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# Analysis of the onion value chain in Bangladesh

Towards a strategic action agenda for the Dhaka city corporations

M.G. (Melanie) Kok MSc, dr.ir J.M. (Han) Soethoudt and D.M. (Vera) Vernooij MSc



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# Abbreviations

BBS	Bureau of Statistics
DAE	Department of Agriculture of Extension
DAM	Department of Agriculture Marketing
DCC	Dhaka City Corporations
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross Domestic Product
GoB	Government of Bangladesh
HSC	Higher Secondary Certificate
FLW	Food Loss and Waste
PS	Private Sector
SAU	Sher-e-Bangla Agricultural University
SSC	Secondary School Certificate
WUR	Wageningen University and Research

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# Summary

Onions are a popular product in Bangladesh, mostly used as spices to give aroma, taste and flavor to food. Onions are used in all types of curries and salads being prepared on a daily basis in home-kitchens and restaurants. Generally for vegetable supply chains in Bangladesh, post-harvest losses and shrinkage are considered main weaknesses and losses are estimated to be higher than 5%. Food Loss and Waste (FLW) studies for onion in Bangladesh are scarce but indicate that the loss percentage increases with the length of the supply chain. An opportunity for the onion supply chain in Bangladesh is to work towards reducing food losses at various links of the chain. This onion value chain analysis in Bangladesh is performed as a first step with the aim to develop a strategic action agenda on the onion supply chain for the four city corporations in Dhaka. It focusses on identifying the leverage points for reducing food losses for onions in order to improve the performance of the onion value chain and thereby to increase the amount of onions that reach consumers and enhance food availability. This strategic action agenda focusses on the (post-)harvest supply chain up to and including food retail and processing.

The analysis of the onion value chain is drafted based upon data and information gathered in two literature studies, a workshop conducted with multiple actors in the supply chain and extensive interviews conducted with individual actors in the supply chain. The interviewees included agricultural producers, intermediaries and truck drivers in Kushtia, Pabna, Faridpur, Rajshahi and Rajbari districts, and wholesalers, retailers, mobile vendors and institutional users located in Dhaka North, Dhaka South, Narayanganj and Gazipur city corporation area.

Part of the produced onions cannot be sold or do not meet the right quality, and do not go to the intended market. Products that do not have the right quality for the intended market are used for home consumption, charity, animal feed or landfill. Losses occur during harvesting, since some onions were harvested immature, onions were perished or damaged during the harvesting activity, or the agricultural producers remain with unsold onions. Onions in Bangladesh spoil quickly due to the poor quality onions due to wrong use of inputs, and the high moisture content due to improper drying. The economic losses at agricultural producers are estimated at 2.4% of the total production volume. The highest economic losses in the post-harvest supply chain occur at mobile vendors (4.6% of total input volume) and retailers (4.1% of total input volume), since they most often lack the ability to sell all onions before spoiling. Overall low quality onions will perish in time and often express itself later in the supply chain. This forces agricultural producers and other actors to sell their onions quickly after harvest or purchasing, and limit their ability to store the onions till after the peak supply to get a better price.

Other challenges related to the post-harvest supply chain originate in the enabling environment. Transportation faces challenges such as extortion on the road, bad road communication and high fuel costs. Another major reported barrier for optimization of the onion value chain in Bangladesh is price volatility leaving actors forcefully to sell at throwaway prices, or contrary leading to high consumer prices for onions. Underlying reasons for price volatility of onions are related to syndicates that artificially drive up or down prices as well as onion imports during harvesting times when already enough onions are available in the market. This also complicates sharing accurate market information. The majority of the unsold onions ends as landfill (FLW) followed by home consumption (not FLW).

Opportunities are related to proper mechanisms to control prices by controlling onion imports and improving information and communication systems, creating incentives to generate the possibility to invest and improve the quality and quantity of the onions produced, and improve the transportation system and facilities towards the city of Dhaka and start decentralizing by reducing the pressure from the main urban areas.



# 1 Introduction

Bangladesh is principally an agricultural based country dominated by crop production. In 2015-2016 the agricultural sector contributed 14.74 % to the country's Gross Domestic Product (GDP), providing employment to about 41% of the labour force (Bangladesh Economic Review 2017). Increasing population growth and urbanization provide food supply challenges and opportunities to feed the growing (urban) population. In 2018 Bangladesh had 9,202.3 thousand hectares of agricultural land of which 830 thousand hectares under permanent crops. In 2018 7,772.3 thousand hectares (84.5% of agricultural land) was arable (FAOSTAT 2018).

As the population of the capital of Bangladesh, Dhaka, grew substantially in the last years, the pressure on the food supply increased. Dhaka is among the top 25 cities in Asia and is growing fast both demographically and economically (Zaman. M., 2019). The 8.9 million inhabitants of Dhaka need to eat food every day and primarily depend on food purchases. Due to this, Dhaka is dependent on food inflows from the rural areas. Large amounts of grain, fish, spices, vegetables, fruits and meat need to be delivered to Dhaka every day in order to meet the demand (Etzold, 2008).

From an survey conducted in 2009-2010, it is known that raw food is sold at 87 different wholesale markets within the area of Dhaka City Corporation (DCC) (Keck 2012). The inflow of food to the city of Dhaka is going on several ways. One way for food entering the city is by the wholesale markets. These are the major distributional links from which food flows into various channels of the urban food system. The majority of the food that is entering Dhaka, flows in informal markets.

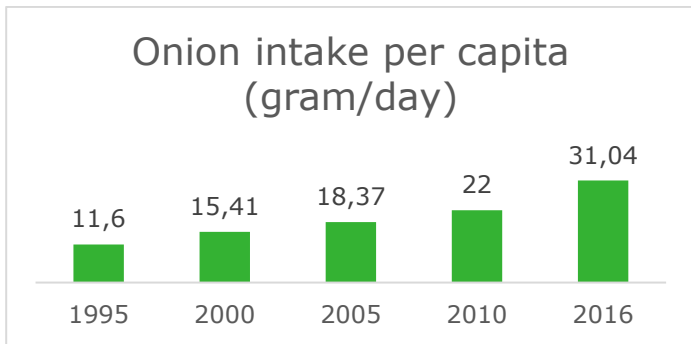
Onions are a popular product in Bangladesh, mostly used as spices to give aroma, taste and flavor to food. Onions are used in all types of curries and salads being prepared on a daily basis in home-kitchens and restaurants. The total onion production in Bangladesh in 2017-2018 was estimated at 1.738 million tons. The top five production districts are Pabna, Faridpur, Rajbari, Kushtia and Rajshahi, in the Midwest regions of the country. These areas covered 68.5% of the countries onion production in 2017-2018 (BBS, 2018). Production of onions keeps increasing: according to the Department of Agricultural Extension, in 2020 above 1.2 million agricultural producers have cultivated onions on a record 0.24 million hectares of land (Sami, 2020).

Bangladesh also imports onions, primarily from India but also from China, Pakistan, Egypt, Myanmar and Turkey. Table 1 shows that in addition to the own production, in 2017-2018 more than 1 million tons of onions were imported. Combining production, import and a growing population, the current total consumption of onions is estimated at around 3 million tons yearly.

**Table 1 Country's production and import of onion from 2013 until 2018 (BBS, 2018)**

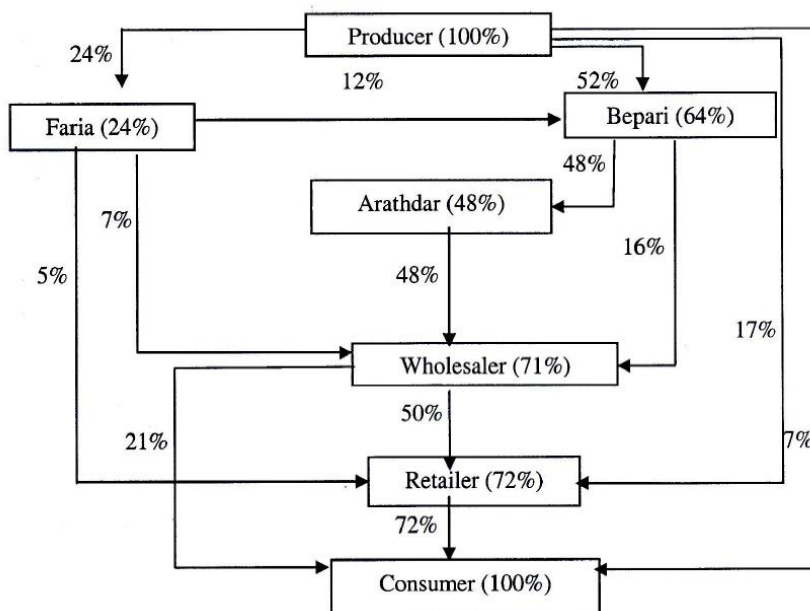
Year	Production (metric ton)	Import (metric ton)	Total
2013-14	1,387,000	811,000	2,198,000
2014-15	1,704,000	880,000	2,584,000
2015-16	1,735,000	921,000	2,656,000
2016-17	1,867,000	953,000	2,820,000
2017-18	1,738,000	1,091,000	2,829,000

The consumption of onions in Bangladesh increased substantially since 1995, namely more than doubling from 11,6 gram/capita/day to 31,4 gram/capita/day in 2016 (Figure 1). Urban consumers consume slightly more than rural consumers: in 2016 urban consumers consume 34,5 gram/capita/day whereas rural consumers consume 29,8 gram/capita/day (BBS, 2016). The average onion consumption varies between regions and the main outlets are in the urban areas of Sylhet, Chattogram and Dhaka (Ahmed and Hoque, 2014).



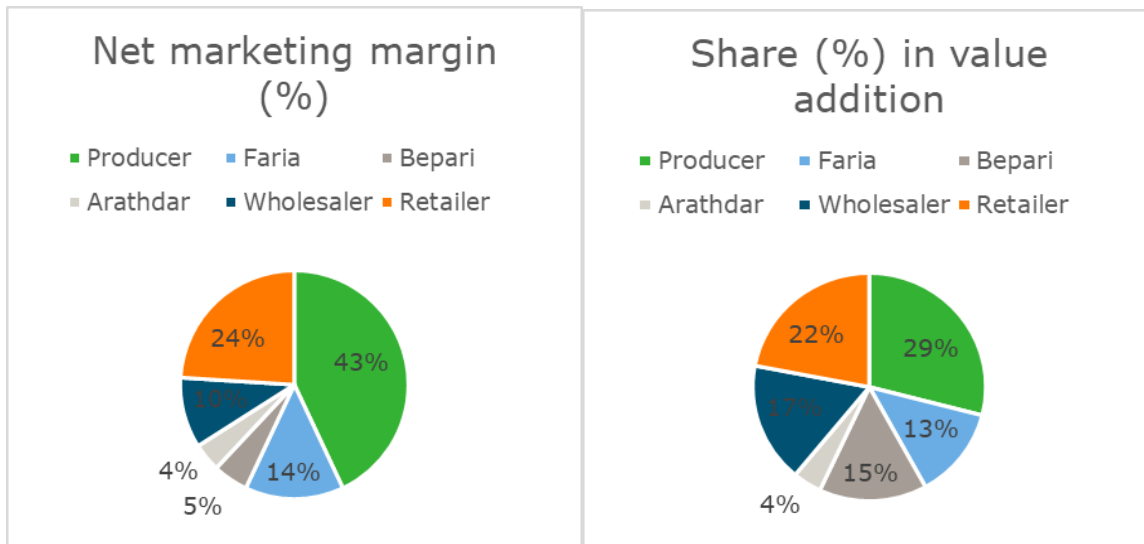
**Figure 1 Daily per capita intake of onions in Bangladesh from 1995 until 2016 (BBS, 2016)**

A typical agricultural supply chain consists of agricultural producers (farmers), different types of traders and consumers. Traders involved in the onion supply chain in Bangladesh are, from smaller scale to larger scale, *faria*, *bepari*, *arathdar*, wholesalers (local, divisional and regional) and retailers (local and urban). Figure 2 shows the onion supply chains and volume share of flows (Sabur et al. 2006).



**Figure 2 Onion supply chains and volume share of flows (Sabur et al., 2006)**

As Figure 3 shows, net marketing margin and share of value addition (%) are greatest for agricultural producers and retailers. Wholesalers and *bepari* have a relatively great share in value addition but a relatively smaller net marketing margin. *Faria* and *arathdar* have more or less equally net marketing margins and share in value addition.



**Figure 3 Net marketing margin (%) and share (%) in value addition of value chain actors (Islam et al. 2019)**

In 2011 the food loss and waste (FLW) worldwide was estimated to be one-third of what is produced for human consumption with most losses taking place for the perishable fruits and vegetables food categories (Gustavsson et al. 2011). In order to increase the amounts of food that reaches consumers, it is therefore very relevant to study where at various links of supply chains FLW takes place. Generally for vegetable supply chains in Bangladesh, post-harvest losses and shrinkage are considered main weaknesses, and losses are estimated to be higher than 5% (Ahsanuzzaman et al. 2017; Hasan and Naim 2018). FLW studies for onion in Bangladesh are scarce but indicate that the loss percentage increases with the length of the supply chain, varying from 2 – 9% depending on chain length, from the shortest (one intermediary between agricultural producer and consumer) to the longest (four intermediaries between agricultural producer and consumer) supply chain (Adnan et al. 2014). An opportunity for the onion supply chain in Bangladesh is to work towards reducing food losses at various links of the chain.

## 1.1 Goal

This onion value chain analysis in Bangladesh is performed as a first step with the aim to develop a strategic action agenda on the onion supply chain for the four city corporations in Dhaka. The ultimate goal is to decrease food loss and waste (FLW) with 5% and increase food availability. A strategic action agenda intends to develop and determine the strategic position to reach its goal. It prioritizes the objectives and concrete steps needed to attain the goals set – usually covering the coming years. It is the common view on and basis for the process towards developing concrete plans to reach the required outcome. Here we identify the leverage points for reducing food losses for onions in order to improve the performance of the onion value chain and thereby to increase the amount of onions that reach consumers and enhance food availability.

