An Overview of the Bangladesh Food System: Outcomes, Drivers & Activities

Foresight4Food

May 2024

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Acknowledgements
The authors would like to thank the wide range of food-system stakeholders consulted in Bangladesh. They are particularly grateful to GAIN and to the research partners Bangladesh Agricultural University (BAU) (chapter 5), Sher-e-Bangla Agricultural University (SAU) (chapter 6), The Center for Environmental and Geographic Information Services (CEGIS) (chapter 3), International Centre for Climate Change and Development (ICCCAD) (chapter 4) and The Institute of Nutrition and Food Science (INFS) (chapter 4) for their contribution to this report.

This report was produced in collaboration with partners in Bangladesh, as part of the Foresight4Food FoSTr Programme. This programme is funded by the Dutch Ministry of Foreign Affairs through the International Fund for Agricultural Development (IFAD) and implemented by Foresight4Food partners, led by the Environmental Change Institute at the University of Oxford, and by Wageningen University & Research.

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Citation: Barois, Z.O., *Hasan, M.M.,* Ahmed, F., Rozario, S.R., Islam, M.A., Kazal, M.M.H., Shaheen*, N., & Dengerink. J. (2024). An Overview of the Bangladesh Food System: Outcomes, Drivers & Activities*. Foresight4Food. Oxford.

This report can be downloaded for free at https://doi.org/10.18174/658843 or at www.wur.eu/wcdi (under knowledge products).

Report WCDI-24-331

Cover photo credit: Sk Hasan Ali/ Shutterstock.com
Cover photo description: Pirojpur, Bangladesh - October 25, 2022: Bangladeshi farmers cultivating various types of vegetables on floating beds in the low-lying delta region at Nazirpur in Pirojpur, Bangladesh.

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Key messages

The Bangladesh food system serves over 170 million people each day. One-third of the Bangladesh population works in agriculture, while over 70% of available land in Bangladesh is dedicated to farming. The food system delivers well on several outcomes, including reducing poverty rates and food insecurity. However, recent shocks, such as the COVID-19 pandemic and the Russia-Ukraine war, have hindered progress and caused stagnation in some food security indicators.

Over the coming decades, Bangladesh faces the challenge of feeding a fast-growing population, expected to grow by another 50 million people over the coming 25 years. Climate change is increasingly causing rivers to flood and coastal areas to become more saline, thereby affecting food production capacity. Urbanisation, economic growth and reductions in poverty levels will have a major impact on the quantities and types of food that will be consumed.

Highlights of the Bangladesh food system

1. Bangladesh has a total of 60 million smallholder farmers across 12 million farms, supplying 60% of domestic food production. Rice, potatoes, pulses, vegetables and fruits are some of the major food crops. The average size of a smallholder farm is 0.24 hectares, and less than 25% of smallholder households live above the poverty line.
2. Rice is the dominant staple consumed by most households, responsible for 14% of food expenditures. Fish is the most frequently consumed source of animal protein, accounting for 63% of protein supply within national diets.
3. Bangladesh has made huge progress in food and nutrition security over the past few decades. Stunting rates dropped from 41% in 2011 to 24% in 2022. Underweight and wasting has also reduced significantly, although these indicators have been stagnating recently.
4. Bangladesh has made considerable progress in increasing food availability. Food production is deemed adequate as, in terms of caloric value, Bangladesh has reached self-sufficiency in cereal and fish production. However, the low availability of diversified food in the market seems to hinder progress in food and nutrition security.
5. To increase crop yields and maintain agricultural production, many farmers have increased pesticide and aqua-chemical use, often without proper training or protective measures. About 47% of farmers are overusing pesticides, which poses risks to farmer health but also contributes to environmental and aquatic toxicity.
6. Urbanisation and rising incomes are driving changes in consumption patterns, leading to a gradual shift towards higher-value diets and increased demand for processed foods, particularly in urban areas. Changes in dietary patters towards higher value-added and calorie-dense foods have caused a rise in the prevalence of non-communicable diseases (NCDs).
7. Food safety is a major concern in Bangladesh, with over 30 million individuals contracting a foodborne illness each year. The high prevalence of foodborne infections and other food safety risks occur due to the country's dense population, poor infrastructure, lack of clean water, and inadequate sanitation and hygiene facilities.
8. Bangladesh has one of the most productive aquaculture sectors, ranking third globally, which has led to commercial aquaculture production. However, to sustain productive levels, many farms widely use aqua-chemicals and produce high amounts of waste, leading to environmental toxicity. This reduces biodiversity and can have negative implications for human health.
9. Much of the Bangladesh food system is focused on growing staples. However, rice – the national staple – requires abundant water sources to flourish, placing strain on the country's limited ground water sources. The dominant emphasis on staple food production limits the production of other foods, such as fruit and vegetables, and diminishes the accessibility of diversified food in the market.

1 Introduction

1.1 Food system transformation is urgently needed

The transformation of food systems is regarded as an urgent issue around the world. Recent hikes in the price of food, far-reaching climate shocks, the COVID-19 pandemic and the Russia-Ukraine war, have awakened the international community to the necessity of reconsidering the ways in which food is produced, handled, consumed and managed. This is critical to ensuring food security for the present generation, as well as for the future. The challenge is to determine how to bring about transformations that will enable better nutrition, sustainability, inclusiveness and resilience.

The urgency of this transformation calls for a systemic approach to policymaking that can be integrated with 'future thinking' to assess the longer-term requirements and consequences of alternative scenarios. Creating the political will and societal understanding for change will demand an effective process of scientifically informed stakeholder engagement. Such processes should integrate systems approaches with foresight and scenario analysis, supported by the effective use of data analysis, computer modelling and data visualisation.

1.2 Prioritising food system change in Bangladesh

Bangladesh has made significant strides in economic growth, poverty reduction, and food and nutrition security through a combination of factors such as the implementation of proactive government policies, investment in key sectors and reception of international support. However, the country faces a wide range of challenges that aggravate food system outcomes, from climate change and land degradation to rapid population growth. This warrants urgent action through a coordinated response from the vast array of sectors operating in the food system.

The Government of Bangladesh has increased its investments to improve food and nutrition security, particularly through agri-food transformation. The country aims to achieve the sustainable development goals (SDGs) and become an upper middle-income country by 2031 and a high-income country by 2041. Food system transformation is high on Bangladesh's political agenda, whereby numerous ministries are involved in the country's food system transformation agenda and the implementation of myriad food system policies and programmes.

The Government of Bangladesh was an early adopter of the food system approach as they published the 2016-2020 Bangladesh Second Country Investment Plan: Nutrition-Sensitive Food Systems. Otherkey milestones for food systems transformation in Bangladesh include the National Agricultural Policy 2018 and its Plan of Action; the country's contribution to the United Nations Food System Summit (UNFSS) 2021; and the progress review for the UNFSS +2 Stock Taking Moment, which were achieved through multi-stakeholder food system dialogues and the formulation of national food system transformation pathways.

Initiating the Foresight4Food process

Foresight approaches have been used for quite some time as a structured method for examining important uncertainties that shape the ways in which decisions taken today might play out in the future. This forward-looking perspective helps ensure that decision-making is prepared for the future, and can be used to test some of the assumptions on which these decisions are based. Merging foresight approaches with an understanding of the complex structures and key outcomes of current food systems, the Foresight4Food initiative developed a means to facilitate planning for food system transformation processes.

The Foresight4Food foresight framework consists of the following stages:

1. Scoping the process: understand stakeholders' interests and concerns, identify key questions, and outline the process

2. Map the system: map key elements and relationships of food systems and collect and visualize key information
3. Assess trends and uncertainties: identify and assess key drivers, trends and critical uncertainties of food systems change
4. Construct scenarios: use scenarios to identify plausible food systems futures given different uncertainties
5. Assess implications: assess the implications of different scenarios on food systems and for stakeholders' interests
6. Explore system changes: explore directions to improve food systems given stakeholders' visions and scenario implications
7. Generate pathways of change: develop and adaptively deploy strategies for change that are desirable and feasible

The objective of the present report is provide a comprehensive description and analysis of the Bangladesh food system that can be used by various stakeholders. This report is aimed at generating a collective understanding of the food system. It will provide evidence-based input for a participatory scenario process, led by stakeholders in Bangladesh, to support the development of food system transformation. Systems and foresight analyses are crucial to helping stakeholders understand the likely consequences of 'business as usual' and encourage them to engage in exploring the trade-offs, opportunities, synergies and risks of alternative scenarios and pathways. This effort is conducted under the support facility known as 'Foresight for Food System Transformation (FoSTr)', a three-year programme funded by the Kingdom of the Netherlands, overseen by the International Fund for Agricultural Development and implemented by the University of Oxford and Wageningen University & Research in four countries: Bangladesh, Jordan, Kenya and Uganda.

The report is structured as follows:

- Section 2 outlines the approach and methodology used to describe and analyse the food system. It also indicates how this report builds on the concept of food system analysis and its application to the context of Bangladesh.
- Section 3 provides key insights into the regional context, land use and geography of the Bangladesh food system.
- Section 4 describes the key outcomes of the Bangladesh food system in terms of food and nutrition security, economic and social well-being, and environmental sustainability.
- Section 5 provides an overview of the key drivers of the Bangladesh food system, including: demographics, economic development, consumption, technology, markets, climate and environment, migration and policy, and geopolitics. This section also describes the impact of recent shocks, including the effects of the COVID-19 pandemic and the war in Ukraine.
- Section 6 presents an overview of key actors in the Bangladesh food system and their economic activities, which shape the system on a daily basis.
- Section 7 describes the causal linkages between the various components in the Bangladesh food system, illustrating examples of archetypes, trade-offs and synergies.
- Section 8 provides key conclusions emerging from this food-system overview.

The report is intended for discussion and is open to comments, suggestions and improvements. This published version offers a snapshot of the current status as of 2024.

Disclaimer

This report uses data from both national and global sources. It is important to acknowledge that we have given priority to national statistics whenever they are accessible, contingent upon data availability. We understand that national and global datasets may not always coincide with each other, thus requiring continuous iterations in order to obtain accurate and up-to-date data.

2 Using the Foresight4Food food systems framework

The Foresight4Food food systems framework

To map the key components of the Bangladesh food system, the Foresight4Food food system framework is adopted (Figure 1, below). This framework builds on previous work and incorporates elements of the food systems framework developed by Ingram (2011), The High Level Panel of Experts on Food Security and Nutrition (HLPE) (2016) and van Berkum et al. (2018). This framework is used as a basis for describing the food system, while customising specific elements to the Bangladesh context. We also use it to scan for trends relating to the food system and to detect major drivers behind it. This framework describes the main components of a food system: activities, support systems, drivers and outcomes.

A set of activities forms the core of the food system. These activities are undertaken by various actors, and include primary production, processing, retail and consumption, along with storage and disposal. Given that, in reality, food systems involve multiple interacting value chains, their proper functioning requires a broad set of support services, including physical and market infrastructure, transport, financial services and information and technology.

The incentives and operating conditions for the actors are influenced by the institutional environment of policies, rules and regulations (e.g. concerning food safety, food quality, financial matters, taxation and environmental considerations), consumer preferences and social norms. These institutions, alongside the dynamics of the political economy and complex relationships between actors, collectively establish the formal and informal rules that govern the functioning of the food system.

The food system operates within the wider context of society, which also includes human and natural systems, with multiple interactions and feedback loops between systems. These wider systems create a set of external trends that shape the behaviour and evolution of the food system as a whole. However, although each system actor influences, it is also influenced and reacts accordingly. Food system drivers include population dynamics, consumption preferences, technological developments, global markets, environmental factors and politics. Food system outcomes can be categorised into three main areas: economic and social well-being, food and nutrition security, and outcomes relating to nature and the environment.

A food systems model provides the basis for understanding and exploring the critical relations, trends and trade-offs that support the transformation of food systems in order to achieve better food system outcomes. For example, indicators of the three food system outcomes enable the assessment of whether food systems are functioning in desirable or undesirable ways, in light of wider societal and environmental objectives. Analysing the drivers that fuel the current state of the food system increases our understanding of the pressures exerted on food systems.

Methodology

This draft report gathered secondary data to identify the key trends across the Bangladesh food system. The approach consisted of an exploratory review to gain a general understanding of the processes that occur across the Bangladesh food system. A range of sources were included to increase the validity of the review, namely journal articles and statistical databases, such as the Food and Agricultural Organization Statistics (FAOSTAT), World Bank Data, Bangladesh Bureau of Statistics, Bangladesh Open Data, Household Income and Expenditure Survey (HIES) and reports by research institutes and United Nations agencies. In the event of multiple sources being available for same indicator, data from the most recent source was included in the study. Importantly, not all processes within the food system are mapped due to the lack of data and, in some instances, limited data accessibility. This makes it challenging to ensure a comprehensive and coherent narrative of the food system is conducted, and thus requires collaborative review, reflection and validation from stakeholders across the food system.

Collaborative workshops were organised to gather information for the food system dynamics in Chapter 7. Three casual loop diagrams were created by the research partners and integrated into one common diagram. The final casual loop diagram was supplemented by the key drivers, activities and outcomes identified in this report. This report was validated during an expert meeting which was well attended by key policymakers, researchers and representatives from UN organisations.

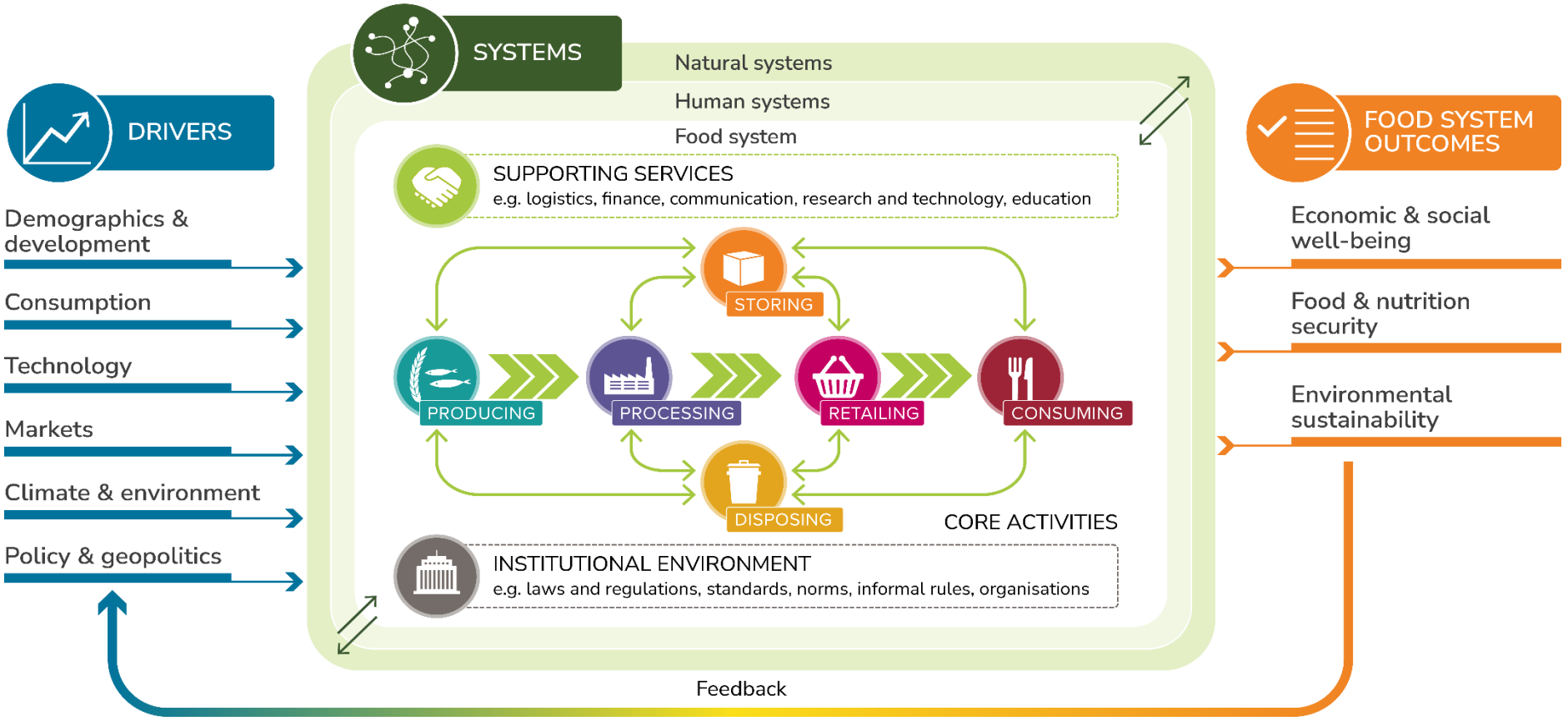

Figure 1 *The Foresight4Food food systems framework*

3 Context and geography

This chapter describes the context of Bangladesh, providing insight into the country's geography, land use patterns, agroecological zones and water resources.

