approach since it greatly reduces product loss and helps to maintain market value. Transportation therefore needs to be assessed according to the total value of the supply chain and not just on the basis of transport cost.

2.6 The infrastructure for storage and the cold chain

The lack of cold storage and the absence of temperature-controlled transport continue to be major drawbacks for perishable fruits; farmers and traders are usually forced to sell their produce quickly during the peak harvesting season because the markets may at that time already be oversupplied.

It is true that relying merely on cold storage will not deal with the issue. Refrigeration is unable to repair fruit which has already been damaged as a result of bad harvesting or handling. Cold-chain investment must therefore be combined with aggregation, pre-cooling, the use of suitable packaging and efficient transport. Just as recent discussions in Bangladesh have stressed cold-chain infrastructure, smart packaging, aggregation centres and public-private collaboration as interconnected solutions.

2.7 Information on the market and coordination

Another significant inefficiency is caused by weak information flow. Farmers might not be aware of current prices, future demand, or the requirements of buyers, and at the same time buyers may have only limited knowledge of the expected production and quality. This situation can lead to delayed sales, uncertainty regarding prices, and an oversupply of goods in the market.

It might not be practical to get rid of intermediaries altogether since they offer important market and logistical services; instead, digital market information, farmer groups, and organized procurement and aggregation centres could be used to improve coordination while still keeping the useful functions of the present system.

2.8 The processing and addition of value

Because of the seasonal nature of production, the market sometimes gets a greater amount of fruit than it can take in at once. By processing the fruit into products such as pulp, juice, dried fruit and jam, an alternative market channel can be provided. As a result, the fruit's commercial life can be extended and the pressure on farmers to sell it immediately can be reduced.

A more effective system would therefore make use of several channels: reserving premium-quality fruit for the fresh and export markets, using lower-grade fruit that is suitable for processing, and setting aside the unavoidable waste for appropriate recovery. Processing should support the improvements made in the fresh supply chain rather than take its place.

2.9 Quality, the process of grading and traceability

Inconsistent grading and varying quality standards it is difficult for buyers to evaluate the fruit before they buy it. Differences in size, maturity, appearance and physical condition may also lead to a lack of price transparency. Standardized grading and improved packaging could enhance quality and increase market efficiency.

Traceability is especially important in the case of organized retail and export markets since buyers nowadays ask for proof of quality, food safety and compliance. It follows that grading and traceability can help to improve both domestic coordination and access to international markets.

2.10 An integrated approach to improving the supply chain

The main conclusion drawn from the literature is that these problems are closely related: poor harvesting leads to greater vulnerability when the crops are being transported; poor packaging causes mechanical damage; insufficient storage makes it necessary to sell the crops quickly; and weak market information can make seasonal oversupply worse. As a result, it is unlikely that resolving just one bottleneck will lead to lasting improvement.

The literature now provides greater support for an integrated approach that includes farmer aggregation, better harvesting, grading, packaging, pre-cooling, storage, transportation, market

information, organized procurement and processing; in this way, various parties could function as part of a single system rather than as individual stages.

2.11 Research Gap

There are already numerous studies which offer valuable evidence concerning individual fruits, places, and stages in the supply chain. Yet a large part of the literature from Bangladesh is still focused on specific commodities or is geographically scattered. These studies generally deal with post-harvest losses or outline the marketing channels without thoroughly looking at how production, logistics, infrastructure, information, and coordination interact.

3.Theoretical framework

The story of fruit in Bangladesh from farms in the countryside to busy city tables displays how much agriculture can achieve. It also how much it struggles. Even though the country grows a lot of sub-tropical fruits the way these fruits get from the farm to the people is not working well. This causes losses after the fruits are picked, with between 25% and 40% of fruits being wasted. If you look at each part of this process you can see problems. Each part has its issues some are about how things are run some about money and some about the plants themselves. Each type of fruit also has its special difficulties.

Phase I: On-Farm Production and Input Vulnerabilities

The chain starts at the farm. Small farmers face problems right from the start. They often cannot get loans from banks so they've to agree to deals with local traders. These deals ask for money front and the interest rates are very high. Because of this the farmers choose what to grow based on needing money not on what is best for the fruit or how it will be handled after it is picked.