In order to achieve the goal we use the food systems approach of Van Berkum et al. (2018), zooming in on the food system activities and food availability in the top five onion producing districts and the four city corporations in the city of Dhaka.

## 1.2 The food system approach

This report is structured following the food systems approach (van Berkum et al. 2018). The food systems approach is aimed at sustainable solutions for sufficient supply of healthy food. System thinking with the help of this approach broadens the perspective when seeking solutions for the root causes of problems. Figure 4 presents an overview of the approach. This strategic action agenda focusses on the (post-)harvest supply chain up to and including food retail and processing. Food consumption is out of scope.



**Figure 4 A way of mapping the relationships of the food system to its drivers (Van Berkum et al. 2018)**

The scope of this report is circled in Figure 4, namely the food system activities and food security. The food system activities include the food supply system, which describes the different supply chain actors and their activities, challenges (including FLW) and mutual connection, and the enabling environment, business services, food environment and consumer characteristics.

For the food system activities, this report includes the first four aspects of the 'food supply system' namely agricultural production, food storage, transport & trade, food processing & transformation, and food retail & provisioning. Food consumption is out of scope. The value chain is at the heart of the food supply system where value is added in each step (van Berkum et al. 2018). Furthermore this strategic action agenda includes two of the four parts that interact directly with the food supply system: the enabling environment in which the food supply system is embedded (transport, regulation, institutions and research infrastructure), and business services that provide services and goods to the actors in the chain (training, agricultural inputs, technical support or financial services). Out of scope are the food environment and consumer characteristics, as these topics have a direct linkage with the consumer that is out of scope. The box 'food security' includes food utilization, food access and food availability. This food system analysis includes food availability only. Food utilization and food access are out of scope. Within food availability, this report includes all aspects namely production, distribution and exchange.

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## 2 Methodology

The analysis of the onion value chain is drafted based upon data and information gathered in two literature studies, a workshop conducted with multiple actors in the supply chain and extensive interviews conducted with individual actors in the supply chain.

### 2.1 Literature studies

Two literature studies on the onion value chain in Bangladesh were conducted. One study was conducted by Wageningen University & Research (WUR) and included studies conducted in the English language, and international available data and statistics. The second literature study was conducted by Sher-e-Bangla Agricultural University (SAU) and included information from local statistics agencies and governments, and studies conducted in English and the Bengali language. Topics included production, consumption and trade, an economic analysis, the supply chain with their actors and challenges, food losses, and other issues included in a food system analysis like climate and transport.

### 2.2 Workshop

At 28 January 2020 the Food and Agriculture Organization of the United Nations (FAO) in Bangladesh, in collaboration with WUR, organized a workshop with actors in the onion supply chain to better understand the supply chain actors, their roles and functions in the value chain, as well as to identify the major challenges within the supply chain regarding inputs, quality of the produce available, food losses, distribution and relations. It was decided to apply a participatory value chain mapping approach to initiate a dialogue between the different actors involved and to validate the information provided by the different actors. The geographical map developed through this process showed where products come from, the passage of the commodity from the farm to the city, the locations it flows through and which channels the commodities flow through. Fourteen participants contributed to the workshop which included agricultural producers, aggregators, wholesalers/importers, retailers and legislators in the form of the responsible government authority. The agricultural producers and aggregators were selected with the consultation of the Department of Agriculture of Extension (DAE), and the importers, wholesalers and retailers were selected with the consultation of Department of Agriculture Marketing (DAM). Minimum two delegates from each value chain actor were selected to participate in the workshop and were divided in two separate groups that included seven participants each. The workshop was facilitated by experts from the FAO in the Bengali language.

### 2.3 Extensive interviews

325 face-to-face executive interviews were executed by SAU by field visiting study areas between 16 July 2020 and 27 July 2020. Actors included in the interviews were agricultural producers, intermediaries, truck drivers, wholesalers, retailers, mobile vendors and institutional users (Table 2). In order to ensure the highest level of quality, the following measures were adopted by SAU:

- a) Recruitment of appropriately qualified and experienced enumerators (Graduate completed and studying Master of Science in SAU and expert in GPS machine and mobile apps system)
- b) Training on use of the interview techniques and use of tools appropriately including field exercise
- c) Pre-testing of questionnaire
- d) Correction of questionnaire according to result found on field tests
- e) Supervision by core team members
- f) Sudden visit by core team member
- g) Day to day checking of collected data in order to ensure proper filling and recording of data
- h) Preserving telephone number of the respondents to recheck if necessary at the analytical stage.

**Table 2 Definitions actors in the onion supply chain (Hasan and Naim 2018; Hasan et al. 2007)**

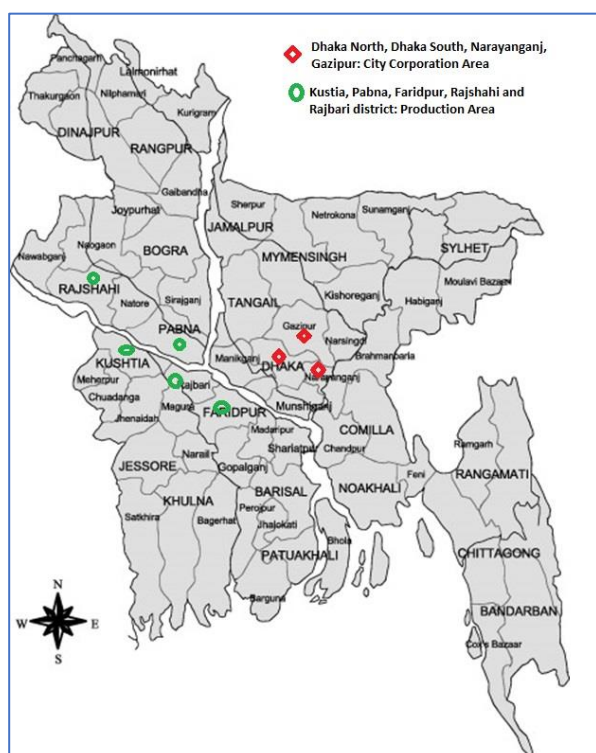
Actor	Description
Agricultural producer	People (farmers) who produce onion.
Intermediary	<p>People who buy onions from agricultural producers or other actors and sell to another. Intermediaries included <i>faria</i>, <i>bepari</i> and <i>arathdar</i>.</p> <ul style="list-style-type: none"> <li>• <i>Faria</i> are intermediaries who collect produce from farmyards, or from agricultural producers in the village or in the local market and sell in local markets to the <i>bepari</i>, or directly to consumers. They have no permanent shop.</li> <li>• <i>Bepari</i> are intermediaries who assemble in local markets and buy from agricultural producers or <i>faria</i> and supply to urban centers. They sell to wholesalers or retailers through <i>arathdars</i> or commission agents. They have no permanent shop.</li> <li>• <i>Arathdar</i> are commission agents who have a fixed establishment and operate between urban <i>beparis</i> and wholesalers or retailers.</li> </ul>
Driver	People who drive vehicles (truck) to carry onions from one place to another.
Wholesaler	People who buy onion from intermediaries or other actors and sell onions in bulk amount to retailers or other actors or consumers.
Retailer	People who buy onion from wholesaler or other actors and sell onions to consumers or to some other actors in small amount.
Mobile vendor/vendor	People who don't have any specific location/place to sell onions; rather they sell onions by moving from one place to another.
Institutional user	Institutes that use onions for various reasons.

### 2.3.1 Sampling plan

Table 3 provides the survey area and sample size per type of actor. The actors were sampled from five different production districts, including Kushtia, Pabna, Faridpur, Rajshahi and Rajbari, and four city cooperation areas, including Dhaka North, Dhaka South, Narayanganj and Gazipur. This is visualized in Figure 5.

**Table 3 Sample size and distribution**

No.	Survey area/ sample distribution	Survey method	Respondents	Sample size
1.	Five selected production area for onion commodity (district which produced highest production of specific commodity). Production areas for onion are Kushtia, Pabna, Faridpur, Rajshahi and Rajbari districts.	Face to face executive interview	Agricultural producers	60 (12 for each production area)
2.	Five selected production area for onion commodity (district which produced highest production of specific commodity). Production areas for onion are Kushtia, Pabna, Faridpur, Rajshahi and Rajbari districts.	Face to face executive interview	Agreed market intermediaries	50 (10 for each production area)
3.	Five selected production area for onion commodity (district which produced highest production of specific commodity). Production areas for onion are Kushtia, Pabna, Faridpur, Rajshahi and Rajbari districts.	Face to face executive interview	Truck drivers	15 (3 for each production area)
4.	Four major wholesale markets in each of 4 cities (Dhaka North, Dhaka South, Narayanganj and Gazipur city corporation area)	Face to face executive interview	Wholesalers	20 (5 for each markets)
5.	20 Traditional retail markets from 4 city corporations (5 from each city)	Face to face executive interview	Retailers	60 (3 for each markets)
6.	60 Informal mobile vendors from 4 city corporations (15 from each city)	Face to face executive interview	Informal roadside mobile vendors	60 (15 from each city)
7.	60 Institutional users (15 from each city)	Face to face executive interview	Restaurants, food processors	60 (15 from each city)



**Figure 5 Map of onion value chain survey**

### 2.3.2 Data collection

Seven different structured questionnaire surveys were developed, one questionnaire per type of actor. These were translated into the Bengali language and entered in the Kobo apps tool system - an online electronic data entry recording system. The survey app was developed by using Kobo collection software<sup>1</sup> for data collection and especially as downloadable by a user to an Android mobile device. Kobo Collect is based on the open data kit and is used for primary data collection. The platform is very intuitive and offers comprehensive collection alongside basic mapping and analysis capabilities. Users can export data into more powerful analysis tools and it has a GPS tracking system. Data processing work consisted of cross checking and matching of data. Statisticians oversaw the data processing activities. Data was stored automatically in electronic data entry record system and data storing system.

### 2.3.3 Data Analysis

Kobo apps was developed for data entry. Data analysis was done by Kobo tool apps. Different types of statistical calculations like number, mean, mode, median, percent and standard deviation were used. A simple tabular technique was presented in the study to classify the data into meaningful categories.

### 2.3.4 Validating findings

Findings from the interviews were shared for discussion, feedback and validation in two sessions. One session took place with the FAO team members and one session took place with four city corporations experts from FAO Bangladesh. Results were incorporated in the recommendations section of this report. All sessions took place online.

<sup>1</sup> <https://www.kobotoolbox.org/>

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## 3 Results: Food system activities

This chapter describes the food system activities for onions in Bangladesh, which includes the food supply system, enabling environment and business services.

In Table 4 a SWOT-analysis is provided regarding the onion food system activities. This analysis shows the strengths, weaknesses, opportunities and threats related to the food supply system, the enabling environment and business services. These results are further explained in chapter 3.1, chapter 3.2 and chapter 3.3.

**Table 4 SWOT for onion supply chain activities**

Strength	Opportunity
<ul style="list-style-type: none"><li>• Part of the unsold onions is still used for human consumption (home consumption, charity)</li><li>• Use of fan for storage (long storage possible)</li></ul>	<ul style="list-style-type: none"><li>• Technical support on production and post-harvest handling like curing to increase the quality of onions</li><li>• Cooperative structures to organize actors</li><li>• Temperature controlled storage facilities within the supply chain</li></ul>
Weakness	Threat
<ul style="list-style-type: none"><li>• High costs for labour</li><li>• Low margins at agricultural producers' level</li><li>• No use of (semi-)automated tools</li><li>• High percentage of rotten onions</li><li>• Actors are dependent on their buyer in the form of loans</li><li>• Bad quality onions are sorted-out later in the supply chain</li><li>• Long thorough supply chain; actors all have to make profit</li></ul>	<ul style="list-style-type: none"><li>• Bad roads</li><li>• Bad road communication</li><li>• Lack of market information and their reliability</li></ul>

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### 3.1 Food supply system

Six main onion food system actors are described: agricultural producers, intermediaries (*faria*, *bepari* and *arathdar*), wholesalers, retailers, mobile vendors and institutional users (restaurants and hotels that prepare food for their customers). Table 5 gives an overview of the amount of onions that are being handled, what percentages are left unsold, the destinations of these unsold onions and the percentage of actors that sold out all onions. The percentages provided in the column under 'sold out' and behind the destinations of the unsold onions represent the amount of actors that mentioned it.