3.1 A brief context of Bangladesh

Bangladesh is located in the North-Eastern part of South Asia, spanning approximately 147,570 km^2, and with a population of 169 million is one of the most densely populated countries of the world (The World Bank, 2021a). The country is split into eight different divisions, each having unique characteristics and population densities (Figure 2). The most densely populated area is the Dhaka Division, with over 44.2 million inhabitants and population density of 2,156 people per square kilometre. The least populated is Barishal, with a population density of 688 people per square kilometre (BBS, 2022a). The country has a rich cultural diversity formed by its unique multi-ethnic community. Bangladesh's neighbouring countries include Myanmar towards the east and India towards the western and northern parts of the country, whilst the south opens into the Bay of Bengal (Husain & Tinker, 2022).

The Ganges, Brahmaputra, Meghna and Karnafuli rivers and many other tributaries criss-cross the country. As, a result, Bangladesh primarily consists of low-lying deltaic plains, never raising more than 12 meters above sea level. Slight changes in topography are observed towards the north-eastern hilly regions of Sylhet and the forest regions of the Chittagong Hill Tracts (Husain & Tinker, 2022; Ministry of Foreign Affairs, 2023).

Bangladesh aims to reach upper middle-income status by 2030 and high income country by 2041, fuelled by the nation's abundant labour supply, fertile land, water and monsoon rains. However, the country's high population density presents challenges, such as rapid rates of urbanisation, declining land availability and infrastructure shortages. In addition, Bangladesh is one of the most disaster prone countries in the world due to its geographical location and geological features (BBS, 2022c). Despite these challenges, Bangladesh has demonstrated resilience and adaptability in addressing these challenges and continues to work towards overcoming such complexities.

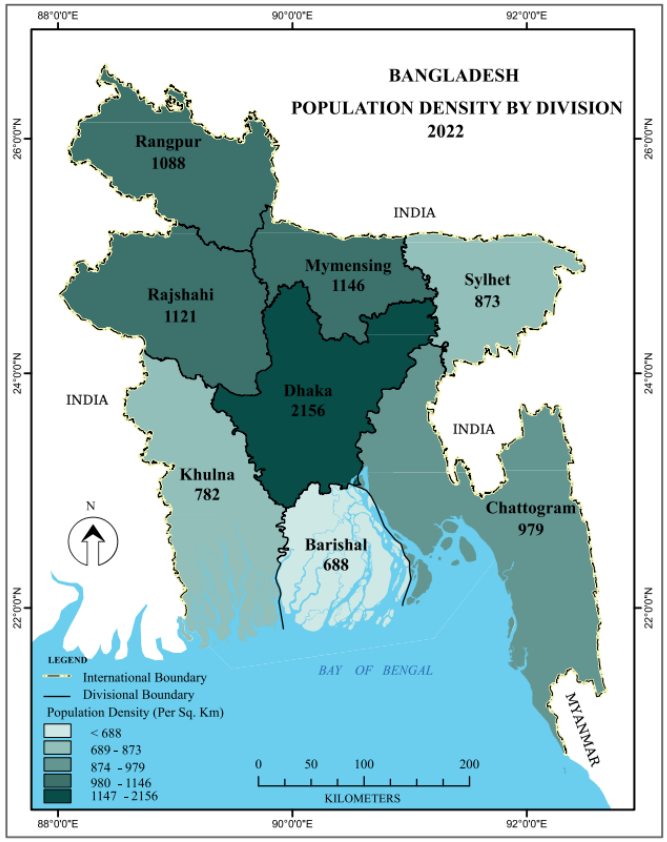

Figure 2 *Population density of Bangladesh per sq km (2022), Division-wise Source: BBS, 2022a.*

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3.2 Geography of Bangladesh

Bangladesh has diverse soil quality, climate and land level, giving rise to 30 agroecological zones and three physiographic zones. The latter is divided into (I) floodplains, (II) terraces and (III) hills, each with distinct soil characteristics. The country's arable land is spread across highland and medium highland areas (71%) and various low land categories (29%) (Ahmed, Saint-Geours & Gitau, 2021).

In addition to these geographical variations, water availability plays a vital role in crop production. Water availability differs across each of the physiographic zones. Water resources are limited in the high to medium highlands, whereas medium lowland and lowland are prone to flooding during the monsoon season. As more than 80% of Bangladesh's land area is situated on a floodplain, latticed with more than 450 rivers, agricultural areas are prone to flooding, droughts and cyclones.

Bangladesh has a humid and warm climate, experiences seasonal variation and receives high amounts of rainfall, averaging around 2,200 millimetres per year (The World Bank, 2021d). As a result, the agricultural land use across Bangladesh is highly dynamic, and flood levels and durations influence farmers' decisions regarding cropping patterns (Ahmed, Saint-Geours & Gitau, 2021).

3.3 Agroecological zones of Bangladesh

Regional differences influence agricultural production due to variation in farming practices, irrigation cover and differences in climate and physiography. As a result, Bangladesh's land cover has been classified into 30 agroecological zones, shown in Figure 3 (DoE & CEGIS, 2023).

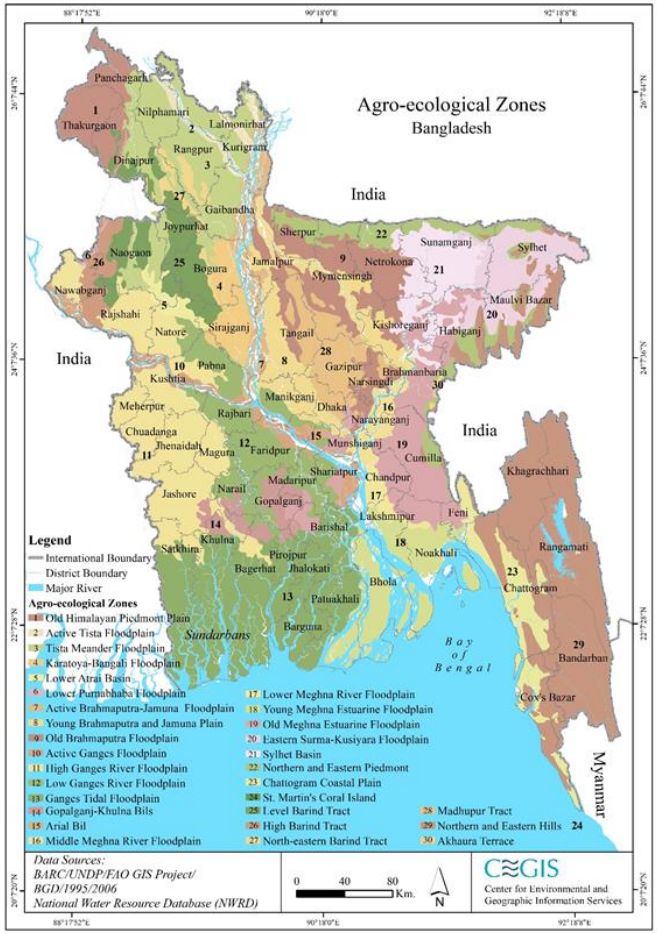

Figure 3 *Agroecological zones in Bangladesh*
Source: DoE & CEGIS, 2023.

3.4 Land use

Bangladesh is experiencing significant transformations in land use due to a confluence of factors, such as population growth, economic advancements, climate variability and technological innovation. These changes have far-reaching implications for food and nutrition security. To effectively address these challenges, a thorough understanding of current land use patterns is imperative. DoE & CEGIS (2013) conducted a study to compare national land use maps from 2010 and 2020 to better understand the breadth of land use change in Bangladesh over the last decade, see Figure 4A and 4B).

The study used LANDSAT satellite imagery to visually identify eight land use categories, including agricultural land, urban areas and natural reserves. Since 2010, a notable shift in land use dynamics has occurred. Urban expansion, driven by rapid population growth and economic development, has encroached upon agricultural land and natural habitats. According to area statistics (Table 1), forest land area decreased by about 0.07% between 2010 and 2020. Similarly, cropland area reduced by 1.51% during the same period. In contrast, grassland area increased by about 1,402 ha (0.01%), whilst rivers and khals (canals) increased by 0.25% (DoE & CEGIS, 2023). Overall, forest land, cropland and other waterbody areas exhibit a decreasing trend, whereas grassland, rivers and khals, settlements, aquaculture, orchards and other plantation areas exhibit an increasing trend.

Table 1 *Area statistics of land use change map (2010 and 2020)*

Class name	Area in 2010 (ha)	Area in 2010 (%)	Area in 2020 (ha)	Area in 2020 (%)	Land use changes (ha)	Land use changes (ha)
Forest land	20,03,242	13.41%	19,92,103	13.34%	-11139	-0.07%
Cropland	74,30,127	49.74%	72,04,586	48.23%	-225541	-1.51%
Grassland	68,207	0.46%	69,609	0.47%	+1402	+0.01%
Rivers and khals	13,30,021	8.90%	13,67,884	9.16%	+37863	+0.25%
Other waterbodies	1,36,374	0.91%	1,25,464	0.84%	-10910	-0.07%
Settlements	32,41,673	21.70%	33,05,370	22.13%	+63697	+0.43%
Aquaculture	2,92,949	1.96%	3,58,396	2.40%	+65447	+0.44%
Orchards and other plantations	98,376	0.66%	1,77,519	1.19%	+79143	+0.53%
Other land	3,35,730	2.25%	3,35,768	2.25%	+38	+0.00%
Total	1,49,36,699	100%	1,49,36,699	100%		

Source: DoE & CEGIS, 2023.

Figure 4A *Land use map of Bangladesh in 2010*
Source: DoE & CEGIS, 2023.

Figure 4B *Land use Map of Bangladesh 2020*
Source: DoE & CEGIS, 2023.

3.5 Water

Water availability is a critical issue in Bangladesh, although the country has a unique geographical position in the Ganges-Brahmaputra-Meghna basin. Abundant rainfall occurs during the four-month rainy season. During this time, rivers become engulfed with excess water, typically leading to the infiltration of water across the vast floodplains, with approximately 22% of the country covered by water. The lack of storage infrastructure leads to excessive water drainage, causing flooding and crop loss. In periods of normal flooding, water depths between 0.3 to 2.0 meters can be expected across about 22% of the country. However, severe flooding can affect up to 80% of the country (Ahmed, Saint-Geours & Gitau, 2021).

Water scarcity is a prevalent challenge after the rainy season, aggravated by upstream dam construction and altered rainfall patterns resulting from climate change. While overall precipitation amounts may remain stable, increasing dry days followed by heavy showers intensify agricultural risks. Currently, tube wells and power pumps are the most common form of irrigation, covering more than 95% of irrigated lands. Groundwater provides 75% of water for irrigation, whilst the remaining is sourced from low lift pumps that pump surface water from rivers and canals (Ahmed, Saint-Geours & Gitau, 2021).

Effective water management and strategic planning are essential for mitigating these water scarcity challenges and ensuring food security. Investment in storage facilities, drainage systems and irrigation technologies, coupled with collaborative agreements on water sharing and adaptation measures, can help address these issues and foster sustainable agricultural development in Bangladesh.

4 Food system outcomes

To obtain an overview of the current state of the food system, it is important to understand what the food system is currently delivering in terms of outcomes. Food system outcomes can be classified into three main areas: ensuring food security and optimal nutrition for all; meeting socio-economic goals, particularly with regard to reducing poverty and inequalities; and making it possible to meet food needs within the boundaries of the planetary environment and climate. To deliver on these outcomes, food systems need to be resilient to shocks, sustainable over the long-term and equitable in terms of the costs and benefits to different societal groups. Trade-offs and synergies occur across the outcomes and properties of food systems, accompanied by the potential for both conflict and collaboration between interest groups. This section provides an overview of the status of the outcomes of the Bangladesh food system.

4.1 Food and nutrition security

Bangladesh is making progress in terms of food and nutrition security compared to many of its regional counterparts. The country is experiencing a slight downward trend in terms of the prevalence of severe and moderate food insecurity decreasing from an average of 32.2% in 2014-2016 to 31% in 2020-2022.

This can be compared to the increasing trend seen for the regional average, rising from 27.6% in 2014-2016 to 41.3% in 2020-2022, Figure 5 (FAO, 2024). Moreover, the prevalence of undernutrition has decreased since 2000, from a three year average of 15.6% in 2000-2002 to 11.2% over 2020-2022, Figure 6 (FAO,2024).

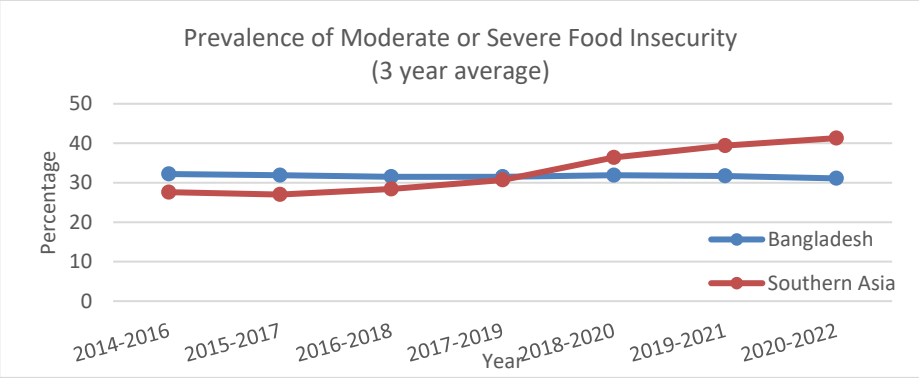

Figure 5 *A comparison between the prevalence of moderate or severe food insecurity in Bangladesh and the average regional data for Southern Asia between 2014 and 2022*
Source: FAO, 2024.