Specific Fruit Vulnerabilities:

Mango (Aam): This fruit grows a lot in Rajshahi and Chapainawabganj. The flowers get hurt by the weather. To stop pests like the mango hopper farmers use chemicals just before picking. This makes the fruit unsafe to eat.

Banana (Kola): This fruit grows all year in Narsingdi and Bogra. Farmers use ways to grow new plants, which spreads diseases like Panama disease. This makes the bananas not grow well and lowers the quality.

Jackfruit (Kathal): This fruit comes from Tangail and Gazipur. There are no strong types of jackfruit that grow fast and have no seeds or thin skin. This makes the fruit very different in size and, in how sticky juice it has.

Phase II: Harvesting and Handling at Farm Gate

The crucial point at which injury occurs starts from the removal from trees to the ground. Farmers have neither proper harvesting equipment nor climate controlled intermediate sites nor pre-cooling facilities; thus, they collect fruit at the height of ambient temperature that retains "field heat" in the produce, increasing respiration and rapid decay.

Specific Fruit Sensitivities:

Litchi (Litchi): It is grown in Dinajpur and Ishwardi areas and has a very short 2-to-3-weeks period for harvesting. The fruit pickers tear out whole branch manually that results in tearing stems, skin browning and rapid moisture loss within 24 hours.

Peyara/Guava (Psidium): It is collected manually in Swarupkathi (Pirojpur) and Gazipur areas. They are placed either directly on unlined ground or thrown in crude bamboo baskets; due to its fragile skin, it is easily penetrated by the fungi.

Phase III: Intermediary Networks and Market Information Asymmetry

After produce leaves the orchard produce goes through a chain of middlemen: local collectors (Faria) primary wholesalers (Bepari) commission agents (Aratdar) and secondary buyers (Paikar). Each layer extracts a profit margin while offering zero preservation support. Smallholders who are isolated do not have real-time price information from city centres giving them no power.

Specific Fruit Vulnerabilities:

Jackfruit: Because jackfruit is very heavy and worth little per kilogram Beparis give discounts on jackfruit at the farm gate. This is meant to cover transport risks. As a result farmers receive no money and many heavy jackfruits are left in the orchard to rot.

Mango: When the harvest peaks, assembly yards such, as Rohanpur experience a big surplus of mangoes. Aratdars deliberately slow down auction rates. This forces farmers, who do not have short-term storage to sell their mangoes in a panic.

Phase IV: Transit, Logistics, and Infrastructure Inefficiencies

The logistics process can be considered the weakest link in the agricultural infrastructure of Bangladesh. Refrigerated transportation or cold chain logistics does not exist at all in the country in the context of domestic transport of fresh fruits. The produce is packed into non-ventilated jute bags or wooden crates, loaded on open trucks covered by thick tarps, and exposed to excessive heat accumulation, vibrations, and traffic jams.

Fruits Specific Transportation Vulnerabilities:

Banana: Stacked horizontally to a depth of 8-10 layers in an open truck bed without any protective padding. Weight presses the lower layers and produces bruising inside the banana tissue, which turns black when the fruit starts to ripen.

Papaya (Pepe): Semi-ripe papayas stuffed in jute bags rubbing against each other during transport on unpaved roads cause the formation of latex leaks, creating scars on their skin surface, making them unfit for sale.

Watermelon (Tarmuj): Transported in bulk from southern coastal belts (Patuakhali, Bhola). Impact of road transportation on unpaved roads causes internal breaking, souring and fermentation of the fruit.

Phase V: Urban Wholesale, Retail, and Consumer Realities

Terminal hubs like Karwan Bazar or Jatrabari in Dhaka receive the fruits into open, unhygienic, and non-ventilated markets. In order to camouflage any damage that may have occurred during transit and prevent total loss, retailers are compelled to resort to illegal post-harvest practices by dipping the fruit into dangerous ripening chemicals like calcium carbide or any other unregistered preservatives to increase their shelf life. Consumers buy these products at increased retail prices that cover the 25-40% losses sustained during upstream processes, but they run risks of exposure to the chemicals and of poor quality fruit.

Fruit Specific Vulnerabilities Litchi: Litchis are constantly sprayed with untreated water to delay skin dehydration. The presence of moisture accelerates the growth of fungal rots in the stem end, thus reducing the shelf-life to below 24 hours.