**Table 5 Summary table onion supply chain actors, kgs handled, unsold and destinations for unsold**

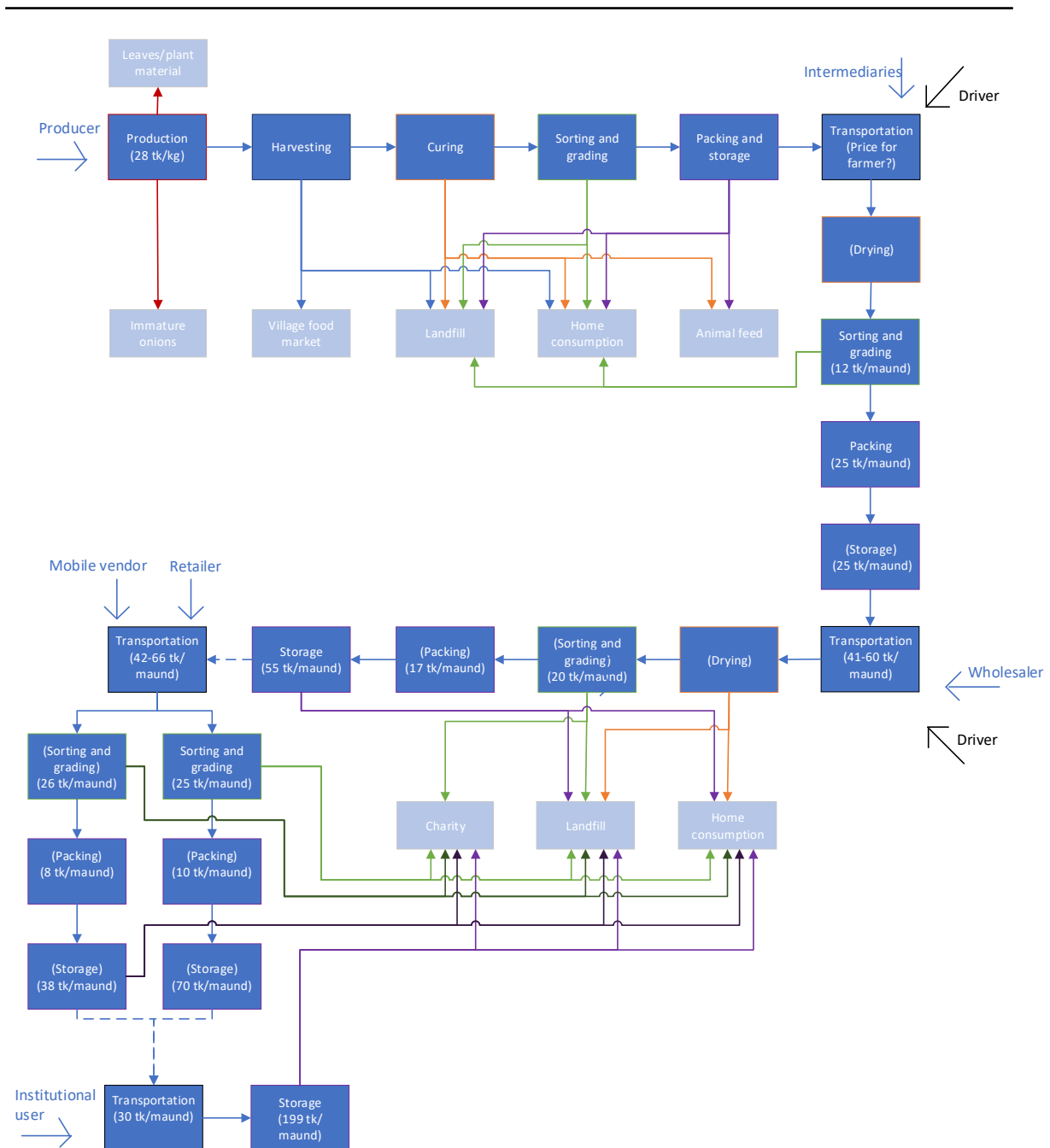
Value chain actors	Kgs handled (average per actor)	Kgs not sold (average per actor)	% unsold (average per actor)	% of actors mentioning to be sold out	1st destination of unsold onions	2nd destination of unsold onions
Agricultural producers	8,987	213	2.37	12%	Domestic consumption (77%)	Landfill (52%)
Intermediaries	5,312,356	6,108	0.11	48%	Landfill (36%)	Sold at lower price (26%)
Wholesalers	1,647,881	32,565	1.98	40%	Landfill (60%)	Domestic consumption (15%)
Retailers	51,048	2,088	4.09	35%	Landfill (58%)	Domestic consumption (42%)
Mobile vendors	31,918	1,473	4.61	43%	Landfill (42%)	Domestic consumption (30%)
Institutional users	6,051	62	1.02	67%	Landfill (25%)	Domestic consumption (15%)

Intermediaries and wholesalers handled the largest amounts of onions, they had a relatively small percentage that remained unsold compared to the other actors. Most unsold onions were at the level of the mobile vendors followed by the retailers. 88% of the agricultural producers remained with unsold onions; these were primarily going to domestic consumption. Of the other value chain actors, the retailers mostly lacked the ability to sell all onions: 65% indicated to remain with unsold onions. Majority of the unsold onions ended as landfill. Regarding FLW, the definition of Gustavsson et al. (2011) is used. Therefore the percentage of FLW is often lower compared to the percentage of unsold produce.

Every actor in the supply chain increases the value of the product. They perform different activities to differentiate themselves from their competitors, to maximize the margin on the products they sell and minimize their losses and costs.

In Figure 6 a summary of the activities, costs and destinations per actor are shown. When a certain activity is shown within parenthesis this means that the activity was conducted by less than 50% of the respondents. It also visualizes the cost per activity and the destination for unsold onions occurring per activity. However, sometimes an activity induces losses, but the destination is not provided. Therefore not all losses can be visualized in the figure.

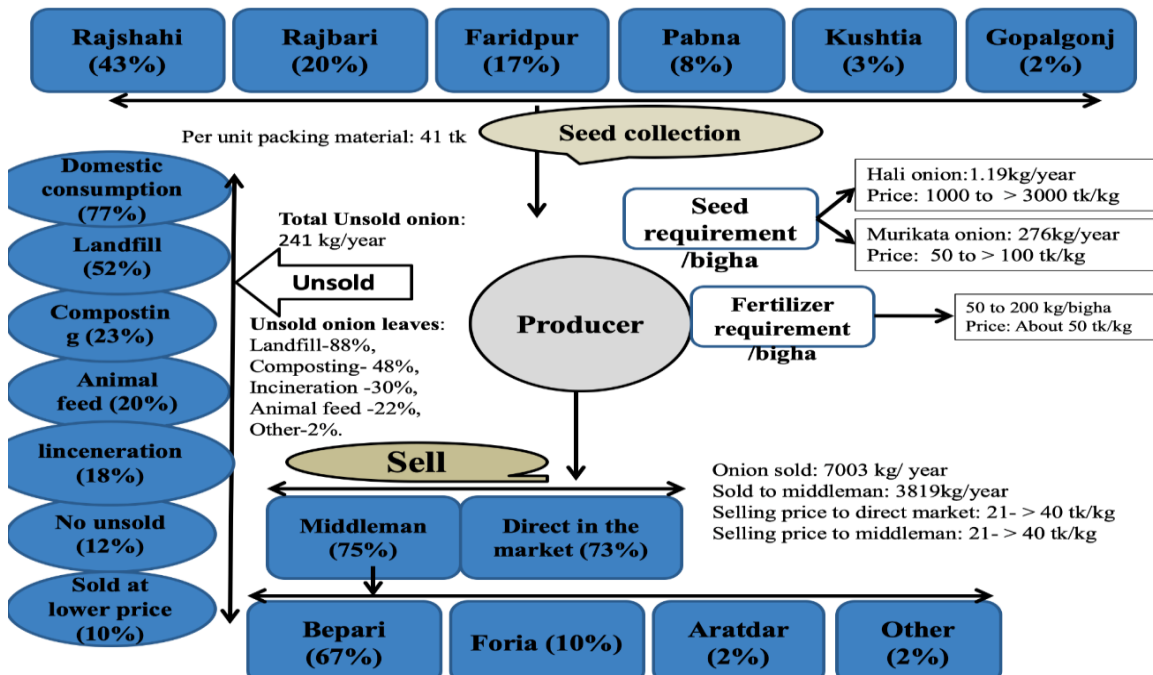
Hereafter the actors are described in more detail.



**Figure 6 Food flow per actor in the onion supply chain**

### 3.1.1 Agricultural producers

The average age of the interviewed agricultural producers (N=60) in Kustia, Pabna, Faridput, Rajshahi and Rajbari was 43 years, but the mean was 50 years. They had on average 18 years of experience but the majority of the actors had 10 years of experience. More than one-third (38%) received primary education only, one-third (30%) received high school education up to class 8 or a Secondary School Certificate (SSC), another 23% received education up to Higher Secondary Certificate (HSC) or graduated, 7% is illiterate, and one respondent received a post-graduation degree. 97% of the respondents were male.



**Figure 7 Agricultural producers value chain overview**

Figure 7 shows the agricultural producers value chain overview. Overall agricultural producers used 48% of their total farmland for onion production. This is on average 4.5 *bigha* (1 *Bigha* = 33 decimal). The average yield was 1,609 kg/*bigha*, which is 40 *maund/bigha* (1 *maund* = 40kg). On average 8,774 kg/year per agricultural producer was sold on the local market and/or to intermediaries. On average per agricultural producer 7,003 kg/year was sold to the market, and 3,819 kg/year to intermediaries. 88.3% of the agricultural producers did not sell all their produced onions, namely 241 kg/year/agricultural producer was indicated not to be sold. This is an average of 213 kg/year/agricultural producer for the total sample. This means that the total production was on average 8,987 kg/year/agricultural producer of which 2.37% was not sold. The unsold onions were consumed at home, used for landfill, composting, animal feed, incineration, or sometimes still sold at a lower price. The plant leaves from the onion production are used for landfill, composting, incineration, animal feed or otherwise used.

Dhaka workshop (January 2020) participants indicated that the amount agricultural producers sell depends on storage room available in the house, e.g. 70% is sold after harvesting and 30% can be stored locally. Participants further estimated that about 20% of the losses occur at production stage, and that agricultural producers have a profit margin of about 25.7% and a value addition of 34.8%.

*Taherpuri* is the most used local variety and *Lalteer King* the most used hybrid variety. *Taherpuri* is the dominant Bangladeshi variety originated in Taherpur area of Rajshahi District. This variety is small in size, high in pungency, compact and water contents are very low. As such it can be stored in normal conditions at agricultural producers' houses for eight till ten months. These varieties are open pollinated (OP) and agricultural producers can reproduce the same seeds year after year (Mintoo, 2019).

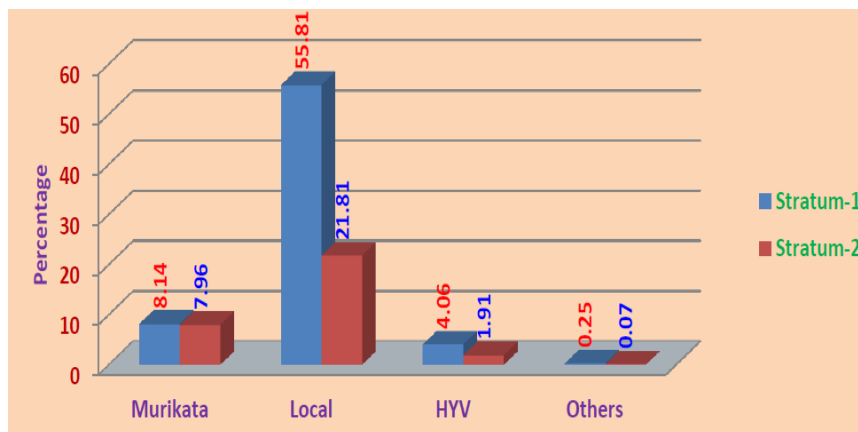
Onion is a seasonal crop called *rabi* crop and two different cultivation systems are used; *hali* cultivation system (seed onion) and *murikata* system (bulbs to bulbs). For the *hali* cultivation system it takes about six months for one production cycle, from October-November to March-April, and it starts with seedling production and ends with the harvest of mature onion. Seeding onions took place in October or November and transplantation of onions in December or January for most agricultural producers (Table 5). 65% of the agricultural producers mentioned that onions matured around April. 20% of the agricultural producers used the *murikata* system and indicated January-February as harvest moment. However, both type of agricultural producers mentioned to have unsold onions, since not all onions were mature.

Mintoo (2019) found that agricultural producer store part of the onion bulbs for three reasons; (i) to cultivate onions through *murikata* system in the next season (bulbs to bulbs); (ii) to produce bulbs which they use to produce seeds in the next season (seed to bulb); and (iii) using bulbs to produce seeds (bulb to seed).

**Table 6 Production plan hali cultivation system**

Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Trans-planting			Harvest						Seeding	Seeding	Trans-planting

According to figure 8, 16.10% of the agricultural producers cultivate onions with *murikata* system and rest of the agricultural producers (83.90%) cultivate onions with *hali* system by using local varieties, hybrid varieties and other varieties.



**Figure 8 Distribution in production area. Stratum-1 = main production areas; Stratum-2 = rest of Bangladesh (BBS, 2015)**

Bad quality onions existed by all type of activities, including production, harvesting, curing, sorting, packing and storage.

For production, unsold onions were related to inputs used, such as fertilizer. At the Dhaka workshop (January 2020) participants indicated that agricultural producers are forced to buy fertilizers and pesticides at high prices on credit due to shortage of capital, which increases the production costs of agricultural producers. Large numbers of smallholder agricultural producers produce onions by leasing land. With their very limited capital, inputs such and fertilizers and pesticides are bought on credit from dealers with higher prices compare to the cash price. The agricultural producers follow the dealer’s often faulty instructions which leads agricultural producers to apply high dosages of fertilizers and pesticides during onion cultivation, resulting in poor quality of onion with high moisture content. Onions with high moisture content spoil quickly resulting in agricultural producers to forcibly sell their onions just after harvest for a low price. In combination with the shortage of modern storage facilities in their homes, food losses occur.

For harvesting, unsold onions occurred since onions were being left on the field, of which partly was immature. 20% of the respondents indicated to leave more than 5% matured onions on the field and 80% indicated to leave less than 5% matured onions on the field. The main reasons were that onions were perished or damaged during harvesting (87%), and/or had diseases or were infected (70%). Overall, after harvesting, less than 20% of the onions went to another destination than the intended food chain (<20% was the lowest percentage provided in the possible answers and could be given by the interviewees).

Curing is a one-month process to dry onions down to make them ready for storage. Due to the curing activity <20% of the onions go to another destination than the intended food chain. Causes included were wrong way of curing (e.g. not ventilated properly), rough handling or no market. Most used destinations for these onions were own consumption (mentioned by 73% of respondents) and landfill (mentioned by 55% of respondents). Three respondents indicated they had no unsold onions after curing.

Sorting of onions was done by size by all participants. 72% also sorted onions by colour and 60% by shape. Five participants mentioned they sorted out the rotten onions. Other possible causes of losses included rough handling and no market. Losses were <20% mentioned by 92% of the agricultural producers and between 20-40% mentioned by 5% of the agricultural producers.