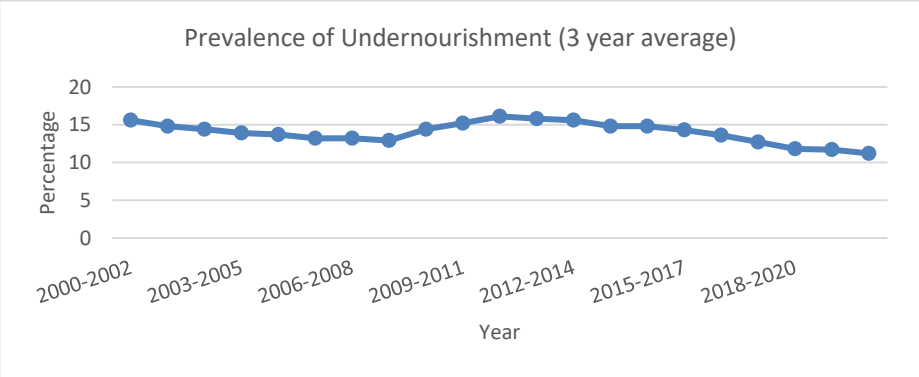

Figure 6 *The three year average prevalence of undernutrition in Bangladesh from 2000 to 2022*
Source: FAO, 2024

4.1.1 Food availability

Bangladesh has made considerable progress in increasing food availability. Food production is deemed adequate as, in terms of caloric value, the country has reached self-sufficiency in rice production. This increased by 3.8 times from since the country's independence, meeting the feeding demand of the population.

However, 25.9% of total rice production is used for non-human consumption and within this a proportion of rice is lost pre- and post- harvest (FPMU, 2023). This loss and non-human consumption of rice reduces its availability on the market and can lead to higher rice prices, food insecurity and malnutrition as rice is heavily depended upon as a staple food (FPMU, 2023).

A consequence of the dominance in rice production is that less space is available to produce other, more diversified food. This therefore results in a low availability of diversified food in the market, which seems to hinder progress in food and nutrition security (IPC, 2022). Furthermore, despite reaching self- sufficiency in the production of rice, Bangladesh continues to rely on imports to meet the food demands to sustain the country's growing population (see § 6.1). Consequently, this high dependency renders the country vulnerable to price fluctuations in international markets, as observed during the COVID-19 pandemic and as a result of the war between Ukraine and Russia.

Other food groups have demonstrated various degrees of supply changes over time. For instance, the supply of fruits and vegetables have gradually increased, with vegetables reaching just over 120 g/capita/ day in 2021 compared to approximately 75 g/capita/ day in 2010 The supply of meat, egg, milk and starchy roots, although experiencing fluctuations, have also seen gradual increase in trends (Figure 5C) (FAOSTAT, 2021). According to current FAO estimates, the supply of rice and rice products is about 715 g/per capita/day, 50 g/per capita/day for wheat and wheat products, and around 25 g/per capita/day for pulses (FAOSTAT, 2021). This data can be incorporated to illustrate the average dietary supply adequacy, which has been fluctuating since 2000 and recently been on an increasing trend rising from 107% in 2012-2024 to 113%^in 2020-2022, Figure 7 (FAO, 2024).

[1] A healthy diet is defined as one that provides adequate calories and essential nutrients for an active and healthy lifestyle. This is based on locally available foods to meet the nutritional requirements set by the food based dietary guidelines (FAO, 2023b).

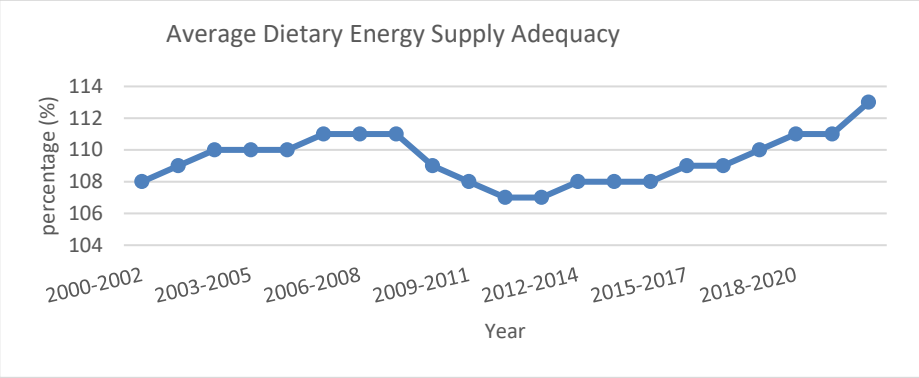

Figure 7 *Average dietary energy supply adequacy (3 year average) Source: FAO, 2024.*

4.1.2 Accessibility

Due to continual population growth, Bangladesh must constantly increase food production to maintain rice self-. Achieving this for other food groups depends on factors such as crop yield, climate variability and changes in agricultural policies. These elements influence the availability of food items in the market. Lower income groups, such as day labourers, have limited financial access for sufficient quality and quantities of food. Moreover, poor access to roads and large distances to markets amongst rural populations are additional constraints in terms of physically accessing food (IPC, 2022). Additionally, there has been a steady increase in the consumer price index, affecting the price of meat, poultry, legumes and fruit (The World Bank, 2021c). In terms of financial accessibility, the cost of a healthy diet[1] has increased due to inflation and fluctuations on the international market. In March 2024, inflation on food prices (point to point) was 9.87 (BBS, 2024). This price inflation is in part due to the depreciation of the BDT-US$ exchange rate. However, due to increasing incomes, the percentage of people unable to afford a healthy diet has decreased (see §5.3).

4.1.3 Food utilisation

National energy intake levels and the consumption of essential nutrients remains below the national dietary recommendations. The majority of Bangladesh diets are largely imbalanced, with staple food cereals contributing towards approximately 70% of total energy intake (Rahman et al., 2022). The average calorie intake per capita per day has increased from 2,210 in 2016 to 2,393 in 2022 (BBS, 2022b). Together with cereals, non-leafy vegetables, roots and tubers make up more than four-fifths of the rural population's total diet.

Only 10% of Bangladesh diets comprise protein and micronutrient-rich foods like fish, meat and eggs. Furthermore, it is reported that the average Bangladeshi consumes around 201.9 g of vegetables and 95.4 g of fruit daily; the latter far below the recommended daily intake of 200 g (FPMU, 2023; Rahman et al., 2022). Interestingly, rice consumption has declined by 20% since 2000 and consumption of vegetables, fruit, fish, meat, onions and eggs has increased (Figure 8) (Ahmed, Saint-Geours & Gitau, 2021; HIES, 2022).

More specifically, the average fish consumption has increased in rural households from 59.4 g/capita/day in 2010 to 67.7 g in 2022, but decreased in urban households. Although the consumption of pulses has increased to 15.9 g/capita/day in rural households and to 19.9 g/ capita/ day in urban households, these amounts are still less than a third of the desirable intake (FPMU, 2023; HIES, 2022). These figures highlight that consumption patterns are changing for the better, as a decrease in rice consumption is observed whilst the consumption of nutrient-dense foods increases.

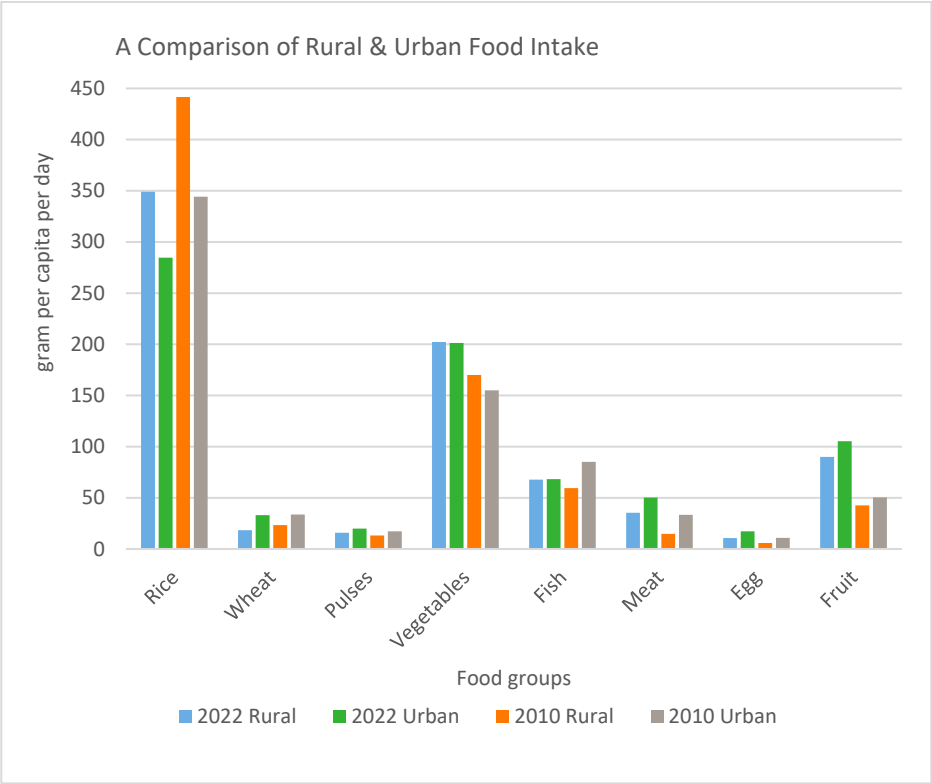

Figure 8 *A comparison of food intake between 2010 and 2022 between rural and urban households*
Source: HIES, 2022.

Bangladesh has made significant improvements in the rates of child stunting and underweight. Stunting has declined from 41% in 2011 to 24% in 2022, whilst the prevalence of underweight reduced from 56% in 1996-97 to 22% in 2022. Although the prevalence of wasting showed a sharp decrease in 2017-18, it slightly increased in 2022 from 8% to 11% (Figure 9) (FPMU, 2023). Stunting rates in the country remain higher than the regional average (28% in Bangladesh vs 21.8% in the Asian region). Wasting patterns follow a similar outcome, as 9.8% of children under five years in Bangladesh remain affected, which is higher than the regional average (8.9%).

Recent findings from the National Micronutrient Survey 2020-21 show improved consumption levels of a minimum acceptable diet from 27% in 2019 to 28.8% in 2020. Minimal progress has been made in reducing anaemia amongst pregnant women, where the trend decreased from 47% in 2000 to 42% in 2019 (The World Bank, 2019). The prevalence of overweight and obesity amongst women follows an increasing trend (Figure 10) (NIPORT and ICF, 2020).

According to the Global Nutrition Report of 2023 and, obesity rates amongst adult women and men and children are 6.2%, 3% and 2.4%, respectively. The prevalence of overweight children under the age of five is also very low, at 2.4% (BBS & UNICEF Bangladesh, 2019).Whilst these rates are amongst the lowest in the world, diabetes is estimated to affect 10.9% of adult women and 11.9% of adult men (Global Nutrition Report, 2023). Interestingly, non-communicable diseases (NCDs) are on the rise, and in 2018, the proportional death from NCDs in Bangladesh was 67%, of which 22% were premature (WHO, 2018).

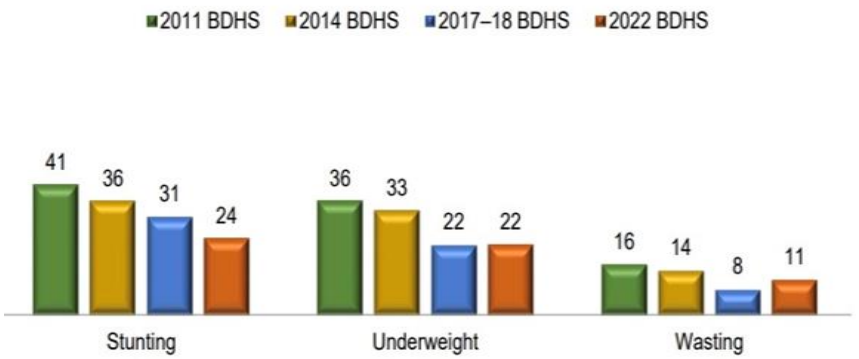

Figure 9 *Trends in child undernutrition*
Source: NIPORT and ICF, 2020.

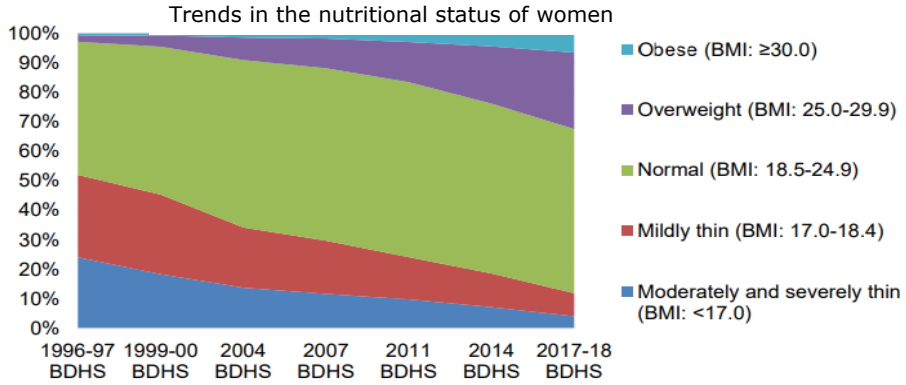

Figure 10 *BMIs of ever-married women over time*
Source: NIPORT and ICF, 2020.

4.2 Social and economic wellbeing

The Bangladesh food system is significantly impacting the country's economy and social well-being of its people. The value added from agriculture, forestry and fishing to the country's gross domestic product (GDP) decreased from 30.5% in 1990 to 11.2% in 2022 (World Bank, 2022a). Additionally, the proportion of people employed in the agricultural sector is rapidly declining, from 70% in 1991 to 37% in 2022 (Figure 11) (World Bank, 2022c).

However, the agricultural sector remains the largest of all economic sectors in terms of employment and accounts for the majority of rural employment. Despite this, seasonal agricultural labour shortages are increasing (Ahmed, Saint-Geours & Gitau, 2021). Agriculture has played a key role in reducing poverty rates, and across rural areas, over 87% of people rely on agriculture to contribute towards their income.

Further, between 2006 and 2016, Bangladesh witnessed a 45% increase in women engaged in agriculture. However, this transition presents its own challenges, as women are often subjected to traditional gender roles and face more constraints accessing markets, finance and services compared to men. Consequently, this limits women's productivity and economic potential (Ahmed et al., 2023). Women require more tailored support to overcome these challenges, in combination with increased agricultural diversification and modernisation to ensure high productivity (Ahmed, Saint-Geours & Gitau, 2021).

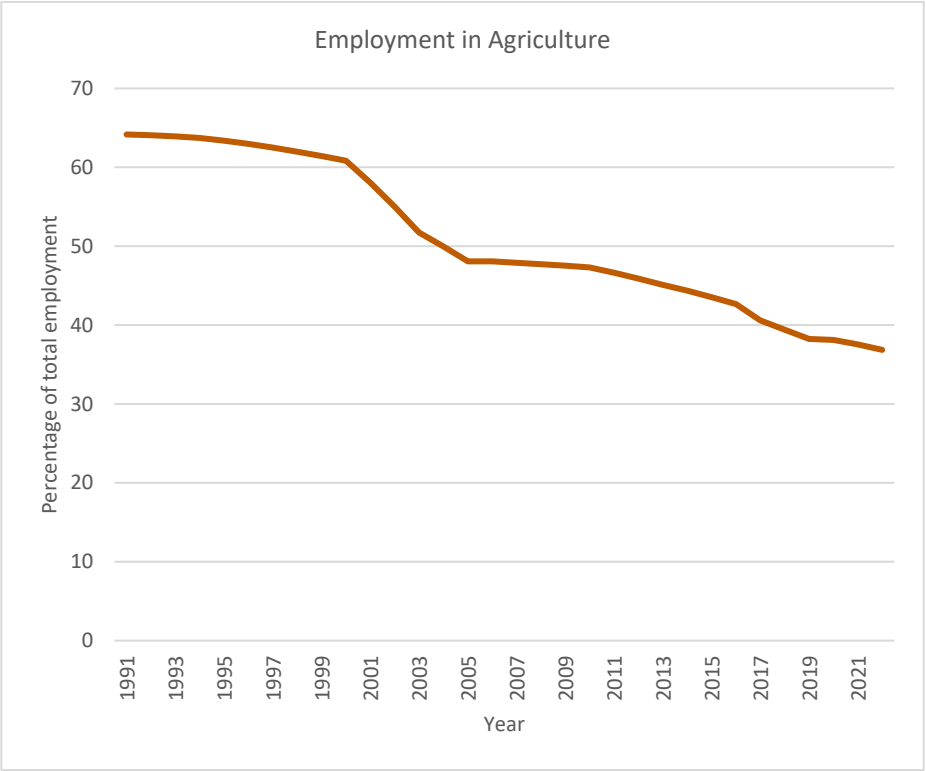

Figure 11 *Employment in agriculture in Bangladesh*
Source: World Bank, 2022c.