Mango & Banana: Retailers ripen the green fruits in underground non-ventilated premises by dipping them in chemicals to give them an artificial uniform yellow color but fibrous or sour pulp.

General fruit market problems

The issues in the fruit industry in Bangladesh have a broad scope of challenges ranging from economic to structural to public health:

Excess Post-Harvest Loss: In the whole country, 25% to 40% of total harvested fruits go wasted due to poor transport systems, inappropriate packaging (baskets made of jute/ wood), and no temperature control system.

Exploitative Pricing System (Dadondar System): Small-scale farmers receive informal credits from the local traders, called Bepari / Aratdar. In exchange for this credit, the farmers are compelled to sell their products at less than the retail price, i.e., 30-40%.

Chemical Fraud & Food Safety Issues: Perishability in the market leads the vendor to use hazardous chemicals like Calcium Carbide (for premature ripening) and Formalin (for preserving shelf life).

Lack of Cold Chain Infrastructure: Bangladesh almost entirely lacks a integrated domestic cold chain. There are virtually no refrigerated trucks or cool-storage aggregation points in major rural fruit belts.

High Seasonality & Supply Gluts: Over 50% of the country's fruit matures during a narrow summer window (May to July). Without processing units or long-term cold storage, markets crash during peak months, causing massive waste.

Unhygienic & Chaotic Wholesale Hubs: Central wholesale yards (like Dhaka's Karwan Bazar and Jatrabari) lack basic sanitary standards, shaded display zones, and ventilated loading bays, accelerating spoilage upon arrival.

4. Research Methodology: Quantitative Primary Survey and Consumer Data Collection

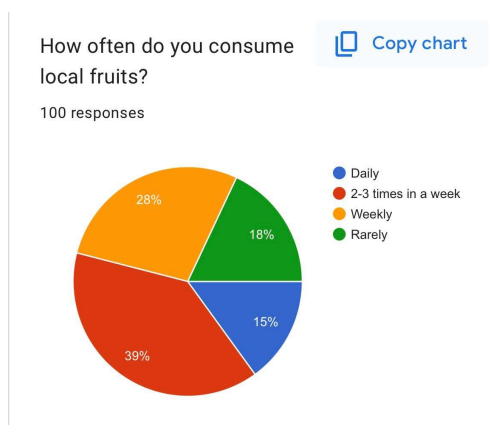
This study adopted a quantitative, descriptive research approach to understand local fruit consumption patterns among consumers in Bangladesh. The questionnaire was designed to examine several aspects of local fruit consumption including frequency of consumption, preferred local fruits, factors influencing purchasing decisions, challenges faced by consumers, health awareness, and preferences for consuming

fruits during the off-season. Both demographic and consumption related questions are included to identify patterns and differences.

The collected responses were organized and analyzed using descriptive statistical techniques, such as frequencies, percentages, and comparative analysis. The findings were used to identify major consumer trends, preferences, and barriers related to local fruit consumption in Bangladesh.

First: Frequency of local fruit consumption:

The findings show that 39% of respondents consume local fruits 2–3 times a week, making it the most common consumption pattern. 28% consume fruits weekly, while 18% rarely consume local fruits. Only 15% of respondents consume local fruits daily. This indicates that local fruits are regularly included in the diets of many respondents, daily consumption is relatively low.



Highlights:

1. 39% of respondents consume local fruits two to three times a week.
2. 28% consume local fruits once a week.
3. Only 15% consume local fruits daily.
4. 18% rarely consume local fruits.

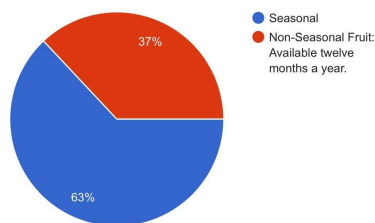
Second: Type of fruits consumed:

Among the respondents, 63% reported consuming seasonal fruits more frequently, whereas 37% preferred non-seasonal fruits that are available throughout the year. Seasonal fruits remain the more popular choice among consumers, possibly due to their freshness, availability, taste, and relatively lower prices during the season.

Which type of fruits do you consume most ?

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100 responses



Highlights:

1. Seasonal Preference: 68% of respondents consume seasonal fruits more frequently.
2. Non-Seasonal Fruits: 37% prefer fruits that are available throughout the year.
3. Higher Seasonal Demand: Seasonal fruits show a stronger preference among the respondents.
4. Freshness, taste, availability, and relatively lower seasonal prices may influence this preference.