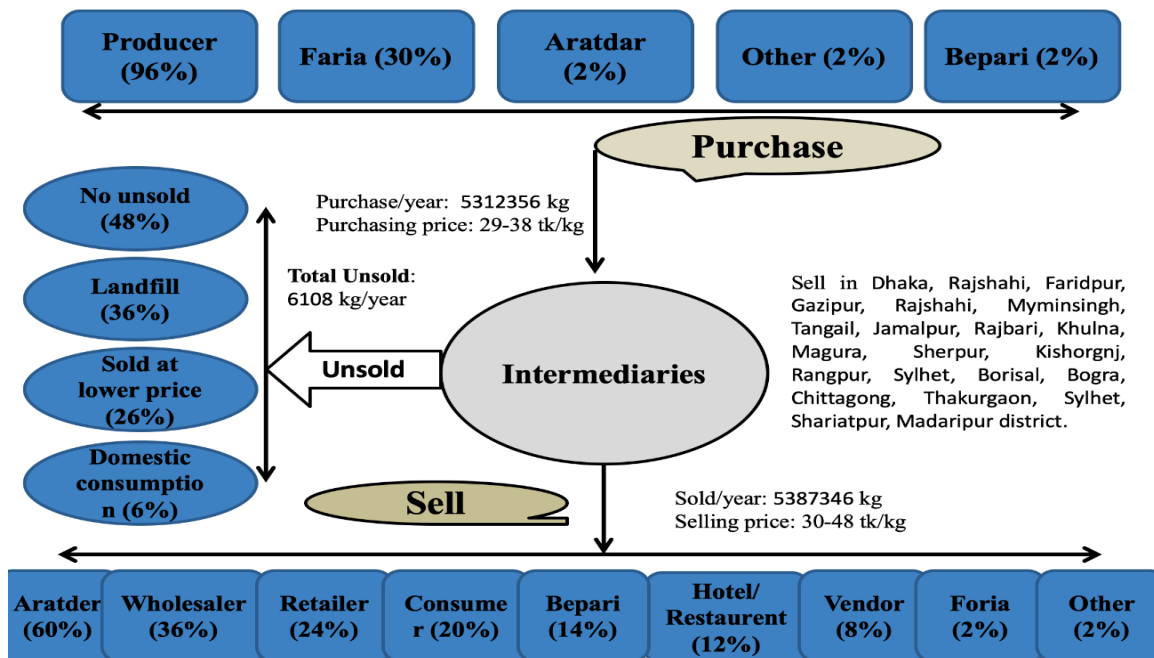
Two participants did not answer this question. Destinations for out sorted onions were own consumption and landfill. Eight agricultural producers mentioned there were no unsold onions after sorting.

Agricultural producers packed the onions in jute or plastic net bags of 50 kg. 92% of the agricultural producers, that stored the onions, mentioned losses of <20%. The other 8% of the agricultural producers estimated 20-40% losses during storage. Destinations used for these lost onions were primarily landfill and own consumption. Four respondents mentioned they had no unsold onions after packing.

In all these activities the very bad quality onions, e.g. rotten, were used for landfill. The good quality onions were sold at the market in Dhaka and the rest was used for home consumption, used as animal feed or sold at the local market.

### 3.1.2 Intermediaries

All interviewed intermediaries (N=50) were male. The profession of the respondents in the study were *bepari* (60%), *faria* (28%) or *arathdar* (12%). They were selected from the same districts as the agricultural producers. Their average age was 45 years and they worked on average 17 years in the onion supply chain. Most intermediaries were educated up to class 5 (42%), followed by up to SSC (28%) and up to class 8 (10%).



**Figure 9 The intermediaries value chain overview**

Figure 9 shows the intermediaries value chain overview. Intermediaries add value to the product by arranging the transport from the rural areas to the city of Dhaka and bulking the products. The intermediaries each purchased on average 5,312,356 kg of onions per year from agricultural producers and other intermediaries. There was however great variation in purchase amount between the sampled intermediaries, namely a standard deviation of 18,193,726 kg applies, with yearly purchased volumes as low as 2,000 kg up to 94,200,000 kg per intermediary. Almost all intermediaries (96%) purchased onions from agricultural producers and 30% of the respondents purchased (also) from *farias*. The yearly purchase price ranged from 29-38 BDT per kg of onion. 60% of the respondents sold (a part of) their onions to *arathdars*, 36% to wholesalers, 24% to retailers and 20% directly to consumers. They sold their onions per year for a price ranging between 30-48 Tk/kg. The price per kg varied according to supply and demand of onions in the market, with usually low prices during the peak season and high prices due to shortage of stock, e.g. just before national holidays. 84% of the respondents mentioned they had no unsold onions. On average 6,108 kg/year per intermediaries was unsold, which is 0.1% of the total input. Destinations of the unsold onions included landfill and onions sold at a lower price.

Intermediaries did not dry the onions after purchasing (98% of respondents), but did sort the purchased onions (64% of respondents). The intermediaries who sorted the onions did this based on size (100%), colour (84%) and shape (53%). Two intermediaries indicated that they sorted out rotten onions. The unsold onions were <20% of the total input. 34% of the respondents mentioned they had no unsold onions. Causes of these out-sorted onions can be tracked back to transportation or bad quality earlier in the supply chain. The intermediaries with unsold onions used landfill as a destination, sold at a lower price and used for own consumption, respectively.

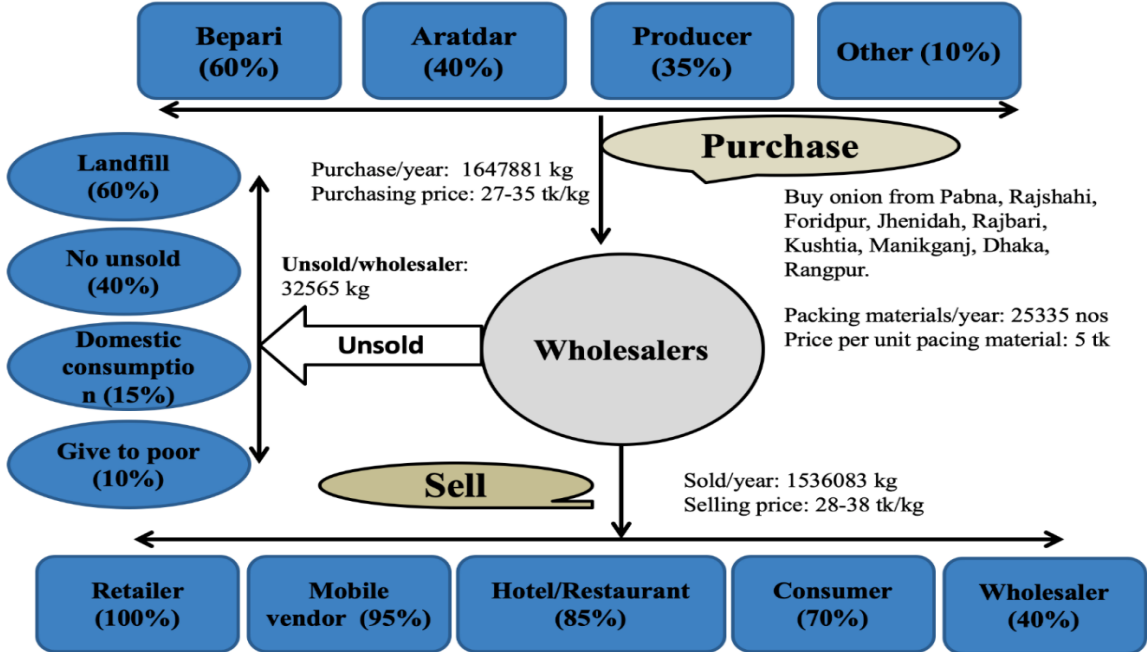
60% of the intermediaries used own packaging material. Own packaging material was used when they sort and re-pack the onions, when they want to make large packages, when they want to pack loosely purchased onions or when they want to re-pack the onions after drying. Intermediaries who re-packed the onions used plastic net bags or jute bags, of which 73% of the respondents made packages of 70-80 kg.

Storage was only applied by 10% of the intermediaries who all used a slatted or multi-slatted room. Most of them used a dry, ventilated room with fan but without temperature control.

Besides, wholesalers had access to storage facilities, that added value to the product since they were able to sell the onions for a longer period. However, storage and transportation resulted in high costs.

### 3.1.3 Wholesalers

The wholesalers (N=20) in the four Dhaka districts that were interviewed were all male. The average age of the respondents was 34 years with on average 11 years of experience. Their education differentiated from up to SSC (50%), up to class 8 (20%), up to HSC (15%), and up to class 5, post graduate and illiterate (all 5%).



**Figure 10 Wholesalers value chain overview**

Figure 10 shows the wholesalers value chain overview. Wholesalers add value to the product by arranging the transport from the rural areas to the city of Dhaka and bulking the products. Wholesalers each purchased on average 1,647,881 kg onions per year from *bepari*, *arathdar*, agricultural producers and other/importers. Of these purchased onions, 32,565 kg of onions were not sold and went to landfill, domestic consumption or charity. This is 2.0% of the total input. 40% of the wholesalers mentioned that they did not had unsold onions. All wholesalers sold onions to retailers. Furthermore, most wholesalers sold to mobile vendors (95% of the respondents), institutional users (85%), consumers (70%), or other wholesalers (40%) as well.

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30% of the wholesalers indicated to dry the onions after purchasing, because the onions were wet or to prevent spoilage due to rotting. Four out of six respondents who dried the onions, dried the onions by keeping them in a cool and dry place, one respondent used a fan, and one respondent dried the onions under direct sunlight. Overall, unsold onions were <20%. Five out of six respondents mentioned that the unsold onions went to landfill and one respondent mentioned own consumption as destination.

30% of the wholesalers sorted and graded the onions after purchasing. The wholesalers who sorted the onions did this based on size (100%), colour (50%) and shape (17%). <20% of the onions that were sorted and graded were sorted out and went to landfill (100% of respondents) or charity (one respondent). Causes of these out-sorted onions can be tracked back to transportation or bad quality earlier in the supply chain.

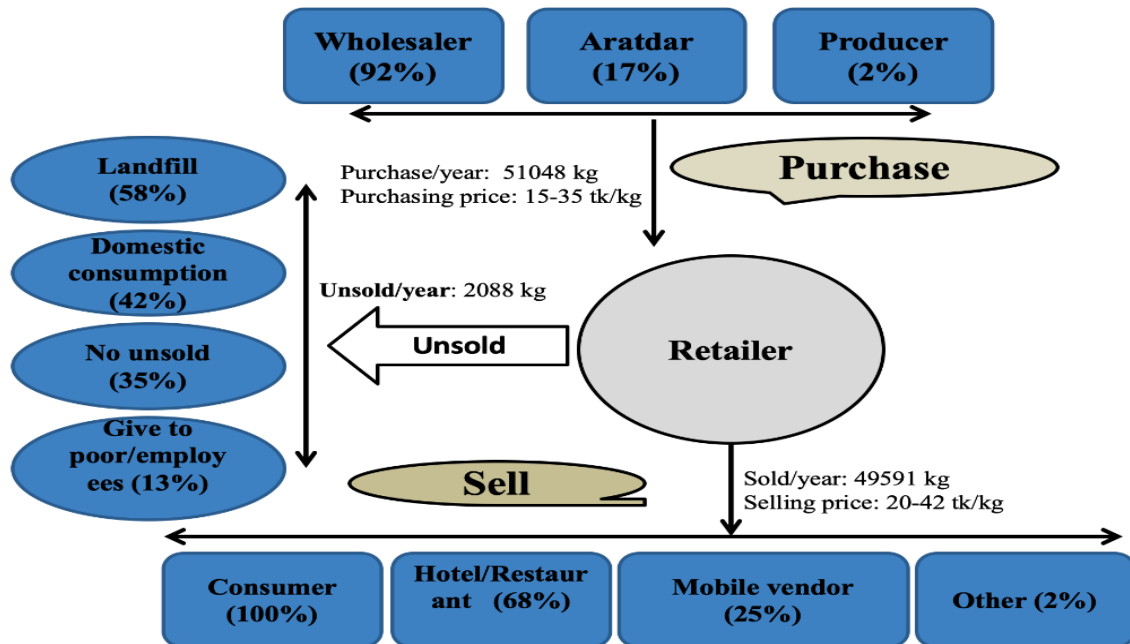
20% of the wholesalers used their own packaging material and 60% of the wholesalers stored the product. They all used a dry, ventilated room with fan, without temperature control. They stored the products in a small or large pack or sac, or in loose condition. Half of the wholesalers stored the product between 1-4 weeks and the other half for less than one week. Main reasons for storage were to prevent product loss, to secure a good price/get higher profit or wait for market demand. Overall less than 20% of the onions went to another destination than the intended food chain and ended up as landfill, own consumption or other. 25% of the wholesalers that stored their onions did not had unsold onions.

The literature distinguishes three types of wholesalers (Keck 2012). Note that this is not specifically for onions:

- Local wholesalers: purchase their product from the agricultural producers, usually at a fixed price. Local wholesalers sell their product to a different division, according to the market demand and market price. They also sell their products to the local market, but a little amount. They make an estimated market margin of 15% to 25%.
- Divisional wholesalers: collect their product from local wholesalers. They act like divisional distributors, and sell their product to the regional wholesaler. They serve as a fixed commission agent. They also sell their product to the local retailer. They make an estimated margin of about 5% to 10%.
- Regional wholesalers: collect produce from the divisional wholesalers. Sometimes they collect their product from local wholesalers. They make a market margin of an estimated 5% to 10%. (secondary data doc, no reference.)

#### 3.1.4 Retailers

The overall average age of retailers (N=60) was 39 year with an average work experience of 12 years. Three out of sixty retailer respondents were female. Most retailers received education up to class 8 (32%), up to class 5 (20%), up to SSC (8%), and 18% was illiterate. Graduates and post-graduates were also found among the respondents.