4.3 Environmental sustainability

Bangladesh struggles to feed its rapidly growing population due to its small and densely populated land, and farmers have turned to higher yielding crops to meet increasing food demands. Consequently, pesticide use has drastically increased since the 1990s (Figure 12), with 77% of Bangladeshi farmers currently using pesticides at least once in a crop season. Moreover, it is reported that 47% of farmers involved in Boro rice, potato, bean, eggplant, cabbage, sugarcane and mango farming overuse pesticides; with only 4% formally trained in pesticide use and over 87% admitting to using little to no protective measures when applying pesticides (Sumon, 2018). Pesticide overuse threatens farmer health and poses environmental and aquatic toxicity, leading to water pollution.

Being the most widely produced crop in Bangladesh, rice surpluses are expected to come at a considerable environmental cost, due to the increasing demands in groundwater use from irrigation. As a consequence, groundwater irrigation could exceed its natural replenishment replacement in many locations, thus rendering areas prone to water scarcity if improperly managed. Subsequently, deficits in soil moisture and water stress has severe implications on food security (Sumaiya et al., 2020).

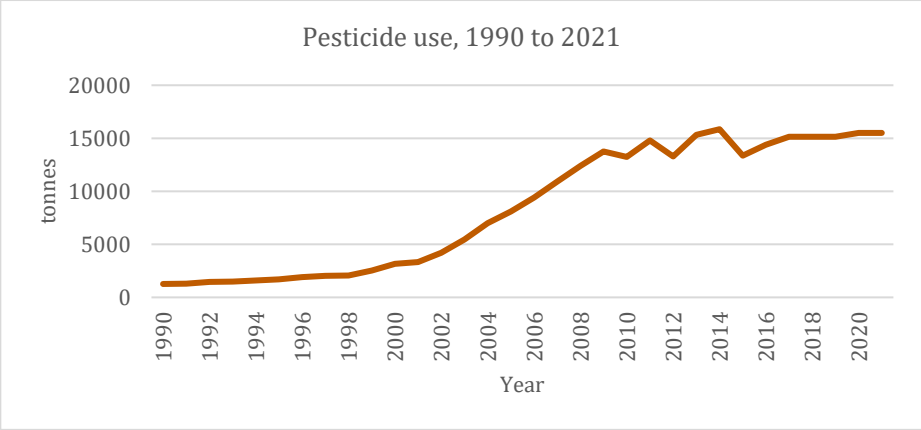

Figure 12 *Trends in pesticide use 1999-2019*
Source: Our World in Data, 2024.

Although rice is still widely produced, dietary preferences are changing towards more value-added products. As a result, the agricultural sector is gradually consuming more energy, as more energy needs to be consumed for producing he same value in the sector. This has been further exacerbated as many farmers do not use energy-efficient machinery (JICA, 2016). The food system is a significant source of greenhouse gas emissions in Bangladesh, and due to rising food demand and supply, greenhouse gas emissions from agricultural activities has increased 1.6 times from 48 in 1972 to 76 Mt CO_{2eq} in 2014, whilst energy consumption rose from 10 to ~50 PJ over the same period (Islam et al., 2021)

As Bangladesh is a leading country in aquaculture production, the growth and expansion of the sector has created a growing demand for aqua-chemicals (pesticides, antibiotics, etc.). These are applied with the aim of treating disease, improving water quality and increasing the productivity of fish culture. In Bangladesh, approximately 400 different aquaculture chemical products are produced and are easily accessible in the market. However, 81% of fish farmers are unaware of effective dosing and 88% lack knowledge in the use of aqua-chemicals and antibiotics. As a result of minimal regulations around aqua-chemicals and their excessive use, widespread health implications and ecological risks have become apparent (Salma et al., 2022).

In addition, the expansion of the aquaculture sector, specifically shrimp farming has led to social-ecological complexities in southwest costal Bangladesh. Although shrimp farming has contributed substantially to increasing incomes and acts as a huge source of revenue for Bangladesh through its exportation, the environmental cost that accompanies plays a critical role in changing the regional environment (Morshed et al., 2020). Since 1990 the land covered by shrimp ponds almost doubled expanding from 22% to 38% in 2016 (Morshed et al., 2020). As shrimp aquaculture requires the infusion of salt-water into ponds, the level of soil and water salinity increased over the same period, whereby salinity levels increase by an estimated 146 km^2 per year (Morshed et al., 2020). Research has shown that the public costs that arise as a result of the impacts associated with shrimp production amount to 21%-30% higher than the profits of shrimp aquaculture. This includes the combined cost of mangrove destruction, water pollution, decreased agricultural yields, reclamation costs and biodiversity losses (Morshed et al., 2020).

5 Food system drivers

Following the snapshot of how the Bangladesh food system delivers to society, we can begin to explore the factors that shape such outcomes. In this section, we describe key forces and influences that shape and structure food system activities and their associated outcomes. Food system drivers are detailed under the following categories: demographics, economic development, consumption, technology, markets, climate and environment, policy, and migration.

5.1 Demographics

Bangladesh's population is expected to continuously grow at an annual rate of 1.1% and projected to reach 220 million by the year 2050. The country has experienced rapid urbanisation, which has increased from just 5% in 1960 to 39% in 2021, consequently placing pressures on the national food system (The World Bank, 2021b; UNFPA Bangladesh, 2023). The diversity of demographic features amongst the Bangladeshi population must be considered when thinking about the future of the food system. This is due to large variations in factors, such as income level, gender, access to education, family size, and household type. For example, in 2019, more than one-fifth of the population still lived below the poverty line, which may exacerbate issues of food insecurity and malnutrition (ADB, 2019). The demographics within the country are thus influencing the food system, as the nation must continue to increase the availability of nutritious food – despite land and climatic constraints – to provide for the highly dense and growing population.

5.2 Economic development

Bangladesh has experienced steady economic growth and development amidst global economic uncertainty, and had one of the world's fastest growing economies in 2019, reaching a GDP growth rate of 8.3% (The World Bank, 2023) However, due to the impacts of the COVID-19 pandemic, the average GDP growth rate in 2020 was significantly lower, reaching only 3.4%. Following this, in 2021, GDP growth increased to 6.8% (ADB, 2021; The World Bank, 2023). According to the Global Nutrition Report (2022), the proportion of the population in extreme poverty (below US$1.9/d) has remarkably reduced since 2002, decreasing from 33.4% to 4.6% in 2021 (Figure 13) (The Global Nutrition Report, 2022).

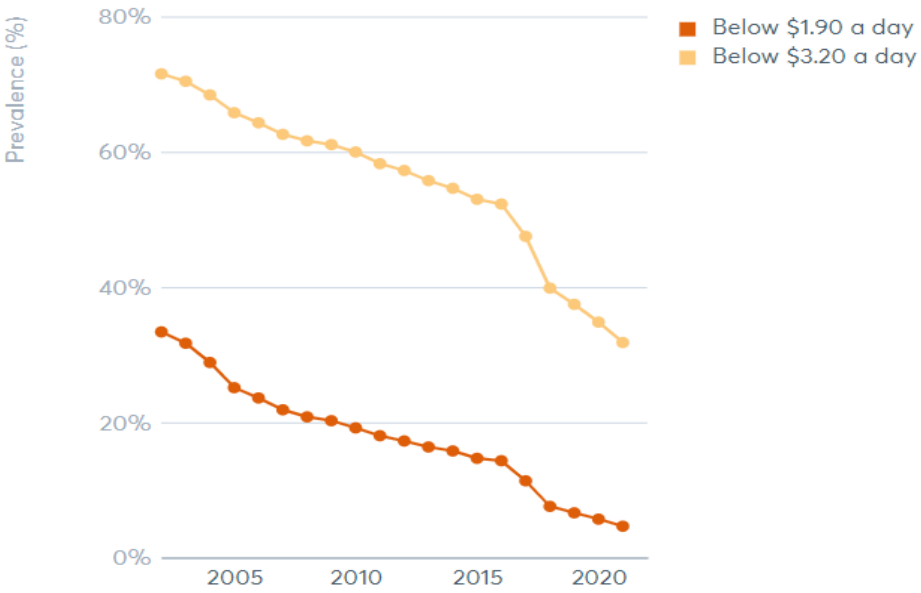

Figure 13 *Population living below the poverty line in Bangladesh*
Source: Global Nutrition Report, 2022.

Between 2005 and 2010, a 69% decrease in poverty was attributed to agriculture, whereas between 2010 and 2016, agriculture contributed towards a 27% decrease in poverty (Ahmed, Saint-Geours & Gitau, 2021). Such changes influence consumer purchasing power, improving access to food. This can, however, also lead to shifts in dietary patterns, as consumers can afford and acquire a taste for higher value - added products.

The improvement in poverty rates can, in part be attributed to the consistent allocation of significant resources to social protection, which amounted to US$ 18.7 billion spent between 2013-2018. In terms of social assistance, Bangladesh spends more than China, Sri Lanka and Pakistan in terms of share of GDP (The World Bank, 2021). Although this high share of resources are allocated to social protection programs, The way in which they are deployed determines their effectiveness. The Government of Bangladesh has increased spending in the agricultural sector relative to the national economy. As a result, the agriculture orientation index doubled from 0.2 in 2013 to 0.41 in 2016 (Bangladesh Planning Commission, 2020).

Foreign direct investment (FDI) in Bangladesh has been lower than in other countries, with FDI mainly driven by the ready-made garment sector. The government offers investment incentives under its industrial policy and export-oriented growth strategy, but FDI inflow has declined due to the global recession following the pandemic (Rahman et al., 2024). New investment projects are mainly proposed by Chinese and Indian investors, primarily in electrical equipment, construction, IT, chemical and food processing sectors. This is expected to cause a surge in the availability of processed foods on the market which may have widespread consequences on health.

Economic development is linked with major agri-food subsidies and food system drivers that are also related to food supply chains, consumer behaviour and diet. A major subsidised food sector of the Government of Bangladesh is the Open Market Sale Programme, led by the Ministry of Food, whereby the Trading Corporation of Bangladesh under the Ministry of Commerce, supplies daily necessary goods such as rice, pulses, edible oil and sugar to poor and lower income individuals at a subsidised rate compared to the market price. Between 2012 and 2014, agricultural subsidies covered the majority (80%) of recurrent public expenditure for the agriculture, livestock and fisheries sectors.

In 2017-2018, agricultural subsidies were estimated at approximately US$1.1 billion, which boosted the domestic agricultural production of staples and dampened the production of more diversified foods (Ahmed, Saint-Geours & Gitau, 2021). To address the impacts of the COVID-19 pandemic, emergency food aid arrangements were made to distribute rice, relief (cash) and baby food to the poor, who suddenly became unemployed at that time (OECD, 2022). Reforms in Bangladesh relating to increased subsidies for consumers will promote economic development and enhance the availability of foods to the population, thus ensuring food security in the country.

5.3 Consumption

Intertwined with demographic and economic drivers, food consumption patterns act as another driver for food systems. Due to urbanisation and increasing incomes, Bangladesh is seeing a gradual shift in diet composition from a dominance of staple foods towards higher value-added diets consisting of more fats, oils, sugars and processed foods. This is most prominent in the diets of urban populations, which appears to delineate the nutrition transitions expected throughout the rest of the country (Ecker & Comstock, 2021; Mottaleb et al., 2018a).

The cost of food is another major determining factor behind consumption patterns, with the high prices of nutrient-dense foods making it difficult for people to afford healthy diets. Based on data from FAOSTAT, in 2022, to afford a healthy diet, a person has to pay US$3.20 per day in Bangladesh. This estimate is significantly higher than in previous years (Figure 14). On the other hand, the percentage of people unable to afford a healthy diet has decreased from 75% to 66% from 2017 to 2021 (Figure 15) (FAO, 2023b).

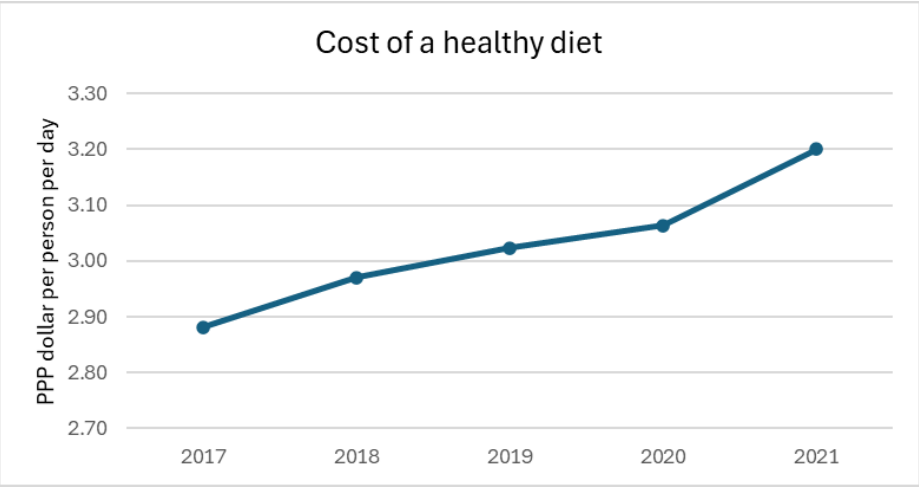

Figure 14 *Cost of a healthy diet (dollar/person/day)*
Source: FAO, 2023b.

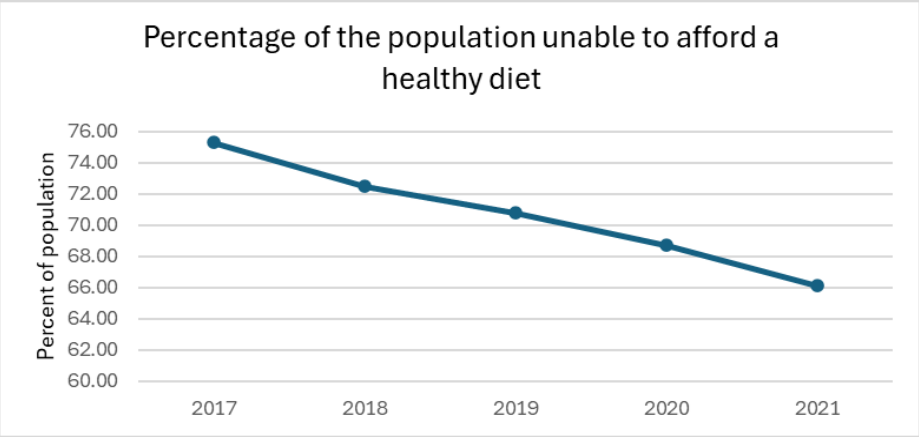

Figure 15 *Percentage of the population unable to afford a healthy diet*
Source: FAO, 2023b.

Food distribution as a driver of consumption patterns

It is important to acknowledge food distribution as a driver of food consumption and influencer of dietary diversity. Improving transportation and logistics helps food reach remote areas and underserved communities, ensuring everyone has access to a variety of food options. The social safety net, comprising programmes such as food assistance and nutritional support, serves as a crucial driver in influencing consumption patterns and the nutritional quality of diets and overall health outcomes, particularly for income-vulnerable households. For example, in rural areas, where availability of fresh produce is limited, food distribution networks may collaborate with local farmers to gain access to a wide range of fresh fruits, vegetables and other food products. Similarly, in urban areas, food distribution mechanisms may work closely with food sales stores to ensure customers receive high-quality products promptly.