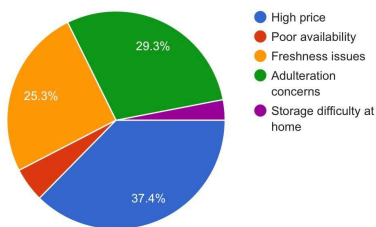
Third: Problems in accessing or consuming fruits:

The findings show that 37.4% of respondents identified high prices as the major problem, making affordability a significant barrier. 29.3% expressed concerns about adulteration, while 25.3% reported freshness issues. A smaller proportion of respondents identified poor availability and storage difficulties. This indicates that price, food safety and freshness are the primary concerns affecting regular fruit consumption.

What problems do you face in accessing or consuming fruits regularly?

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99 responses

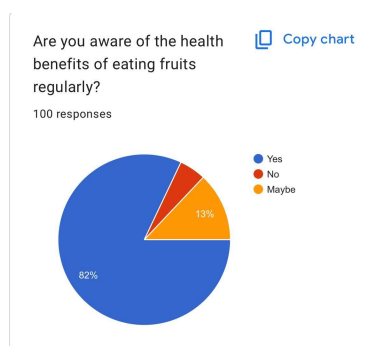


Highlights:

1. Price as a Major Barrier: 37.4% of respondents identified high prices as their main concern.
2. Adulteration Concerns: 29.3% expressed concerns about fruit adulteration.
3. Freshness Issues: 25.3% reported freshness as a significant problem.
4. A smaller proportion identified poor availability and difficulties with home storage.
5. Price, food safety, and freshness emerge as the primary barriers to regular fruit consumption.

Fourth: Awareness of health benefits:

The results indicate that 82% of respondents are aware of the health benefits of eating fruits regularly. Meanwhile, 13% responded “Maybe,” showing some uncertainty, and only 5% were not aware of the benefits. This suggests that the surveyed population has a high level of awareness about the nutritional and health benefits of fruits.



Highlights:

1. 82% of respondents are aware of the health benefits of regular fruit consumption.
2. 13% of respondents remain uncertain about the benefits.
3. Only 5% are not aware of the health benefits of fruits.
4. The findings indicate a generally high awareness of the nutritional value of fruits among respondents.

Fifth: Perception of sufficient fruit consumption:

The findings show that 46% of respondents believe they do not eat enough fruit to meet their nutritional needs. Meanwhile, 29% believe they consume enough fruits, while 25% are uncertain about whether their intake is sufficient.

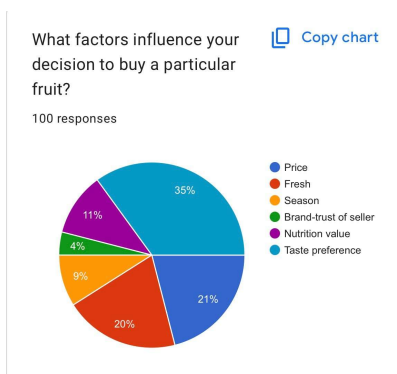


Highlights:

1. 46% of respondents believe they do not consume enough fruits to meet their nutritional needs.
2. 21% believe their current fruit consumption is adequate.
3. 25% are uncertain about whether they consume enough fruits.
4. Potential Nutritional Gap: A significant proportion of respondents may not be consuming sufficient fruits to meet their nutritional needs.

Sixth: Factors influencing fruit purchase decisions:

The data show that taste preference is the most influential factor, accounting for 35% of responses. Price is the second most important factor at 21%, followed closely by freshness at 20%. Nutrition value influences 11% of respondents, while seasonal availability accounts for 9%. Only a small proportion consider the brand-trust of the seller as their primary factor.



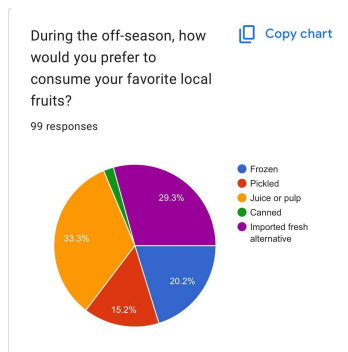
Highlights:

1. Taste preference, being the most influential factor, accounts for 35% of responses.
2. 21% of respondents consider price as their primary factor for purchase.
3. Freshness influences 20% of respondents when they purchase fruits.
4. 11% consider nutritional value the most important factor.
5. 9% are primarily influenced by seasonal availability.