**Figure 11 Retailer value chain overview**

Figure 11 shows the retailer value chain overview. Most of the retailers purchased onions from wholesalers. Ten out of sixty retailers mentioned they purchased onions from an *arathdar* and one respondent mentioned to purchase directly from agricultural producers. On average retailers purchased around 51,048 kg/year each of a price range varying between 15-60 BDT/kg. Of this amount, 49,591 kg/year was sold to consumers, institutional users, mobile vendors and other, respectively, for a price varying between 20-65 BDT/kg. 2,088 kg/year/retailer were unsold and went to landfill (58% of the respondents), domestic consumption (42%) or charity (13%). This is 4.1% of the total input. 35% of the respondents mentioned they did not have unsold onions.

52% of the retailers sorted and graded the onions after purchasing. Sorting was conducted based on size, shape, colour and to distinguishing bad onions from good onions. The onions that were sorted out (<20%) went to landfill, own consumption or other. Losses found during sorting and grading had several causes. Firstly, the packaging material and way of packing was not optimal in combination with transportation, which resulted in bruises and damages. Secondly, retailers also sorted and graded onions that had a bad quality at the moment of purchasing. The losses are then visualized at the retailer, but already occurred earlier in the supply chain. For example bad quality at production, no proper curing or bad storage conditions.

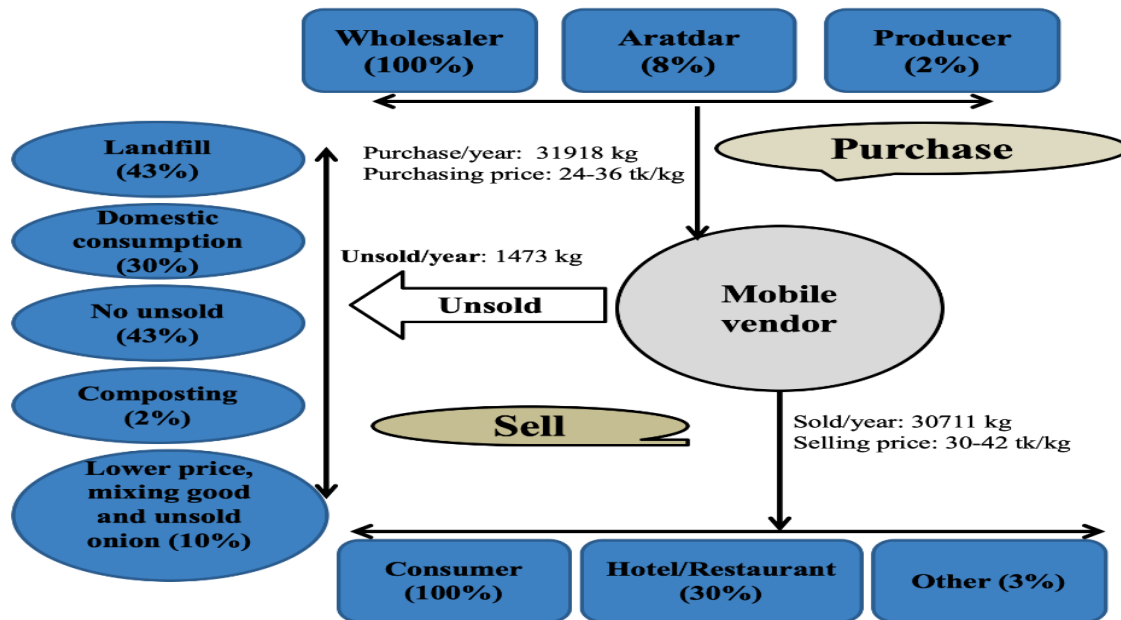
Only 5% of the retailers used own packaging material. Packaging material that was used included large pack or sack, bamboo baskets, or small packs.

Storage was only used by 22% of the retailers. From this group of retailers 84% used a storage facility that is dry and ventilated with a fan. Half of the retailers stored for less than a week, the other half between 1-4 weeks to prevent product loss, wait for market demand, to secure a good price, or to reduce time and labour cost. Overall less than 20% of the onions went to another destination than the intended food chain.

### 3.1.5 Mobile vendors

The average age of the mobile vendors (N=60) was 39 years. 3% of the respondents were female. More than one-third of the respondents were either illiterate (38%) or having primary education up to class 5 (37%). 15% had primary education up to class 8, 7% up to SSC and 3% up to HSC. Mobile vendors worked on average for nine year in the onion supply chain.





**Figure 12 Mobile vendors value chain overview**

Figure 12 shows the mobile vendors value chain overview. Mobile vendors each purchased on average 31,918 kg of onions per year of which 1,473 kg was unsold. This is 4.6% of the total input. All mobile vendors purchased onions from wholesalers. A few also purchased onions from *arathdars* or directly from agricultural producers. Unsold onions went to landfill, domestic consumption or composting. 43% of the respondents mentioned they had no unsold onions. 10% sold the onions for a lower price by mixing them with good onions. Mobile vendors mostly sold onions directly to consumers, institutional users and other.

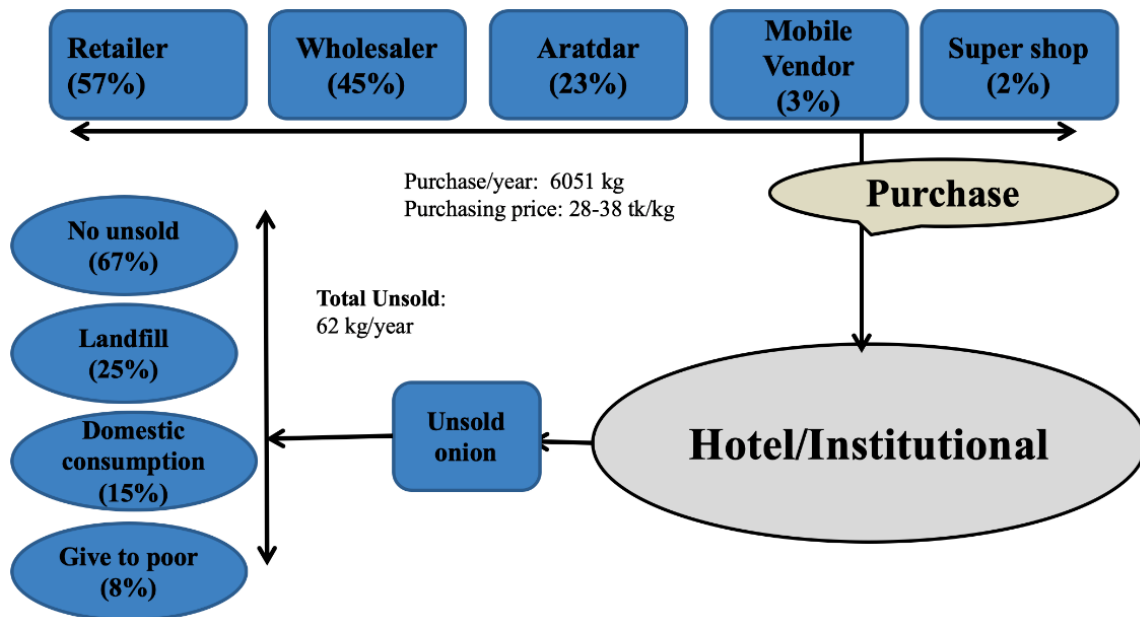
Overall, 37% of the mobile vendors sorted and graded the onions after purchasing. They sorted the onions based on size, colour and shape. Overall less than 20% of the onions went to another destination than the intended food chain due to sorting. They mentioned landfill, own consumption and charity as destinations. 7% of the respondents replied that there were no unsold onions. The onions that were sorted out (<20%) went to landfill, own consumption or other. Losses found during sorting and grading had several causes. Firstly, the packaging material and way of packing was not optimal in combination with transportation, which resulted in bruises and damages. Secondly, mobile vendors also sorted and graded onions that had a bad quality at the moment of purchasing. The losses are then visualized at the mobile vendor, but already occurred earlier in the supply chain. Using own packaging materials was done by 3% of the respondents. Storage was used by 10 out of 60 respondents. Eight of them used a dry room with a fan. The other two respondents used a dry room, without fan. The products were stored loose, in a small or large pack/sack, in small boxes or in a bamboo basket. Five mobile vendors stored onions for less than a week, four respondents between 1-4 weeks, and one respondent between 1-2 months. Seven respondents mentioned that less than 20% of the onions went to another destination than the intended food chain, while the other three respondents mentioned between 20-40%. Destinations for unsold onions consisted of landfill, own consumption and charity.

Literature shows that one of the major actors in the current food system in Dhaka are the non-licensed street food vendors. These vendors sell a great variety of food products, prepared meals or snacks, and provide employment for the urban poor. They are basically tied to retailers, cooking units and other food system actors. Street food vending provides a basic need to the urban population and many people are relying on them for their daily meals. The street food vendors provide food at relatively low prices, since they do not incur overhead expenditures. However official numbers are unknown, as the non-licensed street food vendors do not pay taxes and registration is lacking, but it is estimated that around 200,000 street food vendors are active in Dhaka city and that this number is still increasing (Faruque et al., 2010).

As for street food vendors, the purchaser carries the food through the street. However another activity in the informal food system is the ready-to-eat food that is carried through the street by the preparer, for eating at home or at the office. This food is not for sale or consumed in the street. These 'invisible' street foods include, for example, contract-catered meals. These are meals prepared at home by woman and supplied to businessmen, factory workers or shop owners. The meals are brought to the respective workplaces by rickshaw-drivers, balance-pole-, or basket-carriers (Etzold, 2008; Tinker 1997).

### 3.1.6 Institutional users

For the institutional user (N=60), 56 hotel/restaurant owners and 4 hotel managers were interviewed in the four city corporations. Two out of 60 respondents were female. The respondents were on average 39 years old and were twelve years involved in the onion supply chain. Most respondents reached the educational level up to class 5 (30%), up to SSC (25%), up to class 8 (20%), up to HSC (12%), or graduate (7%). 7% of the respondents were illiterate.



**Figure 13 Institutional users value chain overview**

Figure 13 shows the institutional users value chain overview. Institutional users purchased on average 6,051 kg onions per year from retailers, wholesalers, intermediaries, mobile vendors and super shops (online) at a yearly purchased price between 20-65 BDT/kg. Of this amount, 62 kg/year (1.0%) was unsold and went to destinations like landfill, domestic consumption and charity. 67% of the respondents mentioned they had no unsold onions.

12 of the 60 institutional users stored the onions. 10 of them used a dry place with fan, one respondent used a large bamboo basket and one respondent used a dry place without fan. They stored the onions in small packs or sacks, in large packs or sacks, loose, in a bamboo basket or in small boxes. Two-third stored the onions for less than a week, the rest stored the onions between 1-4 weeks. Less than 20% of the onions went to another destination than intended, and went to landfill (25%), own consumption (15%) and charity (8%).

## 3.2 Enabling environment

The enabling environment includes the transport networks, regulations and institutional arrangements.

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### 3.2.1 Transport networks

Short distance transportation in rural areas and long distance transport are conducted by own mode of transport or by a hired transportation vehicle. Transportation in the rural areas was often over short distances of less than 10 kilometres and was conducted by the agricultural producers or intermediaries. Main modes of transportation used by the agricultural producers in these rural areas were van or *nosimon*: a motorcycle with a small trailer. Other possible modes of transportation mentioned were rickshaw, pickup and minitruck.

Most intermediaries transported the onions over large distances from the rural areas to the consumption areas in cities. The truck is the most frequent mentioned mode of transport for large distances over 20 kilometre. Other options for more than 20 kilometre mentioned were minitruck and *nosimon*. This transport over large distances is mainly conducted by external transportation companies hired by the intermediaries. Agricultural producers and intermediaries mainly faced problems with high transport costs and bad road communication. Furthermore, both mentioned that the market or selling point is far away. Additionally, some intermediaries faced the problem of unavailable transport.

External transporters were also included in this study. The respondents involved in the transportation of onions were male (N=15). The average age of the respondents was 37 years with an average work experience of 12 years. 40% of the respondents were educated up to class 5, 20% up to class 8, 27% up to SSC, and 13% was illiterate.

The included drivers transported onions from the west-side of the country, towards several cities and districts in the rest of the country, including Chittagong, Sylhet, Mymensing, Dhaka and Khulna. They transported onions for *bepari* and *arathdar* and delivered to *arathdar* or wholesalers. They transported around 1,101,567 kg/year/transporter. All drivers transported the onions by truck with average capacity of 12,467 kg, to at least 20 kms from where they collected the onions. 100% indicated extortion on the road as a problem they face, followed by bad road communication (73%) and high fuel costs (60%). Traffic jam and police harassment was only mentioned by two external drivers.

Overall, within Dhaka, the actors themselves were responsible for the transportation between the buying location to their own location. Wholesalers mainly used the truck, minitruck and van as modes of transport. Wholesalers main problem related to high transportation cost. Furthermore the problems of wholesalers related to bad road communication, far away market or selling point, unavailable transport, traffic jams, police harassment and paying bribe to the police. These problems resulted in paying high transportation prices and not being able to sell the onions in time.

Retailers and mobile vendors used smaller vehicles to transport the purchased product to their own location. They used vans, rickshaws, minitrucks, compressed natural gas auto-rickshaws, and trucks. The institutional users mainly used the rickshaw, followed by van, own/company car, minitruck and compressed natural gas auto-rickshaw. The problems of retailers, mobile vendors and institutional users were similar to the problems of the wholesalers.

### 3.2.2 Regulations

Agricultural producers were not very familiar with regulations in the onions sector. More than half of the respondents did not know any regulations. A small percentage of the agricultural producers, intermediaries, wholesalers and retailers mentioned the imposing of a fixed price to sell onions as a disturbing regulation while operating a business. However, the difference between the minimum and maximum price was around 25-87 BDT/kg for wholesalers and retailers this year.