Urbanisation as a driver of consumption patterns

Bangladesh is witnessing an increasing trend of urbanisation, growing at a rate of 3% annually in 2022 (The World Bank, 2022). This acts as a driver of consumption patterns *as d*ue to time constraints, urban consumers often prioritise convenience over nutrition. In this context, processed foods, frequently high in salt, sugar and unhealthy fats, offer quick and easy meal solutions. Moreover, the rising numbers of fast-food chains and eateries in urban centres provides readily available options for packaged meals and eating out, catering to the demands of a rushing population (Khan and Aditi, 2020). Urbanisation also fosters cultural shifts, with traditional home-cooked meals gradually being replaced by fast-food staples and restaurant cuisine (Islam and Ullah, 2010). However, processed and restaurant foods contribute to waste generation, rising rates of diet-related diseases, and environmental implications, including carbon emissions from food production and transportation (Anastasiou et al., 2022).

Liberalisation of trade policies as a driver of food consumption

Globalisation has greatly influenced Bangladesh's food landscape, leading to an increased exposure to international cuisines and a transformation of the local food system. Globalisation has caused trade barriers to diminish and a wide variety of food items to be imported, which has afforded the significant diversification of food options available to consumers in Bangladesh. Due to social media and food tourism, Bangladeshi chefs and home cooks developed international culinary knowledge and cooking techniques, using new flavours and ingredients that blend

local traditions with global influences. Globalisation has facilitated the establishment of international food chains and gourmet eateries, further diversifying dining options in urban centres. However, while liberal trade policies have broadened culinary horizons, they have also raised concerns about food safety standards, nutritional health and food system sustainability. Conversely, marginalised populations, particularly in rural areas, may not have equal access to these global foods due to economic constraints and limited infrastructure (Sawjana, 2023).

Nutrition education

Students in Bangladesh are taught the fundamentals of nutrition and encouraged to adopt healthy eating habits from a young age. However, while students develop knowledge, many of them do not put it into practice from a young age. Instead, they mainly practice good nutrition habits when they are unwell or during and after pregnancy, in the case of women (FAO, 2022a). Mothers' and adult household members' nutrition knowledge plays a significant role in household food consumption patterns. Beyond formal education settings, campaigns and community outreach programmes serve to reinforce nutrition education among a broader audience with the aim of empowering consumers to make healthier choices within their budgetary constraints. Therefore, ongoing efforts to improve and expand nutrition education programmes are essential for building a more resilient and sustainable food system for future generations.

5.4 Technology

Technology within the food system unlocks input use efficiency and increases agricultural sector productivity. Despite frequent natural disasters and population growth, Bangladesh has made considerable progress in agricultural development over the last 40 years. This can be illustrated by the surge in food grain production, tripling between 1972 and 2014 from 9.8 to 34.4 million tons. Such growth can be traced to consistent policy and investments in technology, with a surge in the use of irrigation, fertilisers and agricultural machinery occurring from 1981 to 2016 (Ahmed, Saint-Geours & Gitau, 2021; World Bank, 2016a). However, during this period, the population increased by 121%, confounding this outcome with regard to technological advancements.

Compared to other countries across the region, the introduction of new agricultural technology in Bangladesh appears to be implemented at a slower rate. Using the case of axial-flow-pumps, this may be attributed to low compatibility between the technology, local demand and the environment. Additionally, more efforts are needed to ensure new technology remains competitive with existing alternatives (Mottaleb, 2018). However, motorised equipment is widely accessible, with Bangladesh having one of the most mechanised agricultural economies in South Asia. More than 80% of land preparation is mechanised using two-wheeled tractors, and more than 60% of the available arable land is irrigated using mechanised pumps (Ahmed, Saint-Geours & Gitau, 2021; FAO, n/a). Figure 16 illustrates the surge in machinery use from the 1990s to 2016, the increasing trend of irrigated crop land and gradual increase in fertiliser use.

Climate smart agricultural technologies and practices have been used in by farmers in Bangladesh for centuries, in response to increasing floods and cyclones (CIAT & The World Bank 2017). Such technologies have grown increasingly complex, for example, traditional gher farming – an aquaculture pond with raised dikes – has evolved to allow for the production of shrimp, fish and prawns in non-saline wetlands. Floating vegetable gardens have been introduced in tidal flooded areas and a mix of ridging and furrowing methods are adopted in low-lying waterlogged areas. Due to changes in sea level, salt-and submergence tolerant high yielding crops have become important crops for many farmers (CIAT & The World Bank 2017).

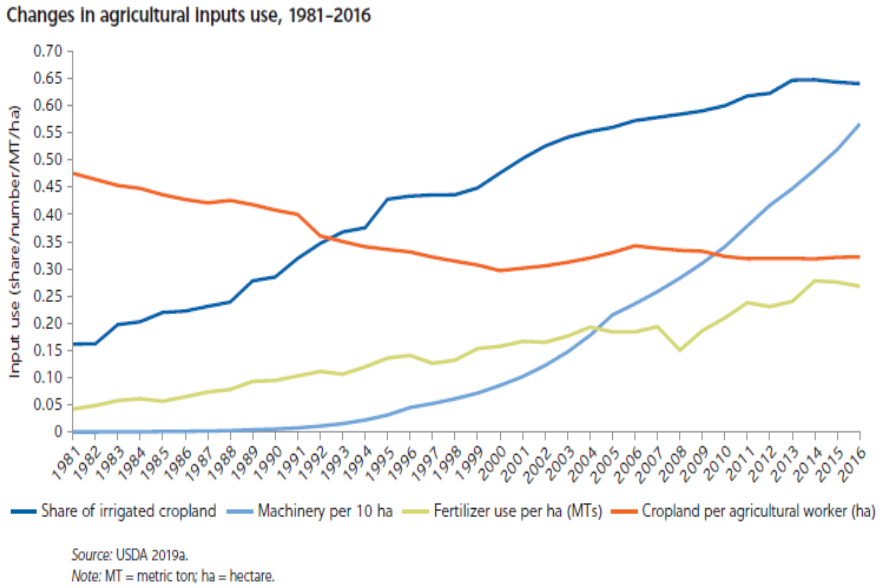

Figure 16 *Changes in agricultural input use, 1981-2016*
Source: Ahmed, Saint-Geours & Gitau, 2021.

5.5 Markets

Most of Bangladesh's agricultural production is primarily characterised through traditional subsistence farming; therefore, only a limited number of crops circulate through commercial channels. In addition to rice, the country produces other agricultural products, including wheat, corn, legumes, fruit vegetables, meat, fish, seafood and dairy products. Despite this, Bangladesh relies on food imports, including staple food items, to feed its growing population (Nath, 2015). In 2015, food imports comprised 17% of total merchandise imports, whilst food exports stood at only 3% (The World Bank, 2015a; The World Bank, 2015b). The country's high dependency on food imports renders Bangladesh vulnerable to the volatile prices of international markets, consequently influencing food security. One of the main reasons for the price volatility in Bangladesh is the number of nodal points in the value chain of the food crops where middlemen play a vital role in fixing prices.

5.6 Climate and environment

The World Risk Index 2021 constructed on 27 indicators, assessed 181 countries according to their impact on climate change (Aleksandrova et al., 2021). The WRI 2021 reveals that Bangladesh (WRI 16.23) is one of the top five Asian nations faced with the highest risk of experiencing climate-related impacts. The vast areas of low lying plains and flat topography renders the country highly vulnerable with a key adverse outcome including extensive riverine flooding and waterlogging resulting from high intensity rainfall.

Meanwhile, a shorter wet season but higher annual rainfall indicates that rainfall during this period will increase by 12-15% (Clarke et al., 2015), and rising sea levels threaten to increase soil salinity and decrease the share of arable land (Aryal et al., 2020). Additionally, increasing temperatures and drought are projected to decrease agricultural yields, while the frequency and intensity of extreme weather events are expected to increase. These factors are estimated to elicit serious consequences on agricultural production and the livelihoods of millions of farmers across Bangladesh (Ahmed et al., 2022).

Bangladesh has been divided into 14 climate stressed areas according to the National Adaptation Plan of Bangladesh 2023-2050, Figure 17 (MOEFCC, 2022). Variability in these climate stressed areas pose different threats to agricultural production and food security in the country. In the Northern North-Western (NNW) and Drought Prone and Barind Tract Area (DBA) regions, drought and water availability pose significant challenges to crop production. Moreover, the Southwestern coastal area and Sundarbans (SWM), Southeast and eastern coastal area (SEE) regions, are threatened by salinity, sea-level rise, tropical cyclones and storm surge inundation. Salt-affected areas increased by 26.71% between 1973 and 2009 (BBS, 2022c). The coastal region's salinity levels vary with location and timing, affecting Rabi (winter crops) and Kharif I (summer crops).

The North-East region is characterised by hilly regions and depression basins (locally known as haors). Generally, the depression basins get inundated during the monsoon season and remain dry in the dry season, which allows for agricultural practices. However, this area is commonly affected by flash floods,

whereby the sudden torrential runoff causes difficulties in crop harvesting thereby imposing a recurrent threat to food security.

An extensive survey by Bangladesh Bureau of Statistics (BBS) (2022c) revealed that the total loss and damage of land due to disaster between 2015 to 2020 amounted to 868,205 acres: 36.5% of this was lost to river erosion, and the remaining 63.47% experienced damaged from various other disasters. Crop land accounted for the vast majority (80.64%) of the total lost and damaged land. Crop damage totalled Tk 517,961 million as a result of various types of natural disaster between 2015 and 2020. Total livestock losses due to disasters amounted to Tk 71,373 million in the period 2015-2020 – with floods accounting for 60.19%, cyclones accounting for 18.73% and river erosion accounting for 9.24%. Other types of disasters were responsible for 11.84% of the total livestock loss. The total loss of poultry birds due to various disasters was estimated to be Tk 26,976 million and estimated fishing losses totalled Tk 66,460 million (BBS, 2022c). Climate and the environment are therefore significantly influencing the food system, affecting the availability of suitable arable land, crop production and crop yields. The effect is not limited to crops and has additionally caused the loss of poultry, livestock and fish, affecting the availability and cost of diversified food in the market.

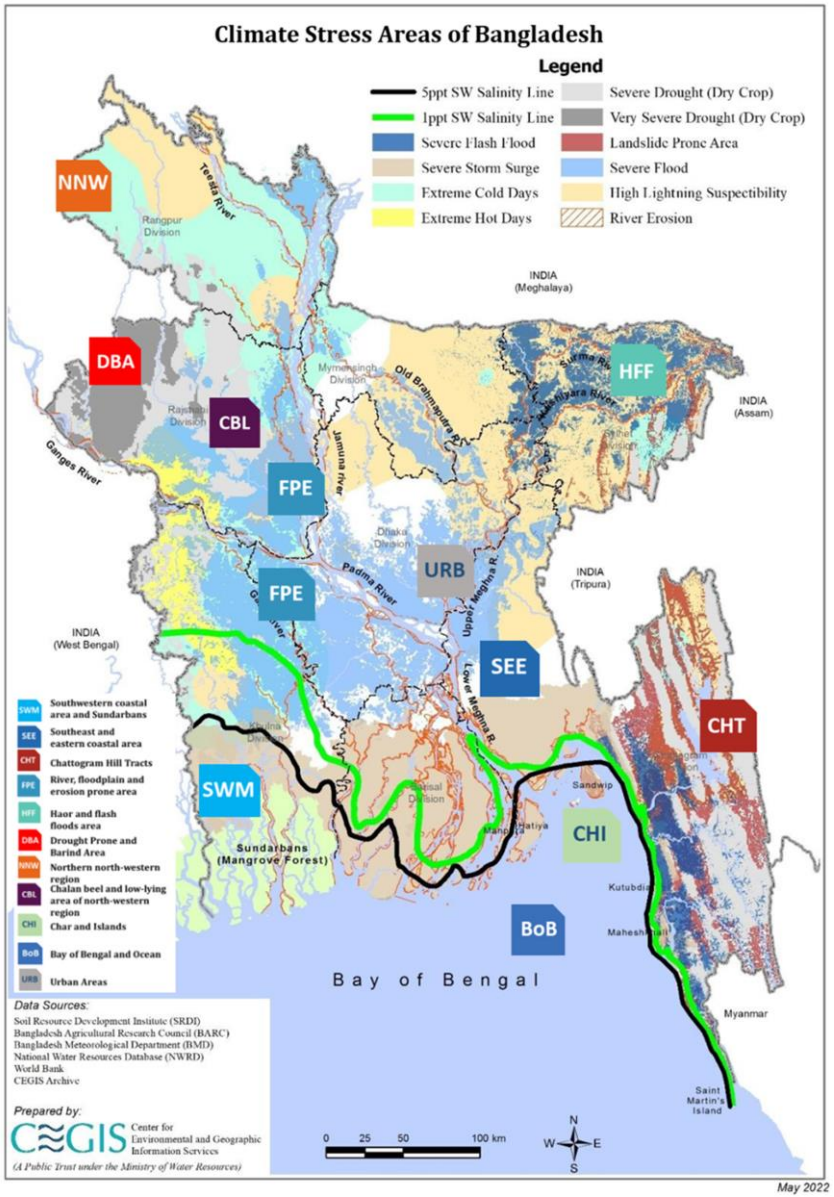

Figure 17 *Climate Stress Areas of Bangladesh*
Source: MOEFCC, 2022.

5.7 Policy

A wealth of agricultural policies exist in Bangladesh which aim to strengthen food and nutrition security and reduce post-harvest losses[2] (GoB, 2018). These policies have been initiated and are being implemented by different ministries and divisions (§6.8.2). A new National Food and Nutrition Security Policy (NFNSP 2020) was approved by the Cabinet in August 2020. To translate this vision into actionable interventions, the Plan of Action of the National Food and Nutrition Security Policy (PoA, 2021-2030) was formulated by the Government. It is anchored on the 8th Five Year Plan 2021-2025 (8FYP) and is to contribute to fulfilling national commitments established in other relevant strategic national policies and sectoral planning documents, such as the Second National Plan of Action for Nutrition (NPAN2, 2016-2025).

The execution of the PoA requires strong consensus among all stakeholders, including development partners (DPs), and adequate resource allocation, to ensure the required interventions in sectors and cross sectors, institutions, infrastructure, regulations and markets are effectively implemented. The Bangladesh Third Country Investment Plan – Sustainable, Nutrition Sensitive and Resilient Food Systems (CIP3, 2021-2025) aims to guide the level of commitment and financial resources generated by the Government of Bangladesh and DPs to support the PoA implementation.

The CIP3 works as a reference tool to guide and track progress of regional, local and sectoral investment plans and programmes. Aligned with the National Pathway Document for the UN Food System Summit – Towards Sustainable Food Systems in Bangladesh (September 2021), the CIP3 has been prepared by the Government of Bangladesh under the coordination of the Food Planning and Monitoring Unit (FPMU) of the Ministry of Food (MoFood), in collaboration with a wide range of ministries, government agencies and departments, and contributions from donors, civil society, the private sector and non-governmental organisations (NGOs), all stakeholders in the food system.

Several complementary policy planning and strategies also influence such policy implementation. However, above all, the Bangladesh Delta Plan 2100 (GED, 2018) has set visionary pathways for sustainable development. It places emphasis on agriculture, fisheries and livestock, alongside the environment, ecology and biodiversity. This long-term plan promises to achieve long-lasting food and nutrition security for the country.