- Only a small proportion consider seller or brand trust as their primary purchasing factor.

Seventh: Off-season fruit consumption:

The findings show that 33.3% of respondents prefer to consume their favorite local fruits as juice or pulp during the off-season. 29.3% selected imported fresh alternatives, while 20.2% preferred frozen fruits. Another 15.2% prefer pickled fruits, and only a small proportion prefer canned fruits. This indicates that juice/pulp and imported fresh alternatives are the most preferred options for accessing fruits outside their natural season.



Highlights

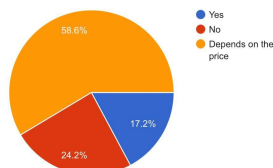
- 33.3% of respondents prefer juice or pulp to consume local fruits during the off-season.
- 20.2% prefer frozen fruits and 15.2% prefer pickled fruits. as off-season alternatives.
- 13.3% prefer imported fresh fruits when local varieties are unavailable.
- Only a small proportion of respondents prefer canned fruits.
- Processed forms such as juice and pulp appear to be more preferred than fresh imported or preserved alternatives during the off-season.

Eighth: Willingness to pay a premium:

Regarding processed or preserved local fruit products, 58.6% of respondents stated that their willingness to pay a premium depends on the price. Meanwhile, 17.2% are willing to pay a premium, while 24.2% are not willing to do so. This suggests that price sensitivity is a major factor in consumers' purchasing decisions, although there is considerable potential demand for value-added local fruit products if they are offered at an acceptable price.

Would you be willing to pay a premium for processed/preserved local fruit products
99 responses

[Copy chart](#)



Highlights:

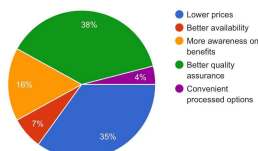
1. 58.6% of respondents indicated that their willingness to pay a premium depends on the price.
2. 72.2% of respondents expressed willingness to pay a premium for processed or preserved local products.
3. 24.2% stated that they would not be willing to pay a premium.
4. The responses indicate that acceptable pricing remains an important consideration for consumers.
5. Potential for Value-Added Products: The level of willingness suggests potential demand for processed and preserved local fruit products at reasonable prices.

Ninth: Factors encouraging higher fruit consumption:

The findings show better quality assurance as the most important factor. It is identified by 38% of respondents. 35% stated that lower prices would encourage them to consume more fruits. It makes affordability another major concern. Meanwhile, 16% of respondents highlighted that there is a need for greater awareness of the health benefits of fruits. 7% preferred better availability, while a smaller proportion considered convenient processed options.

What would encourage you to increase your fruit consumption?
100 responses

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Highlights

1. 38% of respondents identified better quality assurance as the main factor that would encourage higher fruit consumption.
2. 35% believe lower prices would encourage them to consume more fruits.
3. 16% highlighted greater awareness of the health benefits of fruits.
4. Better Availability: 7% identified improved availability as an important factor.

5. A small proportion preferred convenient processed fruit options.
6. Quality assurance and affordable pricing emerge as the two strongest factors that could increase fruit consumption.

5.Results: Empirical Supply Chain Solutions and Survey-Based Off-Season Customer Preferences

This section outlines the key results based on the multi-node supply chain analysis and empirical consumer surveys. By addressing structural constraints along the chain from production to consumption with quantifiable data regarding consumer behavior during off-season, these results provide ways to cut down post-harvest losses, correct market inefficiencies, and maximize local value addition of fruits in Bangladesh.

1. Mitigation of PostHarvest Losses in Handling & Logistics

- A. **Transition to Rigid Vented Crates:** By swapping out unventilated jute sacks and rough bamboo baskets for reusable, perforated plastic crates made from high-density polyethylene Transition to Rigid Vented Crates stops compression damage and heat buildup that usually happen on long road trips.
- B. **Farm-Gate Pre-Cooling Infrastructure:** Setting up low-cost Evaporative Cooling Chambers at rural assembly points removes the heat that stays on fruit right after harvest. Farm-Gate Pre-Cooling Infrastructure slows fruit respiration and browning helping Litchi (Litchi) and Guava (Peyara) stay longer.
- C. **Refrigerated Transit Subsidies:** Using tariff exemptions, for refrigerated trucks reduces the cost of keeping Bananas (Kela) and Watermelons (Tarmuj) at the right temperature. Refrigerated Transit Subsidies keeps fruit from cracking under road vibration. Stops the pulp from bruising inside.