### 3.2.3 Institutional arrangements

Information between actors is shared and consists of information on market price, market demand, quality standards and safety standards, respectively. This information is shared in person or by phone call from the buyer. Other sources of information included television, social media and the newspaper. Related to this information access, agricultural producers and intermediaries faced mainly problems with the reliability of the source, a lack of a platform for online selling, rumours on demand and prices, and the lack of broad band internet or phone network.

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Wholesalers, retailers, mobile vendors and institutional users faced mainly problems with the reliability of the source, rumours on the supply, demand and prices, and the lack of a phone network.

The client can have demands related to the product. Dryness and size were found to be the most desirable quality standards for onions, followed by no quality standards at all. However, most agricultural producers and intermediaries did not receive any feedback related to the onions they sold, except for some who received complaints about the poor quality of the products or the high prices. Wholesalers did receive feedback from their clients about the high price and poor quality of the products.

Most agricultural producers stated that there were no selling contracts with customers. Only 5% had contracts. Most agricultural producers without contracts were paid directly in cash, while a small amount of agricultural producers (3%) were paid in instalments. Most intermediaries were paid in cash directly or by instalments, respectively. While transacting with buyers, agricultural producers faced constraints that included offering lower price by the buyer, bound to sell for low price and bound to sell for market price. The prices were set based on the quality/grade of the product. Furthermore, the number of packing units (or weight), and colour are important to set the price. Constraints experienced by intermediaries, wholesalers, retailers and mobile vendors included delayed payment or transaction in credit.

### 3.3 Business services

Business services include the extension services, agro-chemical providers, technological support and financial services.

#### 3.3.1 Extension services

Support from extension services is considered very important for the dissemination of modern technology, sustainable production and marketing. However, only 22% of the agricultural producers mentioned that they received any support from extension service. The other actors in the supply chain did not receive support from extension services. However 10% of the wholesalers indicated that they took part in a government program organized by the trading Corporation of Bangladesh which was about the price of onions.

Cooperative structures were not prominent in the onion supply chain. More than 90% of the agricultural producers mentioned that there were no cooperative structures, even though 63% of the respondents stated that cooperative structures are a good idea.

#### 3.3.2 Agro-chemical providers

Problems associated to production relate to the lack of labour, lack of irrigation, the competition for land (land leasing) and the price they receive for the product. So, the cost of production are high compared to what they receive for their product. These high production costs are caused due to problems with the availability and price of seed and fertilizer. Intermediaries, wholesalers and retailers faced problems related to high labour and transportation costs, and access to credit and loans. The intermediaries, retailers and mobile vendors also mentioned the location on the market as a resource constraint.

#### 3.3.3 Technological support

Agricultural producers used different type of equipment for onion production and harvesting. For harvesting, a sickle or spade is used. However, 18% of the respondents mentioned they used hand pulling to harvest the onions. Furthermore they used a digger, weeder or kachi to cut weed. Automated harvest and post-harvest tools were almost absent and temperature controlled storage facilities were not used in the onion supply chain. Retailers, wholesalers and mobile vendors mentioned onion rot as a large problem.

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### 3.3.4 Financial services

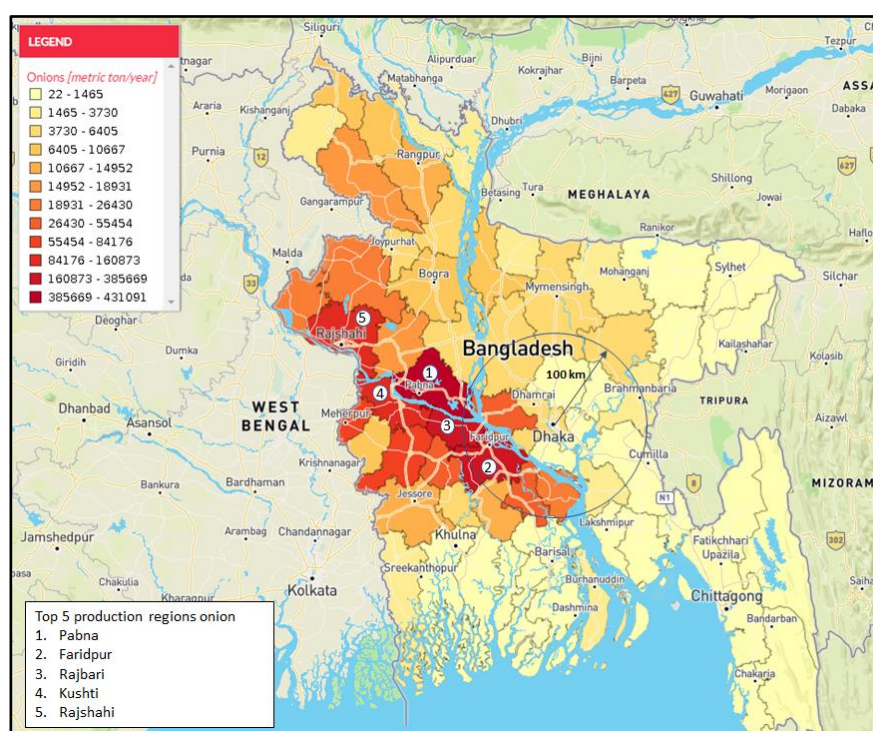
Between 20% and 40% of all actors used loans. They used it for business expenses like cultivation of land or buying products. Furthermore they used it for covering family needs. Loans were taken from banks, relatives, NGO's, neighbours, other actors in the supply chain, or *somity* (association). According to the interviewees loans should be paid back without interest, while other loans had to be paid back by instalment with high interest or reasonable interest.

# 4 Results: Food availability

This chapter describes the food availability as described by the food systems approach of van Berkum et al. (2018). It includes three components: production, distribution and exchange.

## 4.1 Food production

Food production entails how much and which types of food are available through local production (FAO 1996 in van Berkum et al. 2018). The production of onion in Bangladesh is concentrated in the centre and the west of the country as shown in Figure 14. In 2017-2018 1,738 ktons of onions were grown, compared to 1,866 ktons and 1,735 ktons in 2016-2017 and 2015-2016 respectively. Onion is not a top 10 horticulture crop, since it represents about 2% of the total horticultural Bangladesh volume. Main crops are rice and potato, together representing 50% of that volume.



**Figure 14 Onion production regions in Bangladesh (2017-2018) (BBS, 2019)**

The main production areas are located left from the big rivers like Ganges and/or Jamna. The top 5 districts cover almost 70% of the national production volume (See Table 7).

**Table 7 Top 5 onion production districts (BBS, 2019)**

District	Production in kton (2017-2018)
Pabna	432
Faridpur	286
Rajbari	221
Kushtia	128
Rajshahi	124

Some of the available varieties are local like Tahirpuri (dominant variety), Faridpuri, BARI-1 and Red Arrow King. In addition, Indian seeds are used sometimes as well.

To put the local onion production in perspective a SWOT analysis is applied based on the results found in the literature studies, workshop and interviews (Table 8).

**Table 8 SWOT for Bangladesh onion production**

Strength	Opportunity
<ul style="list-style-type: none"> <li>• Use of tractors and power tillars (mechanization)</li> <li>• 95% uses rotation system</li> <li>• 43% uses fan for storage (long storage possible)</li> <li>• Almost 100% have irrigation in place</li> </ul>	<ul style="list-style-type: none"> <li>• Cooperative structure not prominent yet</li> <li>• Use storage for price speculation</li> <li>• Standardize quality system to boost investment</li> </ul>
Weakness	Threat
<ul style="list-style-type: none"> <li>• Market price unstable</li> <li>• Seed price volatile</li> <li>• High labour costs</li> <li>• Lack of labour</li> <li>• Lack of automated harvesting tools</li> <li>• Lack of curing field</li> <li>• Rot during curing</li> <li>• Low yield</li> <li>• Lack of knowledge (identifying appropriate inputs)</li> <li>• No access to high value markets</li> <li>• No support from extension services</li> </ul>	<ul style="list-style-type: none"> <li>• No standardised quality</li> <li>• Road communication not good</li> <li>• Low reliability of demand, volume and price</li> <li>• No proper network for internet or phone</li> <li>• Buyers cooperate to offer low price to agricultural producer</li> <li>• No control of markets by government</li> <li>• High transport costs</li> <li>• India import dependency</li> <li>• Further migration to Dhaka of younger people</li> </ul>

Combining elements from Table 9 the following main issues come forward.

*Market price:* the price for onions is unstable and unpredictable and seems to be influenced or controlled by intermediaries and wholesalers. Since transport is expensive, agricultural producers are bound to sell to local wholesaler syndicates or local markets with low prices. The government has no supervision on the market operations in urban areas, herewith enabling these practices. In addition, market price and supply information are often not available to agricultural producers, because internet and phone network are absent or show low performance. If information is available, it is often unreliable. Last but not least, from September to December import from India enters the country and traders are storing these onions to fetch high prices. Sometimes, instead of overflowing the market, all imports are hampered at the land- and seaports, causing spoilage of the foreign onions and adding to retail prices for onion (Dhaka workshop January 2020).

*Farm activities:* from inputs to sales the average Bangladesh onion agricultural producer lacks technology, knowledge and support. In the rural areas extension services are hardly present, and the need for support is there on many levels. It starts with finding the proper seeds and fertilizer, which increases yield and lowers the disease pressure and rot. Although some mechanization is used in the preharvest phase, for harvest this equipment is not available. In combination with the labour costs and shortage of labour capacity, it is difficult for an agricultural producer to manage the harvesting.

*Transport:* in Bangladesh transport costs are high. For horticulture the logistic costs at supply chain level are estimated at 50% (Herrera Dappe et al. 2019). There are several reasons for that. Firstly, bribing the police is necessary when you travel over significant distances. Secondly, the road information system is very poor and together with congestion a lot of extra costs are involved. Congestion takes place on the road and at the ferry terminal. In this context it is difficult for agricultural producers to connect to high value markets in urban areas, unless they have some scale.

In fact, this is a standard resume of a push market system, where smallholders have no negotiation power in the supply chain. Note that the three issues above are not typical for onion but hold for all horticultural products in Bangladesh.

## 4.2 Food distribution

Food distribution entails how food is made available (physically moved), in what form, when, and to whom (FAO 1996 in van Berkum et al. 2018). The distribution of onion starts at farm level. Agricultural producers either sell their produce in a *haat*<sup>2</sup> locally or from farm gate to itinerant

<sup>2</sup> is an open-air market that serves as a trading venue for local people in rural areas and some towns



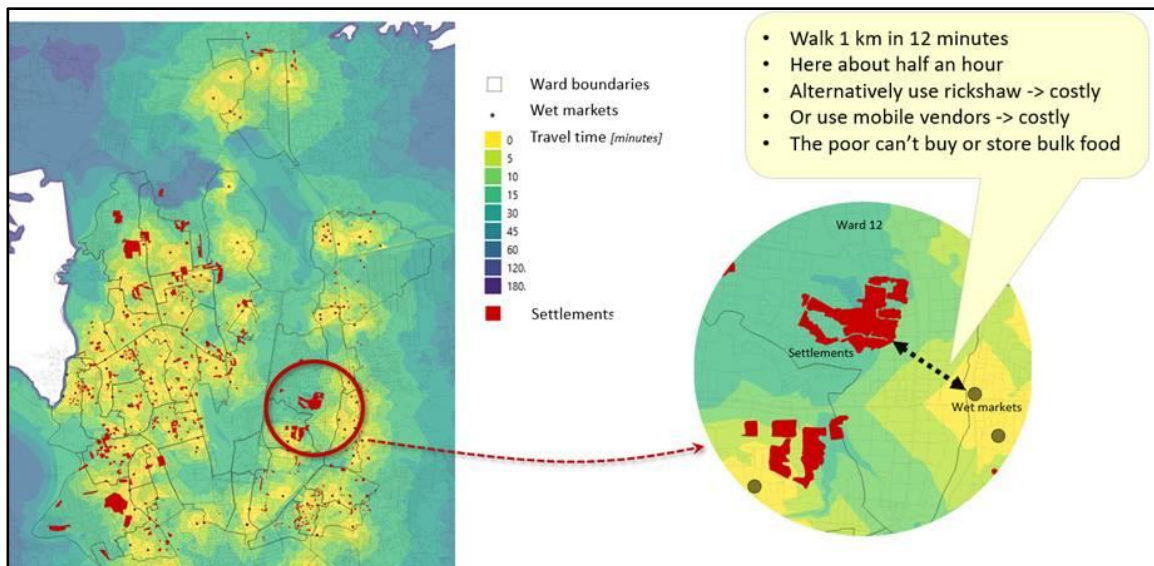
intermediaries like *faria* and *bepari*. The sales unit is 50 kg and this is packed either in plastic net bags or jute bags. In general *farias* sell to *bepari*, herewith creating enough volume for long distance transport. These local intermediaries keep the onion for about 10-12 hours. *Bepari* sell their produce to wholesalers via brokers (commission agents) called *arathdar*. These agents operate from fixed locations where the onions are transported to, mostly long distance (between different districts). Drivers go from *bepari* to *arathdar* or from *arathdar* to wholesalers and drive between 100 and 600 km (see table 9).

**Table 9 Distances (in km) travelled by the drivers in the project sample<sup>3</sup>**

	to	Bogra	Barishal	Chittagong	Dhaka	Faridpur	Jamalpur	Jessore	Jhalkathi	Khulna	Mymensing	Narayangonj	Rangpur	Saydpur	Sherpur	Sylhet
from																
Chuadanga		243		231			76		137							
Doulatpur				346		457										574
Faridpur		235	125	117				162					358	396		
Kushtia			403	170	92	250							264		246	494
Meherpur			266	247			99		171							
Pabna				153						204	167					
Rajbari			153		109		120		180							
Rajshahi				488												456

Wholesalers may add value like sorting, grading and/or repacking, and then they use storage to prevent losses and for price speculation. Wholesalers sell produce to other actors in the supply chain (business-to-business transaction), like retail, street vendors and out-of-home channels. Transportation distance from wholesaler to one of these actors is often short and in one area. The final link is the consumer.