5.8 Migration

Migration, both international and internal, is a prominent driver of Bangladesh's food system. Bangladesh's economy is heavily dependent on remittances. It is the second largest sector of foreign currency earnings after the garment sector. About 10 million migrants work in different countries and send remittances (Sabur, 2018). Bangladesh is the seventh highest recipient of remittance in the world and the third highest recipient of remittance in South Asia, with remittances increasing from US$18.3 billion in 2019 to US$ 22.3 billion in 2022, (IOM, 2022).

Remittances sent back by Bangladeshi migrants can contribute to increased purchasing power among recipient families, which may influence food consumption patterns and market demand (Moniruzzaman, 2022). Although the migration of agricultural workers may lead to labour shortages, among farming families, remittance may increase the possibility of them using modern agricultural technologies (Rahman et al., 2021).

At the same time, geopolitical tensions, conflicts or wars in the destination regions where Bangladeshi migrants reside may interrupt remittance flows, and impact household incomes and food security for families dependent on migrant earnings, subsequently affecting their contributions to the food system. Furthermore, shifts in geopolitical or international trade alliances can influence the economic conditions in both Bangladesh and migrant destination countries, which may affect the family income, purchasing power and consumption patterns of migrant

[2] The nutrition and food security related policies include: i) The "Country Nutrition Paper – Bangladesh" (CNPB, 2014); ii) National Social Security Strategy (NSSS) of Bangladesh (NSSS, 2015); iii) Bangladesh National Nutrition Policy 2015; iv) Children Act 2013 for child nutrition; v) The Third Country Investment Plan 2021-2025 (CIP 3); vi) Second National Plan of Action for Nutrition (NPAN2, 2017); vii) National Food Safety and Quality Policy and Plan of Action Review of Food Safety and Quality Related Policies in Bangladesh (DRAFT) 2012; viii) Health Population & Nutrition Sector Development Programme 2011-2016; ix) National Communication Framework and Plan of Action on Infant and Young Child Feeding (IYCF) 2010; x) National Guidelines for Management of Severely Malnourished Children in Bangladesh 2008; xi) National Vitamin A plus Campaign (NVAC); and xii) National Strategy for Anaemia Prevention and Control in Bangladesh 2007.

households in Bangladesh (Moniruzzaman, 2022). Although remittances have a great impact on the country's economy, the utilisation of remittance by the families is not well planned. A survey on the remittance usage conducted by the Bangladesh Bureau of Statistics in 2013 showed that 32.81% of the remittances are used for food expenditure (BBS, 2013).

Internal migration, unlike international migration, has different socio-economic consequences both in destination and origin. While internal migration is mainly seen as the product of rapid urbanisation, other causes, like natural disasters and river erosion, have become very regular in Bangladesh. Studies suggest that internal migrants suffer in terms of housing (most take shelter in slums), unemployment/under employment, and poverty, leading to food insecurity. On the other hand, in migrant originating areas, the shortage of labour is a common phenomenon (Marshall and Rahman, 2013).

In recent years, Bangladesh's already limited resources have faced an additional burden due to high rates of Rohingya refugees, forced migrants from Myanmar. According to the speech of the Bangladeshi Prime Minister Sheikh Hasina at the 73rd United Nations General Assembly on 28 September 2018, about 1.1 million Rohingya refugees currently reside in Bangladesh.

These refugees are facing economic, health service, food, residence, social and security challenges (Sultana et al., 2023). Increased demand for food due to the large numbers of Rohingya refugees has led to food shortages and higher food prices within the country. If the situation persists and development partners do not continue their support, the continual influx of migrants and refugees will exert implications on food security of the country.

5.9 External shocks

5.9.1 The COVID-19 pandemic

The agricultural sector in Bangladesh was negatively impacted during the COVID-19 pandemic and expected to lose approximately US$630 million as a result (Bangladesh National Nutrition Council, 2020). Lockdowns and travel restrictions hampered farmers' access to hire machinery to perform agricultural activities. Combined with 25% of farmers experiencing labour shortages, crop harvesting decreased – with the maize harvested reducing by 40% (Bangladesh National Nutrition Council, 2020). Travel restrictions disrupted transportation links, resulting in increased food transportation costs and preventing numerous farmers from reaching markets.

The measures inflicted by COVID-19 caused an 85% business decline for agricultural input dealers, illustrating their reduced accessibility and availability for farmers. Interestingly, the impact of the COVID-19 pandemic on rice farmers was relatively small compared to those involved in high value agricultural commodities. This may be attributed to the inability to sell high value products due to a lack of demand. This resulted in losses of around BDT 565.36 billion (FAO, 2020a).

The demand for high value food items, such as poultry and fish, decreased due to misinformation concerning the spread of COVID-19 through these products. Consequently, numerous reports highlighted reduced protein consumption, raising concerns about food security. According to the Bangladesh National Nutrition Council, 75% of survey respondents indicated they did not have sufficient access to food at home (Termeer, Brouwer & de Boef, 2020).

5.9.2 The war in Ukraine

As a consequence of the ongoing war in Ukraine and the sanctions imposed on Russia, global food, fuel and fertiliser prices have risen rapidly over the last couple of years (Figure 18).

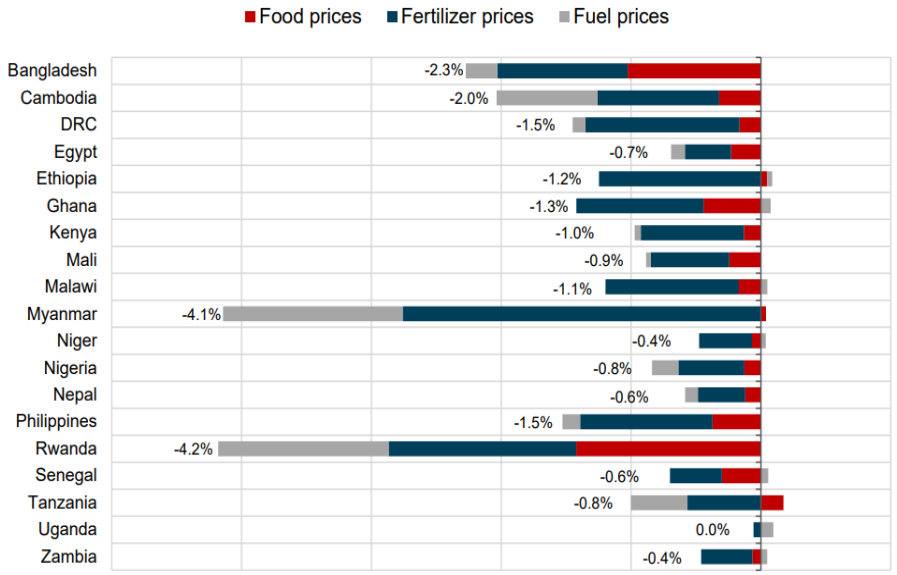

Figure 18 *Percentage change of key Food and non-food commodity prices since mid-2021*
Source: Arndt et al., 2022.

Bangladesh is heavily dependent on the import of numerous food and non-food items to feed its growing population. Between 2016 and 2021, Bangladesh sourced over 60% of its wheat from Ukraine and over 80% of their chemical fertiliser from Russia and Belarus (FAO, 2022b). Due to the global price shocks resulting from the conflict, Bangladesh saw a -2.3% change in their agrifood system GDP (Figure 19). According to Arndt et al. (2022), the fertiliser price shock is the most significant driver of agrifood system GDP losses, as it causes indirect downstream disruptions.

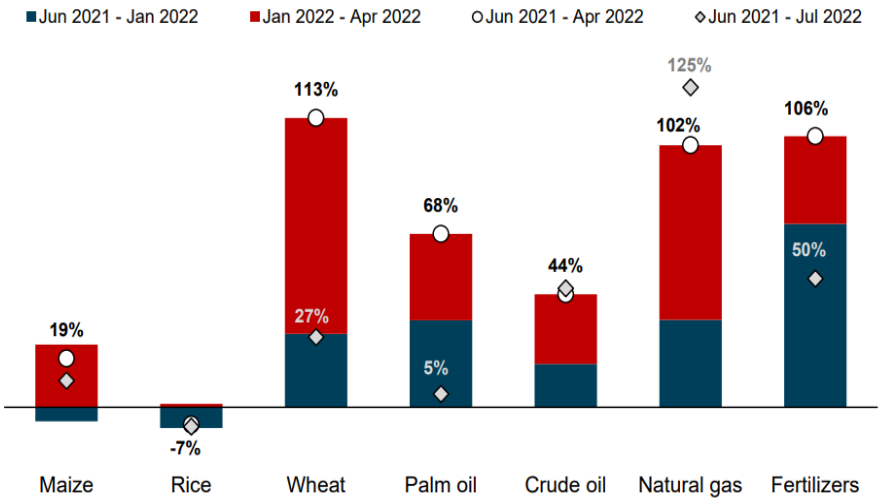

Figure 19 *Percentage change in agrifood system GDP due to world price shocks*
Source: Arndt et al., 2022.

6 Food system actors and activities

This section presents the key actors in the Bangladesh food system, along with their activities throughout the value chain and the environment within which they operate. With high urbanisation rates and a highly dense population, Bangladesh has devoted more than 70% of land to agriculture. Over 50% of the population is primarily employed in agriculture, with the majority of farmers engaged in smallholder farming and mainly based in rural areas. The fisheries sector is one of the most productive, with inland fish production in Bangladesh ranked third globally. The food marketing system in Bangladesh is dominated by informal trade, with food imports surging three-fold from US$3 billion in 2007 to US$10.7 billion in 2017. Food consumption is dominated by rice and fish, although rice consumption has been decreasing over time.

Table 2 *Overview of key food system actors along the value chain and their main activities*

Production	Processing	Marketing	Retail	Consumption
Rural smallholder farmers • Account for 57.60% of all households in rural areas (BBS, 2019) • Supply ≈60% domestic food • More than 95% grow rice, • 81% raise livestock & grow crops, 55% sell poultry, 75% raise goats for income (Anderson et al., 2016) **Urban/peri-urban small-scale farmers** • Dairying and poultry production • Nursery industries • Rooftop gardening (fruits & vegetables) & kitchen gardening • Peri-urban areas produce <5% of vegetables marketed in Dhaka (Pramanik, 2013) **Large-scale farmers** • In rural areas, these households account for 0.34% of all households (BBS, 2019). • More dependent on hired labour • Grow diverse crops (Quddus & Kropp, 2020) **Agricultural input suppliers** • Supply of seed, fertiliser, insecticides, pesticides & machineries **Production facilitators** • Extension work done by the personnel of Department of Agricultural Extension, Department of Fisheries, Department of Livestock	**Agri-processing** • 468 agri-processing manufacturers • Employ ≈40% of labour force (BIDA, 2021), PRAN is the largest (Katalyst, 2016) **Processing agricultural crops:** **A. Primary processing** • All exported fruit and vegetables go through this stage • Engages a significant number of women involved in drying, shelling/threshing, cleaning, grading & packaging ▪ Edible oils, dairy products and snacks dominate the packaged food market (BIDA, 2021) **B. Secondary processing** • Conversion into value-added products (use of secondary ingredients), e.g. pureeing, cooking, grinding, frying, baking. • All processed products are stored & distributed through various channels (Katalyst, 2016)	**Informal trade** • Seed trade with India • 98% informal cattle trade sourced from India (Khatun et al., 2016; Rahman & Bari, 2018) **Domestic markets** • Smallholder farms sell to individual buyers who distribute to domestic markets. • Large farms/processors directly distribute to domestic markets or use distributors **Import & Export** • Food imports ≈17% of total imported merchandise; food exports ≈3% (World Bank, 2015a; World Bank, 2015b) • Main import items: palm oil, wheat, beet sugar • Main export items: frozen fish & shrimp (>50% agricultural exports), tea, spices, fruits (incl. dried fruit) (BIDA, 2021; Ministry of Foreign Affairs, 2021)	**Open air temporary shops** • In urban and rural areas & sell primary commodities: fruit, vegetables, semi-processed homemade food & fish **Roadside shops** • Include village markets • 85% of households in Dhaka buy their food from fresh markets • Sell a wide range of products: poultry, fish, meat, eggs, vegetables, fruits, grains, legumes **Municipal cooperation markets** • Sell specific food types e.g. vegetables, meat, fish, fruits & processed & imported foods • 22% of the food retail sector **Supermarkets** • ≈30 companies, >200 outlets, key players: Shwapno, Agora & Meena Bazar • Growth rate ≈15% per year (Rahman et al., 2019) • Visited by middle/above middle income group **Neighbourhood grocery store** • ¾ households in Dhaka purchase from small grocery stores • Visited especially to purchase dry goods, vegetables, eggs (Islam, 2019)	**Low-income consumers** • Consume liquid milk as a source of animal protein, occasional consumption of small & dried fish • Consume less fruit than the rich • Consume more khesari dal (hardy pulse) **High-end consumers** • Consume large variety of protein • Frequent consumption of small and large fish (Ayubi & Ara, 2017) **Rural consumers** • Decreasing consumption of wheat: 23.3 to 13.3 g/capita/day from 12010 to 2022 (HIES, 2022) • Decreasing consumption of rice 441.6 to 349.1 g/capita/day from 2010 to 2022 (HIES, 2022) **Urban consumers** • Stable consumption of wheat: 33.6 to 33 g/capita/day from 2010 to 2022 (HIES, 2022). • Decreasing consumption of rice: 344.2 to 284.7 g/capita/day from 2010 to 2022 (HIES, 2022).

6.1 Food production

Bangladesh has devoted more than 70% of land to agriculture due to fertile soils and produces 70 million tonnes of agricultural output per year (BIDA, 2021). Bangladesh grows several major crops, including rice, jute, potato, wheat, pulses, oil-seeds, vegetables and fruits. Rice constitutes 71% of the production area whilst contributing to 59% of the total crop value. Potatoes have the second highest crop value at 9.5%. Fish and crustaceans provide the highest percentage of total animal production (73%), with the majority of fish produced in aquaculture (68%). This is followed by goat production, constituting 6% of the meat value (Ahmed, Saint-Geours & Gitau, 2021).

Nearly 50% (40.6%) of the employed population, age 15 or above, primarily work in the agriculture, forestry and fishing sectors, with the majority of farmers engaged in smallholder farming (FAO, 2023a). In Bangladesh, 60 million people live on 12 million farms, together supplying about 60% of domestic food production. The average size of a smallholder farm is 0.24 hectares. Typically, households grow between one and three crops, one of which is usually rice. Moreover, 81% of smallholder households who typically grow crops also raise livestock (Anderson et al., 2016). Such farmers heavily rely on agricultural income, but usually supplement their earnings with other means. Less than a quarter of smallholder households live above the poverty line (i.e., living on less than $2.50/day) and over a quarter of farming households live in extreme poverty (Figure 18) (Anderson et al., 2016).

6.1.1 Crop production

Due to the ability of rice to adapt to the different agro-ecological niches of Bangladesh, it accounts for 75% of the country's total cropped area. Rice is produced in three seasonal varieties: Boro (54% of rice produced), aman (40% of rice produced) and aus (6% of rice produced). Since 1995, the total amount of rice produced has more than doubled, growing from 16.8 million metric tons in 1994-95 to 36.3 million metric tons in 2017-18, resulting in a diminished dependency on imports (Ahmed, Saint-Geours & Gitau, 2021). The crop subsector has witnessed increasing diversification from rice to non-rice crops though substitution and intensification. Across the remaining crop land, single, double, triple and quadruple crops are grown in sequence. These include wheat, maize, potato, pulses, oil seeds, jute and sugarcane (Nasim et al., 2017).