2. Restructuring Financial Access and Middleman Exploitation

- A. **Formal Harvest Micro-Credit:** Expanding micro-loans through Bangladesh Krishi Bank (BKB) breaks the dependence of smallholders on high-interest Dadondar advance-sale agreements giving farmers price leverage at the farm gate.
- B. **Farmer Producer Organizations (FPOs):** Aggregating smallholder yields at cooperative hubs allows farmers to sell directly to urban retail chains capturing a larger share of the end-consumer price.

- C. **Real-Time Price Intelligence:** Disseminating wholesale auction rates from urban hubs (e.g., Karwan Bazar) via mobile SMS feeds through the Department of Agricultural Marketing (DAM) reduces information asymmetry, for rural growers.

3. Eradication of Chemical Adulteration and Food Safety Hazards

- A. **Commercial Ethylene Ripening Hubs:** By swapping the calcium carbide dipping with government-subsidized hot-water treatment (HWT) and using central ethylene gas ripening rooms we guarantee that all fruit ripens the same way and that there are no biological safety risks.
- B. **Integrated Pest Management (IPM) & Testing:** By increasing training, on and enforcing the pre-harvest interval (PHI) we lower the amount of pesticide residue. At the time we send mobile testing teams to wholesale Arats so they can spot unapproved preservatives right away.

4. Innovation Perspective: High-Value Fruit Products (Chips, Dehydration and Upcycling)

The focus here is on turning fruit surpluses often seen as value or wasted into profitable high-quality consumer goods. By using food technologies we can move beyond simple preservation and create products that are not only stable but also command high margins in the market

- A. **Vacuum-Fried Fruit Chips (Jackfruit & Green Mango):** When it comes to fruit that grows in abundance but has limited market value like Jackfruit and Green Mango processing them into vacuum-fried chips changes the game. These chips are made under pressure and low temperature which keeps most of the natural nutrients intact. Up to 90% of vitamins. The original color stay in the fruit. This method also uses little oil making the final product healthier and more appealing. The result is a shelf-premium snack that can be sold in urban grocery stores and exported to international markets.
- B. **Solar and Mechanical Dehydration (Dried Slices & Fruit Leather):** Another way to add value is by drying fruit right at the farm. Using tunnel dryers and mechanical dehydrators allows farmers to process over-ripe Mangoes, Pineapples and Papayas quickly and safely. No harmful chemicals are. The final products dried slices, fruit candies and fruit leather last long and stay fresh. These products are perfect for consumption and can also be exported, especially to markets like the UK and other parts of Europe where demand for natural healthy snacks is growing.
- C. **Industrial Upcycling of Fruit By-Products:** Most fruit processing creates waste peels, rinds, seeds and cores. This waste can be turned into something valuable. For example Jackfruit rinds, Mango peels and Citrus seeds can be used to extract pectin, essential oils and dietary fiber. These extracted materials are useful in food processing and even in the pharmaceutical industry. By

upcycling these by-products we reduce waste. Create new raw materials that can be used in high-value products. This not improves sustainability but also opens up new income streams for farmers and processors.

In short by applying innovation to fruit products we can transform low-value surplus into high-value goods. Whether it's chips, dried snacks or industrial ingredients from waste the future of fruit farming is not, about growing more—it's about adding more value.

5. Off-Season Processing and Value Addition Based on the survey empirical findings

there is an unmistakable consumer preference for fruit alternatives in the off season. As opposed to importing fruits at a high cost (presently responsible for 26.9% of off-season consumers' demand), the supply chain should consider local processing routes.