In Dhaka there are many wet markets<sup>4</sup>, however the traveling time for inhabitants to reach these wet markets varies significantly as shown in figure 15. Clearly a few settlements are more than 30 minutes away from a wet market, probably implying less food availability because of additional costs.



**Figure 15 Travel time (in minutes) to nearest wet market for inhabitants of Dhaka<sup>5</sup>**

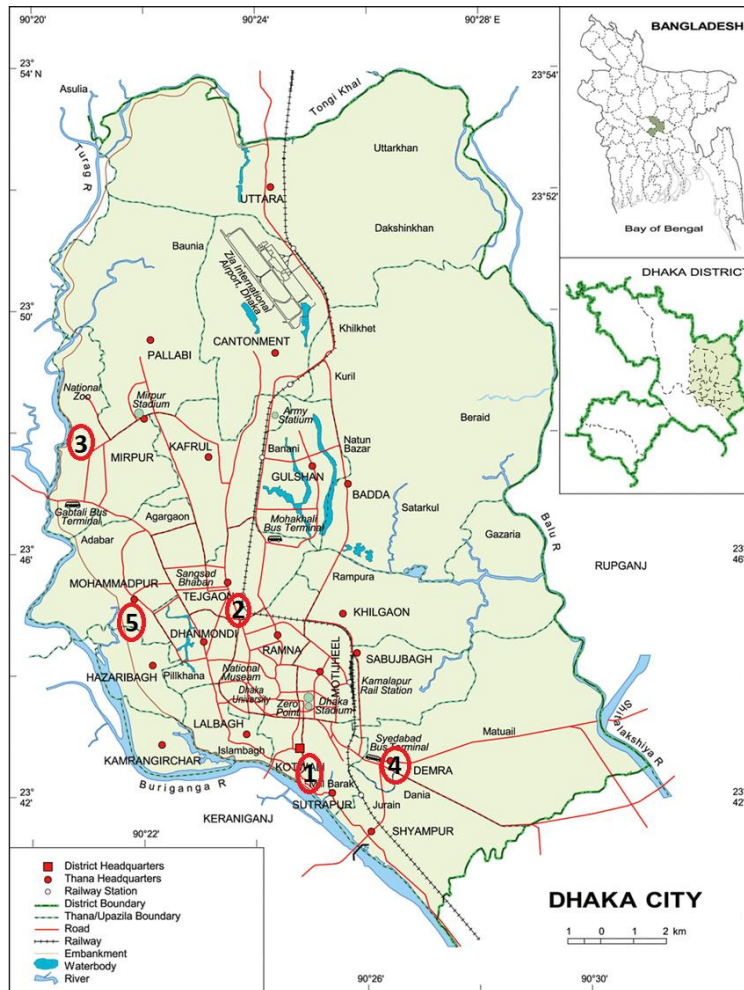
<sup>3</sup> <https://www.google.com/maps>, accessed 27-11-2020

<sup>4</sup> A wet market is a market that sells perishable foods such as meat, fish, fruits, and vegetables. Wet markets can be found around the world, but are especially common in China and Southeast Asia (<https://www.dictionary.com/e/pop-culture/wet-market/>), accessed 27-11-2020

<sup>5</sup> Based on spatial analysis from Wageningen Environmental Research (mail Anouk Cormont, October 29, 2020)



There are five big wholesale locations (biggest commodity hub) of onion in Dhaka city and one in Chattogram city. These are Shyambazar wholesale market, Karwan Bazar wholesale market, Mirpur-1 Shah Ali wholesale market, Jatrabari wholesale market, Rayer Bazar wholesale market in Dhaka city (Wardad. Y., 2019; Bdnews24, 2019 and The Daily Star, 2020) and khatunganj wholesale market in Chattogram city (The Business Standard, 2019).



**Figure 16** Map of Dhaka City with showing 5 wholesale market of onion (1 = Shyambazar wholesale market, 2 = Karwan Bazar wholesale market, 3 = Mirpur-1 Shah Ali wholesale market, 4 = Jatrabari wholesale market, 5 = Rayer Bazar wholesale market)

**Packaging:** Packaging can have many functions like protection, containment, convenience, communication and product climate control. The packaging used by the various actors is shown in Table 10. Since prices are unstable and onions are less perishable and vulnerable than e.g. leafy vegetables, in many cases packaging is not common practice due to extra costs.

**Table 10** Most common packaging used by actors in the onion supply chain

Actor	Most common packaging
Agricultural producer	Jute or plastic net bags of 50 kg (air ventilation through packaging)
intermediaries	Jute or plastic net bags of 70-80 kg (make large packaging, or pack loose onions)
Wholesaler	Large pack or sack (to put in storage)
Retailer	Large pack or sack, bamboo baskets or small pack
Street vendor	Large pack or sack, bamboo baskets, small pack or small box
Institutional	Large pack or sack, bamboo baskets, small pack or small box (in storage)

*Transport:* The logistic costs are high, due to bribing and huge traveling times. Truck owners feel compelled to make facilitation payments to traffic police and labour unions to ensure smooth passage through different districts. Especially for long distance deliveries the impact is immense. Congestion impedes normal driving speed, even on highways. The average speed of a truck is between 25-30 km/h on the highway from Dhaka to Chittagong (see Table 11) (Herrera Dappe et al. 2019). A detailed analysis on logistics by the World Bank shows that the average truck speed in the country is 19 km/h.

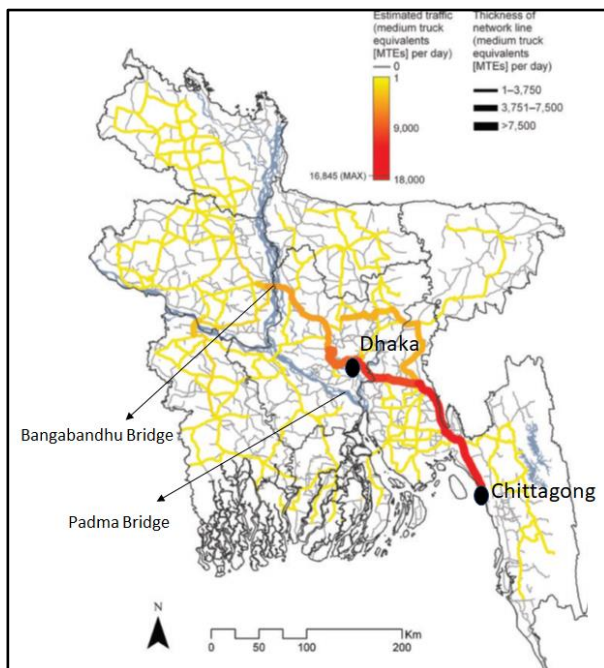
**Table 11 Speed statistics for trucks in Bangladesh (Herrera Dappe et al. 2019)**

VARIABLE	MEAN		MINIMUM		MAXIMUM	
	UNCONGESTED	ACTUAL	UNCONGESTED	ACTUAL	UNCONGESTED	ACTUAL
Distance (kilometers)	113	114	20	20	318	306
Duration (hours)	2.8	18.0	0.7	2.5	7.4	96.2
Speed (kilometers/hour)	40	19	20	0.4	60	36

Source: World Bank analysis.

Also, the river Padma is a logistic bottleneck. It separates West from East Bangladesh and the only connection by road is the Bangabandhu Bridge. The ferries crossing the Padma River that connect the southwest with Dhaka and other divisions in the east are inefficient, with long and uncertain waiting times. Without making extra payments at ferry crossings, it takes trucks 5–24 hours to cross rivers, which results in low utilization rates for trucks and damage to perishable cargo. A large number of trucks thus take the longer route across the Bangabandhu Bridge to reach the southwest districts and the border with India (and vice versa). Currently a new bridge is built that will connect Louhajong, Munshiganj to Shariatpur and Madaripur. The multi-purpose Padma Bridge is expected to be opened in 2021 (see Figure 17).

For small distance transport, the impact is also significant but mainly on cost. With respect to food loss the effect of small distance transport will be negligible. Contrary to long distance transport where delays are much higher, quality decay is more likely. In the field study wholesalers and retailers mention rotten onions as a regular problem for food loss and waste, that could be related to the traveling time and the lack of control on moisture content (e.g. curing at farm level, or absence of ventilation). Transport for all actors is mainly by road. For short distance it can be by foot, van, rickshaw, pickup or minitruck, whereas for long distance larger (uncooled) trucks are used.



**Figure 17 Freight map with the two bridges across the Padma**

The waterways are not used for transport of domestically produced food (Herrera Dappe et al. 2019). In 2017 the government planned to install modern equipment to overhaul 29 river ports and dredge them to increase national and international connectivity<sup>6</sup>. Among them the river ports Nagarbari and Faridpur, that are close to the onion production region. In particular, non-food items could profit from waterways connected to these ports. Unfortunately, both ports are still not upgraded, implying no alleviation of road congestion.

The SWOT analysis for onion distribution in Bangladesh is shown in Table 12.

**Table 12 SWOT for Bangladesh onion distribution**

Strength	Opportunity
<ul style="list-style-type: none"> <li>• Availability year-round</li> <li>• In most cases inhabitants of Dhaka are close to wet markets</li> <li>• Packaging allows for air ventilation</li> </ul>	<ul style="list-style-type: none"> <li>• Switch (partly) to waterways (Nagarbari and Faridpur (non-food))</li> <li>• Improved handling (curing, moisture management)</li> <li>• Padma bridge reduces lead time and costs</li> </ul>
Weakness	Threat
<ul style="list-style-type: none"> <li>• Bad connectivity between West and East of Bangladesh</li> <li>• High transport costs</li> <li>• Bribe along the road</li> <li>• Long lead times cause quality decay</li> <li>• 25% of wholesalers and 13% of retailers mention supply of rotten onions</li> </ul>	<ul style="list-style-type: none"> <li>• High risks from nature (especially long distance)</li> <li>• Increasing population and migration to Dhaka will increase logistic costs and lead time</li> </ul>

## 4.3 Exchange

Exchange of food entails how much of the available food is obtained through exchange mechanisms such as barter trade, purchase, or loans (FAO 1996 in van Berkum et al. 2018). The field study provided a lot of information on the exchange of onions and issues related to buying and selling. About 70% of the agricultural producers did not use loans, and about 28% did use it for cultivation. Loans are taken from banks or relatives, some with high interest, some with none. High prices for inputs and labour are the main drivers for loans.

Onion agricultural producers sell to *faria* and *bepari* in most cases, but they hardly sell on contract basis (5%). The payment is directly by cash in almost all cases. Very few receive money on instalment. For all buyers quality is the main driver for price, and quality is determined by dryness and size mainly. Other elements that affect the price is the colour and the amount the agricultural producer is selling.

Transactions with buyers had several constraints that included offering lower price by buyer syndicate (92%), to sell for lower price (17%) and to sell for market price (10%). Lack of proper and correct information from the markets hampers the power of the agricultural producer during negotiations. This is an important shortcoming knowing that prices are extremely volatile. In 2019 the price of one kilogram of onions in Bangladeshi markets has risen from \$0.36 to around \$3.25.<sup>7</sup>

By the absence of cooperatives, agricultural producers are found to collaborate with colleague agricultural producers mostly by talking and visiting them. Cooperative like structures are not prominent in the existing value chain. As high as 91.67% respondents stated that there was no cooperative like structure even though 63.33% respondents stated that a cooperative structure is a good idea.

There are several intermediaries that buy from agricultural producers like *faria*, *bepari* and *arathdar*, and together they sell to other intermediaries, wholesalers, retailers and consumers. For intermediaries colour, size, dryness and hardness are quality criteria. Most of them buy and sell onions seven days a week. If the selling place is far away intermediaries suffer from high costs, quality decay and unavailability of transport, hereby increasing risks.

<sup>6</sup> <http://www.theindependentbd.com/printversion/details/120348>, accessed 19-11-2020

<sup>7</sup> <https://breakingnewsenglish.com/1911/191121-onions.html>, accessed 2-10-2020

Different media to exchange the operating market information are used. Information is shared regarding market price (98%), market demand (86%), quality standards (48%), and safety standards (12%) among the intermediaries in the value chain. Unfortunately, this information is often unreliable. The following terms of payment were used when buying onions: by cash directly without interest (68%), by instalments (34%), and otherwise (4%). Note that they not only purchase from agricultural producers.

On the other side, regarding transacting with buyers, the 46% of the respondents told that the major problem was "delayed payment", 36% reported about "transactions in credit" and 24% of the respondents told about "payments in instalments".

Loan facilities or credits facilities helped the traders to conduct smooth business of onions and ensure fair price of the produce, but many financially sound intermediaries did not need money as a loan, although in the field survey it was still 28%. Credit or loan collection for different sources was not so easy. If respondents wanted to collect a loan they had to obey or maintain some conditions or consequences. They had to pay interest with some conditions of payments. In this survey, 16% of the respondents took loan from relatives with applying interest. 10% of the respondents took loan with condition that loans will be paid by instalment with high interest (more than bank interest).

It is known that some actors may have several roles, for instance if an intermediary or their employees are transporting the produce themselves, they are also a 'driver'. For short distances volumes are small and the time effort is restricted. For long-distance transport external drivers are often hired by intermediaries. Overall drivers are not owner of the produce they transport. For inter-district transport drivers the costs are shown in Table 13. The payment is done after transport (67%) or before transport (13%). Problems the drivers encountered were delayed payment and transaction in credit.

**Table 13 Cost drivers for truck transport of onions**

Basis of payment	Percentage
Based on both kilometre and kg	47%
Price per packaging unit	33%
Price per kilo meter	27%
Price per kg	20%

In most cases wholesalers purchased onions from intermediaries to obtain significant volume to sell. Like intermediaries, they work seven days a week. The price (buying and selling) is determined by dryness, hardness, colour and size. About 70% of the wholesalers are paying for transport from origin to their location. They sell to retailers, consumers, out of home institutions (hotels/restaurants) and sometimes to other wholesalers. For 75% of the wholesalers delayed payment was an issue, and 50% suffered from transaction in credit. Many wholesalers did not like to take loans or credit facilities. In the field study 60% of the respondents did not take loans for trading, where 20% said they took loan to buy products, mainly from banks.