Areas growing fruit, flowers, fibres, spices and pulses have increased by more than 60%, whilst the total crop area for these crops grew by 29% (Ahmed, Saint-Geours & Gitau, 2021). However, compared to the other agri-food sectors, crop production had the lowest annual growth rate (2.9%). This is compared to the livestock sector, which grew at 3.9%, and the fisheries and forestry sectors, which grew by more than 5% per year (Ahmed, Saint-Geours & Gitau, 2021).

6.1.2 Fisheries

Importantly, the fisheries sector is one of the most productive industries in Bangladesh, and contributes to 24.41% to the agricultural GDP. Bangladesh is ranked third globally for inland fish production, which accounts for 56% of total production. It is also ranked fifth globally in aquaculture. This combination has led Bangladesh to reach self-sufficiency in fish production (DoF, 2017; Shamsuzzaman et al., 2020). Driven by demand from the domestic market, the inland aquaculture and farmed fish market has grown 25-fold in only three decades (Ahmed, Saint-Geours & Gitau, 2021). This created a surge in the growth of fishpond areas and the number of fish farmers, increasing by 30.4% and 63%, respectively, between 2004 and 2014 (Ahmed, Saint-Geours & Gitau, 2021).

6.1.3 Livestock and Poultry Farming

Livestock farming is mainly practiced by rural smallholder farmers, with nearly 80% of smallholder farmers engaged in either livestock or poultry production. The people of Khulna, Rangpur and Rajshahi divisions engage in the highest share of rural livestock production. Interestingly, these are where poverty rates are highest (Figure 20) (Ahmed, Saint-Geours & Gitau, 2021). Poultry farming occurs on a larger scale than livestock faming whereby rural households in Chattogram, Barishal and Sylhet have the highest percentage of poultry farming, ranging from 30-36% of all households in the areas. In the same regions, livestock farming occurs in only a fraction of households, ranging from 5-11% (Ahmed, Saint-Geours & Gitau, 2021; BBS, 2019).

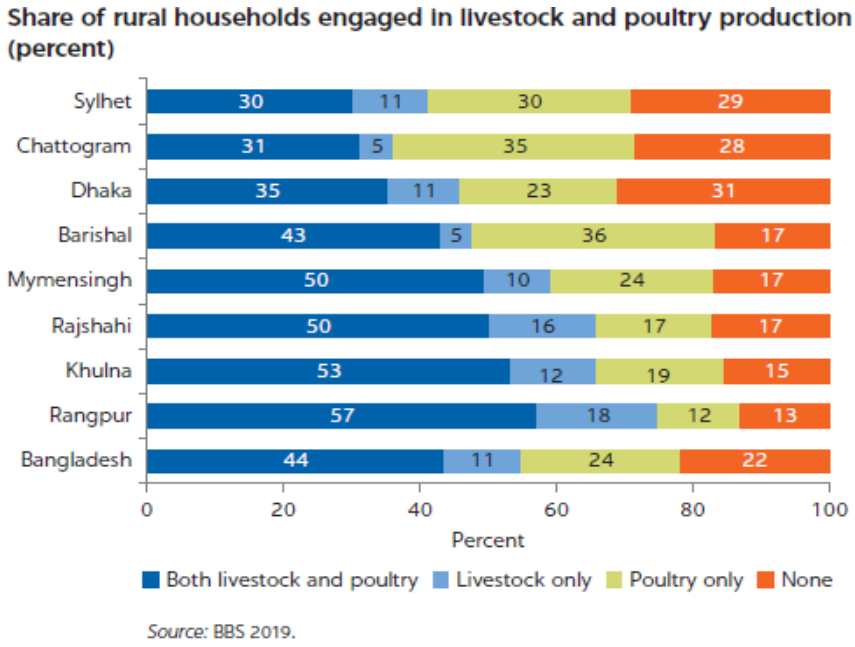

Figure 20 *Share of rural households engaged in livestock and poultry production (%)*
Source: Ahmed, Saint-Geours & Gitau, 2021; BBS, 2019.

6.2 Processing

The private sector is gradually increasing its involvement in the agri-food processing sector. Currently, Bangladesh has 486 agri-processing manufacturers, of which 241 are exporters and 235 cater to the domestic market. A diverse array of agri-processors are present within the Bangladesh market, with PRAN being the largest agri-products processor. PRAN employs 80-100 agents for individual crops, and their major products include spices, beverages and consumer goods (Gazi, 2020).

Processors are mainly situated in the northern districts of Bangladesh and are distantly connected to farmers. As a result, they procure their agri-food inputs through suppliers, who collect products throughout the country. Additional inputs, such as machinery and packaging material, are sourced from Bangladesh manufacturers, whilst certain additives are imported.

Agricultural processing is divided into primary and secondary levels. At the primary stage, various activities are conducted without the use of heavy machinery and a low use of secondary ingredients. Secondary processing refers to the conversion of agricultural products into value-added products – for example, juice, concentrates and jams. Secondary ingredients are usually used at this level (Katalyst, 2016).

6.3 Trade

Agri-food products are marketed via two channels, either domestic or through the export channel. The domestic channel depends on the type of product and where it's produced. Many smallholder producers sell to individual buyers who then sell to wholesalers for distribution to domestic markets. Alternatively, large farms or processors directly distribute their supply to domestic markets or distribute via means of a distributor (Katalyst, 2016).

Additionally, Bangladesh engages in international food import and export activities. Despite meeting domestic demand for most food items, Bangladesh relies on the importation of various staple foods to feed its growing population. Several key import items include animal/vegetable fats/oils, cereals and sugars, together comprising of 60% of Bangladesh's food imports (Figure 21) (Ahmed, Saint-Geours & Gitau, 2021).

Consequently, an agricultural trade deficit has occurred, whereby imports surged three-fold from US$3 billion in 2007 to US$10.7 billion in 2017, and exports decreased by 9% to US$0.9 billion over the same period. Figure 22 provides an overview of the value of the import and export of agricultural goods between 2007 and 2017.

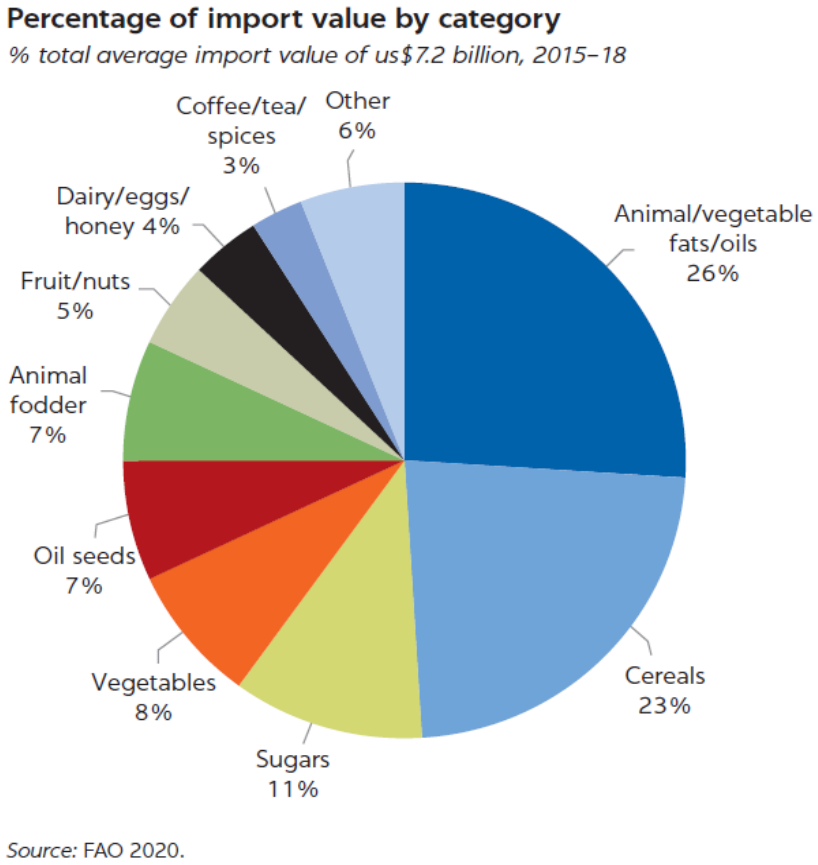

Figure 21 *Percentage of import value by category*
Source: Ahmed, Saint-Geours & Gitau, 2021; FAO, 2020b.

In 2018, more than 90% of Bangladesh's US$40.5 billion export market was ready made garments (Ahmed, Saint-Geours & Gitau, 2021). Several key food export items are highlighted in Figure 20, of which over 50% of food exports consist of fish and crustaceans (World Bank, 2020b; FAOb, 2020). Bangladesh's biggest export markets comprise of countries in the Middle East, United Kingdom and Italy (BIDA, 2021; Ministry of Foreign Affairs, 2021).

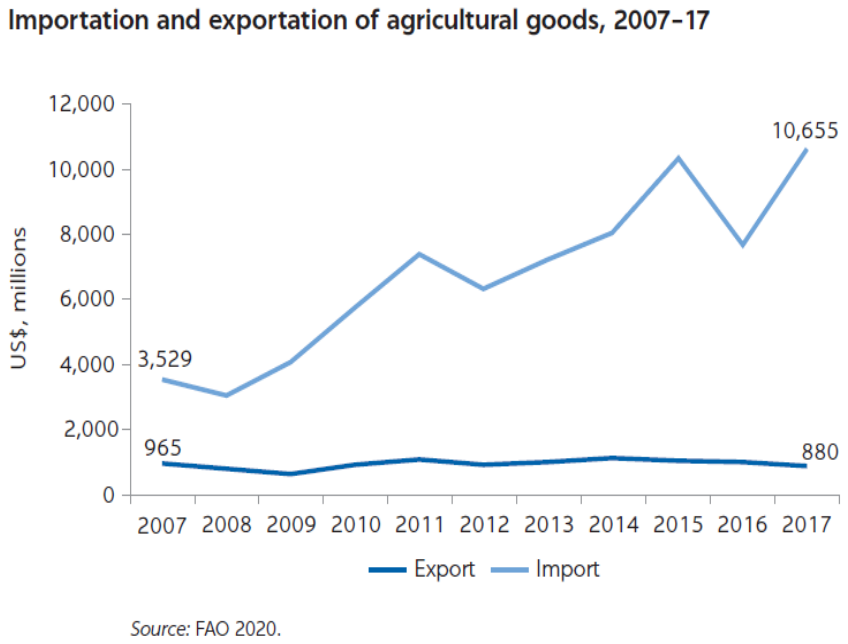

Figure 22 *Import and export of agricultural goods (US$ million), 2007-2017*
Source: FAO, 2020b.

6.4 Retail

In Bangladesh, a diverse food retail landscape exists. The most common means in which Bangladesh consumers access food items is through open air temporary shops and small roadside shops, accounting for 70% of the food retail sector (Islam, 2019). Retail supermarkets account for only 1% of retail sales of fruit and vegetables. The largest supermarket company is Shwapno, with 37 stores and occupying the largest proportion of fresh fruit and vegetables sold through supermarkets. However, this only amounts to 0.8% of the total market, of which traditional wet markets dominate (98.4%) (Ahmed, Saint-Geours & Gitau, 2021).

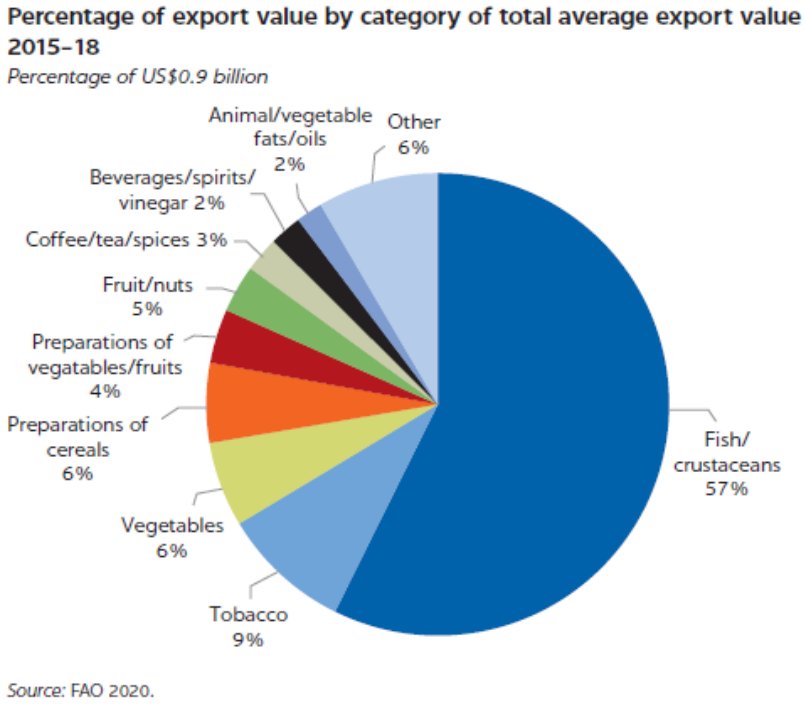

Figure 23 *Percent of export value by category (of total average export value of US$0.9 billion, 2015-2018)*
Source: Ahmed, Saint-Geours & Gitau, 2021; FAO, 2020b.

6.5 Storage

Due to Bangladesh's history of famine, both in colonial times and just after independence, the country has developed a large system of public grain storage. A total of 50% of all grain, mostly rice, is stored at the household level and almost 92% of households hold grain stocks (Dorosh, Kindie & Smart, 2017). While grain storage is well developed, the country has limited cold storage infrastructure capacity, with a current capacity of 6-7 million metric tons. This contributes to food loss and waste due to the inability to properly store perishable items, especially in fresh markets with inadequate storage facilities (FAO, 2021b).

6.6 Consumption

An increasing trend is observed in terms of food expenditure for both rural and urban households (Figure 24) (HIES, 2022). Between 2010 and 2022, urban households increased their monthly food expenditure from Tk 7,362 to Tk 15,875. In the same period, rural households increased their average monthly expenditure from Tk 5,543 to Tk 13,125. Both rural and urban households allocate a higher percentage of their expenditure to rice. This is due to rice being the national staple food and widely available throughout the country.

However, a trend analysis conducted by Mottaleb et al. (2018a) indicates that rice expenditure is decreasing amongst urban households and increasing within rural households. This is also supported by HIES (2022), which indicated that rice is the most popular cereal consumed. Wheat is also consumed, but in much smaller amounts, with consumption higher in urban regions (HIES, 2022). Cereal expenditure in general decreased from 41.9% in 2000 to 29.2% in 2016 (Ahmed, Saint-Geours & Gitau, 2021).

This may be explained by assuming that with higher incomes, households tend to switch from staple crops to high-value food items (Mottaleb et al., 2018b) – and expenditure on non-cereal food groups has increased since the 2000s (Ahmed, Saint-Geours & Gitau, 2021).

Across all social strata, fish is the most frequently consumed animal protein source, traditionally complementing rice in Bangladesh diets (Haque et al., 2019). Fish accounts for the second highest share of total food expenditure and contributes to 63% of protein supply within national diets (Haque et al., 2019).