- A. **Pulping & Juice Processing Expansion** (37.2% Consumer Preference): The survey shows that juice and pulp are the choice for people who want fruit outside of harvest time. Pulping & Juice Processing Expansion can be achieved by building pulping and aseptic packaging plants in major production areas, such as Rajshahi for Mango and Tangail for Jackfruit/Pineapple. Pulping & Juice Processing Expansion can soak up the fruit that appears in the season stop wholesale market crashes and provide stored raw material that beverage makers can use.
- B. **Individual Quick Freezing (IQF) Infrastructure** (24.4% Consumer Preference): one in four participants like frozen fruit when the market is slow. By growing commercial flash-freezing facilities Individual Quick Freezing (IQF) Infrastructure can keep fruits such as Jackfruit and Litchi fresh for a long time without changing the flavor or needing extra chemical stabilizers.
- C. **Import Substitution Strategy**: Domestic juice pulping (37.2%) and flash freezing (24.4%) together satisfy 61.6% of what people want when fruit's not in season. By building these two supply chain nodes Import Substitution Strategy pulls market demand away from imported fruit (26.9%) and keeps money inside the local agricultural economy.
- D. **Targeted Cottage Industry Processing** (10.3% Pickled vs. 1.3% Canned): The survey shows that people like items more than canned ones. Targeted Cottage Industry Processing should focus on low-cost artisanal pickling, for green mangoes and plums (Amra) instead of building expensive canning plants.

6. Discussion

From a Fragmented Chain to an Integrated System: Bangladesh's fruit supply chain includes farmers, collectors, wholesalers, retailers and consumers but coordination among these actors remains

weak. Removing intermediaries is not the solution because intermediaries provide important market and aggregation functions. Better coordination is needed among existing actors. A integrated system can connect farmers with collection centres, grading, packaging, storage, transportation and organized buyers. This can improve both fruit flow and fruit market access.

Cold Chain and Storage: access to pre-cooling and cold storage forces farmers and traders to sell fruit quickly especially during peak seasons. However cold storage alone cannot solve losses caused by harvesting or handling. Therefore affordable and decentralized cold-chain facilities near production areas would be more practical. Storage requirements should also vary according to the characteristics and perishability of each fruit.

Harvesting, Handling and Packaging: harvesting, rough handling and unsuitable packaging contribute significantly to fruit damage. Simple improvements such as harvesting tools, maturity selection, reusable crates and better loading practices can reduce these losses. Such solutions are particularly important for farmers because farmers require less investment than advanced technologies. Collection centres can also provide packaging and handling facilities.

Market Information and Coordination: access to reliable information about prices demand and buyer requirements creates uncertainty for farmers and other supply-chain actors. Digital platforms and organized farmer groups can improve information sharing. However technology should be supported by extension services and local organizations so that farmers can use the information effectively. Better market information can also help buyers plan procurement before seasonal harvests reach the market.

Processing and Value Addition: Seasonal oversupply often causes prices to fall and increases the risk of fruit. Processing can provide a market for suitable surplus fruit through products such as pulp, juice, dried fruit and jam. This can extend the life of fruit while creating additional value. A multi-channel system can direct high-quality fruit to export markets and suitable lower-grade fruit to processing.

Farmer–Processor and Retailer Linkages: Stronger relationships between farmers, processors and organized retailers can improve market certainty and supply consistency. Contract farming and organized procurement can provide farmers with reliable buyers while helping businesses obtain consistent-quality fruit. However these arrangements should ensure pricing and fair contractual conditions. Farmer groups can strengthen the bargaining position of producers.

Fruit-Specific Strategies: Different fruits have levels of perishability handling requirements and market conditions. For example litchi requires handling while mango has significant opportunities for both fresh consumption and processing. Therefore Bangladesh should develop a supply-chain framework while applying fruit-specific solutions. This approach would be more practical than using one system for every fruit.

An Integrated Supply-Chain Model: Based on the reviewed literature a cluster-based model can connect farmers with aggregation centres for sorting, grading and packaging. Fruit can then move through storage and transportation channels according to quality and market demand. Premium fruit can target organized retail and export while suitable lower-grade fruit can enter processing. Such integration can reduce losses improve coordination and create value throughout the supply chain.

Conclusion Bangladesh has potential, in fruit production but weaknesses after production prevent the country from fully realizing this potential. The problem is not simply producing more fruit but preserving the value of fruit from farm to consumer. An integrated approach combining aggregation, better handling, packaging, storage, transportation, market information and processing can address bottlenecks together. The future of Bangladesh's fruit industry depends on losing less coordinating better and creating value from what is already produced.

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