Retailers purchased their onions from wholesalers, and sometimes from *arathdar*. Their clients are consumers, although hotels, restaurants and street vendors might take a small share. Like the other actors, in general retailers work seven days a week. There are some regulations which may disturb the operation of a business of retailers. Those were "imposing fixed price of the product", "time bound selling" etc., but most of them don't know about these regulations. Most retailers did not take loans, but when they do it is used for buying products. Not banks, but NGOs are the main service provider for retailers.

Price fluctuation is present in the onion supply chain (see Table 14). According to the intermediaries, wholesalers, retailers, mobile vendors and institutional users the fluctuation of the price in the onion chain is the largest bottleneck, including sudden drops in prices.

**Table 14 Purchase and selling prices of onions (in BDT/kg) for 2020 and 2019**

	Agricultural producer	Intermediary	Wholesaler	Retailer	Mobile vendor	Institutional user
Purchase price		29-38	27-35	15-35	24-36	28-38
Selling price	21-40	30-48	28-38	20-42	30-42	
This year Min - max price	25-56	24-52	25-87	25-86	24-104	27-126
Last year min - max price	36-211	35-224	35-242	36-214	34-221	39-222

In overview, all actors, except agricultural producers, deal with the same issues and operate in a similar way with respect to quality, pricing and payments. However, in the field study agricultural producers mention the buyer syndicate manipulating market prices, an observation that is supported as well as doubted in literature. In Karim and Biswas (2016) price manipulation is confirmed, not only by price setting but also by sharing false information on actual demand. Agricultural producers lack trustworthy market information and are always in mess thinking about whom to sell their product in time and as a result, they are often bound to sell their product to local wholesaler syndicate at a very cheap price. Sometimes the cunning local wholesaler makes an artificial demand among the market only to cheat the agricultural producers. They make a fake sort of demand. As a result of that demand, agricultural producers then sell their whole bunch of product to the wholesaler at a very reasonable price thinking that this is their profit. But actually they are in a huge loss because the wholesaler then sells this product at a higher price in town and city market. According to Karim and Biswas (2016) government involvement, coordination and monitoring on price fluctuation in the existing value chain are limited and should be improved significantly to provide a fair share to the agricultural producers.

In Ahmed et al. (2014) there is no strong evidence found of collusive price setting in major markets of the country, nor proof of traders withholding information regarding the essentials of the market. The role of traders' association is largely non-existent. In brief, the onion market appears to hold most of the pre-conditions for a competitive market. The occasional price volatility is mainly caused by natural forces of demand and supply in the market. As apparently there is no sign of oligopoly or cartel in the onion market.

The payment agreements between actors mentioned earlier suggest strong relationships in the onion market. Delayed payment and transaction in credit require trusts and there is evidence of long-experienced traders, which suggest that survival in the market with positive market return requires relationship with other traders as well as learning from doing business over time. Although such factors imply that entry is not always easy, it does not either imply the presence of anti-competitive behaviour by traders in the market. It is rather the inherent structure of the onion market that assigns high value to experience and market knowledge. With respect to government institutions like the Competition Commission or Ministry of Commerce could try to get some grip on the price fluctuations, however such intervention would be rational and effective if any anti-competitive behaviour at all prevails and if we could know the nature of that market failure. In Ahmed et al. (2014) it is suggested that the government should have proper mechanism to control prices by declaring minimum support price or fix rate based on cost or production, rather than take action to unproven buyer syndicates.

The SWOT analysis for onion exchange in Bangladesh is shown in Table 15.

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**Table 15 SWOT for Bangladesh onion exchange**

Strength	Opportunity
<ul style="list-style-type: none"><li>• Most actors do not require loans (except a share of smallholders)</li><li>• Onion is profitable for all actors</li><li>• Consumer demand is high</li><li>• Agricultural producers are paid in cash</li></ul>	<ul style="list-style-type: none"><li>• Import from other countries than India to be less dependent and decrease consumer price</li><li>• Cooperative structure to improve market power at farm level</li><li>• Storage at farm level</li><li>• Processing options (outside Dhaka region)</li></ul>
Weakness	Threat
<ul style="list-style-type: none"><li>• Delayed payment and transaction in credit</li><li>• Weak market position agricultural producer, because lack of good information and power of intermediaries (price fixation, bounded amount)</li><li>• High share of transport costs in onion price</li><li>• Price related to import India at the end of the year</li><li>• Huge price fluctuations disturbing the market</li><li>• Contracts are absent in the supply chain</li><li>• Many actors in supply chain (everyone needs a margin)</li></ul>	<ul style="list-style-type: none"><li>• Restricted investment in rural areas with respect to information technology</li></ul>

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## 5 Conclusions

FLW studies for onion in Bangladesh are scarce but indicate that the loss percentage increases with the length of the supply chain. An opportunity for the onion supply chain in Bangladesh is to work towards reducing food losses at various links of the chain. This value chain analysis focusses on the (post-)harvest supply chain up till and including retail and processing.

Part of the produced onions cannot be sold and do not go to the intended market. Besides the losses that occurred during production (infected and diseased products), different post-harvest activities resulted in losses. Products that do not have the right quality for the intended market are used for home consumption, charity, animal feed or landfill. Losses due to harvesting occurred because not all onions were harvested since they were immature. Other reasons were perished or damaged onions due to the harvesting activity. Low quality onions produced will perish in time and therefore can express itself later in the supply chain. Underlying reasons for these low quality onions at agricultural producer level often originates from inadequate use of inputs such as fertilizer and pesticides, and lack of curing. Using more fertilizers and pesticides than necessary results in poor quality onions with a high moisture content that spoil quickly. This forces agricultural producers to sell their onions quickly after harvest and limits their ability to store the onions till after the peak supply to get a better price. The percentage of unsold onions per actor, together with the causes of losses, can be found in the table below.

**Table 16 The amount of unsold onions and their causes**

Actor	Unsold	Causes
Agricultural producers	2.4% of the onions not sold	Harvesting: Immature, perished or damaged Post-harvest: Rough handling, no market, wrong way/no curing, lack of storage
Intermediaries	0.1% of the onions not sold	Transport: Damages due to road conditions and packaging Sorting: Unknown, causes should be sourced earlier in the supply chain
Wholesalers	2.0% of the onions not sold	Transport: Damages due to road conditions and packaging Sorting: Unknown, causes should be sourced earlier in the supply chain. Storage: no proper curing after harvest, no cooled facility
Retailers	4.1% of the onions not sold	Transport: Damages Sorting: Unknown, causes should be sourced earlier in the supply chain Storage: no proper curing after harvest, no cooled facility, no market on time
Mobile vendors	4.6% of the onions not sold	Transport: Damages Sorting: Unknown, causes should be sourced earlier in the supply chain. Storage: no proper curing after harvest, no cooled facility, no market on time
Institutional users	1.0% of the onions not sold	No market on time

Intermediaries and wholesalers handled the largest amounts of onions and they had a relatively small percentage that remained unsold compared to the other actors. Most unsold onions were at the level of the mobile vendors followed by the retailers. 88% of the agricultural producers remained with unsold onions. Of the other value chain actors, the retailers mostly lacked the ability to sell all onions: 65% indicated to remain with unsold onions. Majority of the unsold onions ended as landfill (FLW) followed by home consumption (not FLW).

Estimates of losses further along the chain were reported as less than 20% per activity. Reasons for losses further along the supply chain largely originate in the enabling environment. Transportation faced challenges such as extortion on the road, bad road communication and high fuel costs, which almost all actors faced.

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Another major reported barrier for optimization of the onion value chain in Bangladesh is price volatility, leaving actors forcefully to sell at throwaway prices, or contrary leading to high consumer prices for onions. Underlying reasons for price volatility of onions are related to syndicates that artificially drive up or down prices as well as onion imports during harvesting times when there already enough onions in the market. This also complicates sharing accurate marketing information. For agricultural producers, opportunities are for the government to have proper mechanism to control prices by declaring minimum support price or fix rate based on (high) cost or production, and for agricultural producer organizations such as cooperatives to create economies of scale and enhance bargaining power.



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## 6 Recommendations

The four Dhaka city corporations are responsible for interventions that can be applied within the borders of their districts and have a regulatory starting point. They have impact on the local (market) regulations, including monitoring, prices, syndicates and food adulteration. However they can also facilitate and stimulate the private sector to invest in new proven interventions or in the implementation phase, or set the agenda for long term goals that have to be implemented in collaboration with the government of Bangladesh (GoB). For this reason the recommendations for a strategic action agenda are provided below and can have different potential implementors including the government of Bangladesh (GoB), city corporations of Dhaka (CC), the private sector (PS), or a combination of these actors, dependent on their responsibilities.

### Short-term recommendations:

- Bangladesh's dependency on India as virtually the only source of onion imports makes Bangladesh vulnerable. The government needs to carefully examine the feasibility of alternative sources such as China, Egypt, Malaysia, Myanmar, Pakistan, Turkey, and Vietnam (GoB).
- Although government imports have the potential to decrease market prices, their expected impacts on prices need to be more carefully assessed. While relatively small imports distributed over a long period of time would not have much impact on the market price, too much price reduction could create disincentive for agricultural producers to produce onion (GoB & CC).
- Bangladesh is mostly dependent on onion imports between September and December. Therefore, the government has to be vigilant during this period to prevent traders from engaging in speculative storing during this period (GoB).
- Timely provision of high-quality inputs to agricultural producers—particularly seeds, fertilizers, and pesticides—is important for increasing domestic production (higher yield) of onion and reducing the dependency on imports (GoB). This only makes sense if storage capacity and technology is increased to overcome the last four months of the year (PS, CC & GoB).
- Incentives such as subsidies to purchase agricultural machineries and loans with low interest from governments or other organizations will increase the possibility for agricultural producers to invest; It will reduce production and labour cost and the dependency of agricultural producers related to the dealers will diminish what will increase their possibilities regarding the use different inputs (GoB).
- Set up organizations where agricultural producers can rent equipment and machinery for harvesting (like in Kenya) to circumvent high labour cost and save time (GoB & PS).
- The government should monitor market regularly and take action against market syndicate (CC & GoB).
- Seed treatment and selection of the variety are the important technical practices for increasing the yield of onion which was not realized by agricultural producers. Hence, the extension agencies should take up suitable training programme on these aspects to those agricultural producers are properly educated. Training on onion cultivation should be organized by government and non-government organizations to develop technical knowledge of the agricultural producers, which will help the agricultural producers to use the inputs in efficient way (GoB).

### Medium-term policy recommendations:

- The government should explore ways to promote more participation in the onion trade by creating an enabling environment. This would increase competition in the supply market and thereby erode the scope for seeking windfall profits through speculation (GoB & CC).

- Timely, adequate, and accurate information is the basis for policy formulation and decision making, but there are often major discrepancies in the information and data on agricultural production reported by the two government agencies responsible for collecting it—the Bangladesh Bureau of Statistics (BBS) and the Department of Agricultural Extension (DAE). Measures should be taken to reconcile the data reported by these agencies, improve their quality, and minimize their delivery time (GoB).
- Develop an information and communication system among the agricultural producers (GoB & PS).

Long-term policy recommendations:

- An important and sustainable way to tackle the onion crisis would be to mitigate dependency on imports by taking steps to increase domestic onion production. Research can play a pivotal role in this by finding ways to increase that production by improving productivity. Since Bangladesh currently has very little fallow arable land available, future production increases will have to come from higher yields of onion. This will mean developing new technologies and innovations through research to address production problems. Agricultural technologies can offer significant promise for augmenting onion productivity, but only if they are disseminated to agricultural producers through effective extension systems and supported by appropriate policies and institutions (GoB).
- Improve the quality of the onions at the production level ensures a decrease of food loss in the rest of the supply chain. Supply chain actors at the end of the supply chains face problems with onions rots. This can be solved by paying more attention to curing, handling and at the farm level. Effective extension systems to facilitate and educate agricultural producers can improve the quality (GoB).
- Create a business link between the agricultural producers and a high value market for direct selling. Currently these markets are out of reach, but substantial and integral development of regions outside the current urban areas like Dhaka will instigate middle class growth in these areas and solve this problem, contributing to congestion reduction along the way. This recommendation is not typically for onions, but supports all agricultural producers of agricultural produce and inhabitants of these regions (PS, CC & GoB).
- Setting up cooperative structures to organize agricultural producers will facilitate the possibilities to reach these high value markets for direct selling and improves the positions of agricultural producers regarding price negotiations. Cooperatives also improve the communication between agricultural producers which will increase their knowledge on market prices and market standards, and will promote their collaboration regarding increasing the production and quality of the produce (PS & GoB).
- Transportation systems and facilities should be developed and the government should take necessary steps to avoid additional cost during transportation. The Padma Bridge is a good example as the first fixed river crossing for road traffic. It will connect the south-west of the country, to northern and eastern regions (GoB & CC).
- A key answer to many problems (not only for the onion supply chain) could be decentralization. Releasing the pressure from the main urban areas will not only reduce bribing, market power of syndicates, congestion, etc. but also create many positive effects in the context of rural development like employment (opportunities), higher level of infrastructure in other parts of Bangladesh and so on. This should be a well-coordinated integral approach including infrastructure, social aspects and value addition (processing close to production) embracing the agricultural context and taking into account climate change impacts and the location of disaster-prone districts. Migration takes place to urban areas and very often towards the east part of the country. This will increase the country's dependency on food imports, whereas yield increase for various agricultural products could on the one hand satisfy the changing need of the urban population towards a mix of fresh and processed convenience food and on the other hand offer jobs that might spread the economic activities and development all over the country (GoB).

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