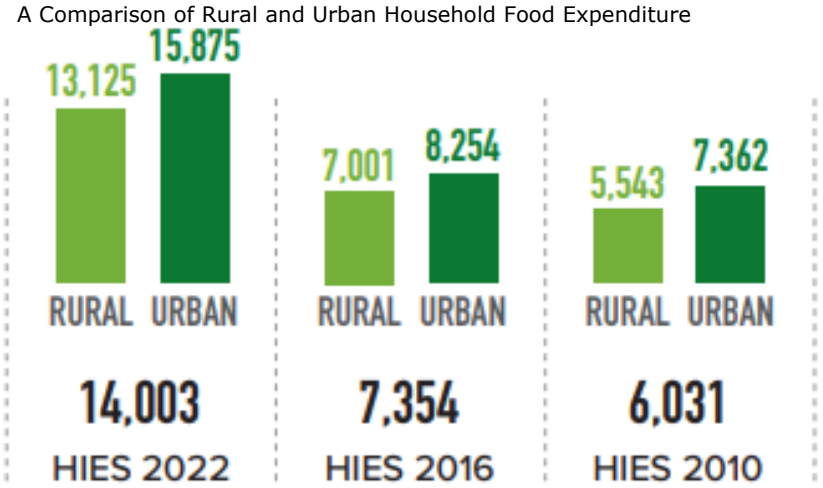

Figure 24 *A comparison of food expenditure in Bangladesh between rural and urban households in 2010, 2016 and 2022*
Source: HIES, 2022.

6.7 Food loss & waste

Excessive food waste is a huge issue in Bangladesh, with 68.3-81.1% of municipal solid waste being food waste. Alarmingly, only 40-50% of food waste is managed properly. No specific food waste management policy exists, as food is currently treated under the existing regulations of municipal solid waste management. Post-harvest losses of paddy at the farm level amount to 9.49%, 10.51% and 10.59%, for Aman, Boro and Aus paddy, respectively.

Between 2016 and 2017, nearly 15.85 million tons of food waste occurred between the post-harvest to consumer stage (67% total food waste). Moreover, only 64.61% of the total available harvest reached consumers, meaning 35.39% of the total harvest was wasted during the processing and consumption stages of the value chain. Using combine harvesters over manual harvesting techniques lowers harvesting costs and reduces postharvest loss by 1.84% (Nath et al., 2022).

In 2016-2017, it was estimated that 23.69 million tons of food was wasted. Considering Bangladesh's limited production capacity, such high amounts of food waste negatively impacts its economy and environment, posing additional complexities in terms of the country's development (Ananno et al., 2021). Thus, reducing food wastage is critical to increasing food supply without incurring substantial environmental costs.

6.8 The enabling environment

6.8.1 Supporting services and infrastructure

Bangladesh has made significant improvements in its infrastructure and national services which support the food system. For example, access to electricity increased from 55.3% of the population in 2010 to 96.2% in 2020 (The World Bank, 2020a). Additionally, the use of at least basic sanitation services increased from 39% in 2010 to 54% in 2020, and the proportion of people using safely managed drinking water increased from 55% in 2010 to 59% in 2020 (The World Bank, 2020c). The transport sector remains poorly developed and receives insufficient funding. As a result, the high transportation costs associated with food distribution have contributed to making domestically grown cereals expensive (FAO, 2023a).

Food system support services and infrastructure in Bangladesh can be categorised as:

- Production input support by ensuring smooth supply of seed, feed, and harvesting services and equipment.
- Processing support by facilitating activities like sorting, grading, packaging, etc.

- Aggregation and distribution support through facilitating activities such as marketing cooperatives, storage facilities, brokerage services, logistics management and delivery trucks.
- Retail support by ensuring food is served to consumers from restaurants, grocery stores, etc.

Five types of capital act as drivers to the effectiveness of these supports:

i. Physical capital: Infrastructure, transport, water, energy, communication, etc.
ii. Financial capital: Loans, investments and other financing.
iii. Natural capital: Land, water and other ecological resources.
iv. Social capital: Youth groups, chambers of commerce, etc.
v. Human capital: Creativity, labour and other talent, including education and training.

To support continued ongoing development assistance and incentives in agricultural productivity, the Government of Bangladesh is providing 20% cash incentives to encourage the importation of agricultural products. Additionally, 20% rebate is provided on the electricity bills for agro-based industries and irrigation systems. Moreover, the government revised the agricultural loan interest rate from 8% to 4% to increase the production of peas, mustard seeds and spices (FPMU, 2023).

The Ministry of Agriculture (MoA) plays a significant role in supporting agricultural research and training, maintaining quality of the seed and preservation, conducting soil survey and soil quality assessments, marketing of agricultural products, disseminating market information and, in some cases, supporting minor irrigation programs. In terms of technology, Bangladesh has a strong agricultural research and extension base, especially for rice. The national research expenditure is approximately 0.35% of the GDP. The government plays a vital role in setting the research agenda, facilitating this through universities and research institutes (Ahmed, Saint-Geours & Gitau, 2022).

6.8.2 The institutional environment

In Bangladesh, numerous ministries are working on elements of the national food system. These include the Ministry of Agriculture (MoA), the Ministry of Fisheries and Livestock (MoFL) and the Ministry of Food (MoFood). The MoA provides support across several domains, including the development of new agricultural technology, distributing agricultural inputs and subsidies, and marketing agricultural products in local and international markets. The MoA comprises seven wings, with responsibilities in policy formulation, planning, monitoring and administration. Sixteen agencies operate across these seven wings to implement the MoA's projects and plans.

The MoFL works to enhance the production, productivity and value addition of fish and livestock products to meet animal protein requirements. The MoFood is responsible for food policy management and works towards ensuring dependable and sustained food security at all times. Thus, the Government of Bangladesh has proactively engaged in realising its vision of a resilient, nutrition sensitive and sustainable food system, able to deliver safe and diversified diets to all, and contributing to enhanced nutrition outcomes and the livelihoods of rural communities, marginalised and fragile groups.

Institutional arrangements have been established to coordinate and monitor key policies and plans of action. The institutions involved are:

- The Cabinet-level Food Planning and Monitoring Committee (FPMC), chaired by the food minister and including ministers and secretaries from other key ministries. The FPMC delivers strategic guidance on food and nutrition security related issues and establishes a high-level commitment to inter-sectoral collaboration. It provides leadership and oversight in the formulation of food policy strategic documents developed by the institutions it oversees. It also relies on technical support provided by these same institutions, which provide feedback based on their monitoring activities.

- The National Committee (NC), chaired by the Food Minister, comprises the secretaries of key ministries and divisions, heads of universities/research institutions, DPs, private sector representatives and other NGOs. The NC oversees the CIP3 implementation and monitoring processes.

- The Food Policy Working Group, chaired by the Food Secretary, performs the task of coordination and collaboration at both technical and operational levels. A particularly important role is played by the Ministry of Finance and the

Implementation Monitoring and Evaluation Division of the Planning Commission (Ministry of Planning), and the Economic Relations Division to provide feedback on the financial section of the CIP3.

- The five Thematic Teams corresponding to the five Pillars of the NFNSP, which carry out the monitoring activities.

- The Food Planning and Monitoring Unit (FPMU) of the MoFood, which provides technical, operational and secretarial support with inputs from the Thematic Working Groups.

- The Local Consultative Group on Agriculture, Food Security and Rural Development, which is the venue for dialogue between the Government of Bangladesh and DPs. Local Consultative Groups are designed to contribute towards the effective and coordinated implementation of national policies, strategies, plans and programmes.

This structure coexists with another central coordination and governance body specifically for nutrition, namely the Bangladesh National Nutrition Council (BNNC), chaired by the Honourable Prime Minister. Close linkages between the two institutional setups must be ensured and leveraged as much as possible. For actions directly relating to nutrition, field level interventions must be implemented through the Upazila Nutrition Coordination Committees (UNCC) and the District Nutrition Coordination Committees (DNCC), which are the multi-sectoral coordination and governance structures for nutrition at sub-national level and are considered extended bodies of BNNC.

6.8.3 Food safety

Bangladesh is highly susceptible to the risks associated with hazardous food, and over 30 million individuals contract a foodborne illness each year. The high prevalence of foodborne infections and other food safety risks occur due to the country's dense population, poor infrastructure, lack of clean water, and inadequate sanitation and hygiene facilities (Islam et al., 2023).

The adoption of malpractices by food producers is of concern as, sometimes, to increase production, polluted or hazardous input supplies are used and insecticides may not be applied until the last moment before harvesting. Additionally, concerns over food safety have gained attention due to the increasing geographic separation of consumption and production centres as a result of urbanisation. As a localised national food preservation and storage system is yet to be developed, food marketers or distributors adopt their own ways to preserve perishable food items. Unfortunately, this sometimes leads to compromised food safety standards, increasing the threat of food-borne illnesses.

To make safe foods more available, the Government of Bangladesh has taken two major strategies with an emphasis on the sustainable production of nutritious foods and scaling up nutrition-sensitive diversification of food production. Bangladesh is now focusing on ensuring safe foods to protect the overall health of the population, and the Food Safety Act of 2013 by the Bangladesh Food Safety Authority is currently being employed in full consideration (Ministry of Food, 2016).

7 Food system dynamics and behaviours

7.1 Mapping the food system dynamics

To enhance understanding of Bangladesh's food system dynamics, it is necessary to draw links between its various elements: the drivers, actors and activities, and outcomes. The links and influences (+/-) between some key food system elements are mapped in Figure 25. This diagram captures the key elements detailed in this food system report and was produced during a collaborative workshop involving FoSTr's research partners.[3]

This simplified causal loop diagram indicates a few general patterns:

i. **High population growth and density are key drivers** of the Bangladesh food system. For Bangladesh to meet growing food demands, the country has turned to producing high yielding crops. However, these require high amounts of agricultural inputs such as fertiliser and pesticides, consequently impacting soil fertility and leading to environmental toxicity. To supplement domestic food production, Bangladesh has also increased food imports. This causes markets to be vulnerable to international price fluctuations, affecting the affordability of a healthy diet.

ii. **Coupled with globalisation, urbanisation can be identified as another key driver of the food system**. Among the growing urban population, changing habits, lifestyles and exposure to media have all encouraged the population to develop a preference for higher value-added foods, which have high fat, oil, salt and sugar content. Together, these contribute towards decreased healthy diets and an increase in the prevalence of NCDs. This gradual shift in dietary patterns is leading to a decrease in rice expenditure and lower consumption of traditional staple foods.

iii. **Staple food production is a key activity** across Bangladesh. Governmental spending and agricultural subsidies have contributed to the country producing rice surpluses and reaching self-sufficiency. However, rice – the national staple – requires abundant water sources to flourish, placing a strain on the country's limited ground water sources. The emphasis on staple food production has also limited the production of other foods, such as fruit and vegetables, and diminished the accessibility of diversified food in the market.

iv. **Bangladesh has one of the most productive aquaculture sectors, ranking third globally,** and this food system activity has led to commercial aquaculture production. However, to sustain productive levels, many farms widely use aqua-chemicals and produce high amounts of waste, consequently leading to environmental toxicity. This reduces biodiversity and can have negative implications for human health.

v. **The majority of farmers in Bangladesh are smallholder farmers**, who generate income through agricultural employment. Therefore, the majority of food products are retailed through wet markets, which have minimal cold storage facilities. This activity has caused concerns over food safety standards, and consequently impacts food and nutrition security.

[3] BAU, SAU, *CEGIS*, ICCCAD & INFS.

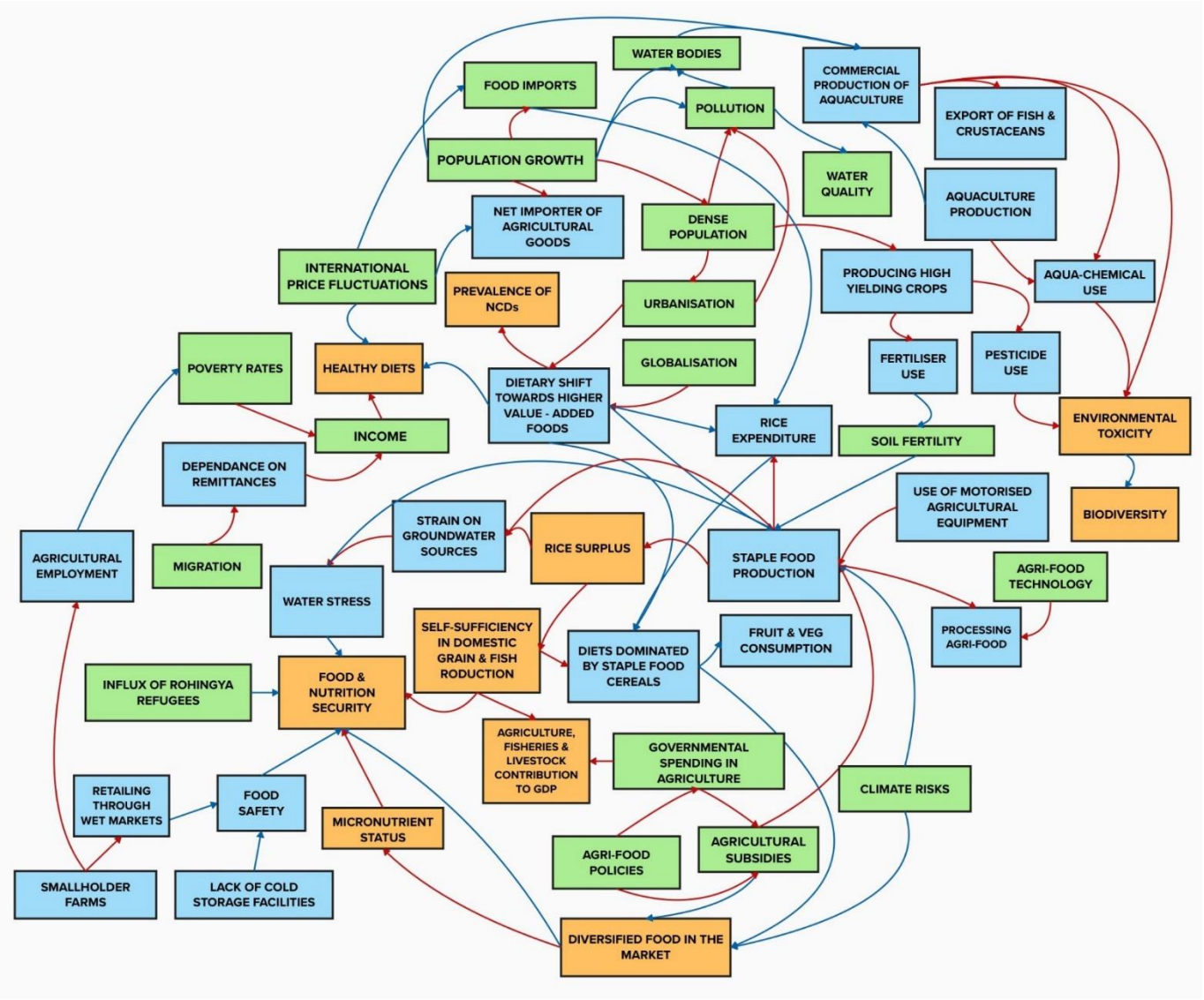

Figure 25 *A visualisation of the Bangladesh food system*

Note: Red arrows indicate positive causality and blue arrows indicate negative causality. Food system drivers [blue]; food system activities [green]; food system outcomes [orange]. This simplified causal loop diagram represents a preliminary analysis of the dynamics in Bangladesh's food system, produced during a collaborative workshop with FoSTr's research partners.

7.2 Patterns and archetypes

System archetypes represent generic dynamics or patterns in any system. Adopting the use of archetypes leads to the assumption that if one can understand the systemic structure resulting from system dynamics, then action can be taken to change the system structure, system behaviour and system outcomes (WUR & KIT, 2018). Using the work of WUR & KIT (2018), several archetypes have been identified in the Bangladesh food system.

Tragedy of the commons

This archetype describes situations in which actions are pursued that are individually beneficial. However, such actions increase at a level that is too high for the system to sustain, resulting in diminishing effects impacting the wider population (WUR & KIT, 2018). These are noticed in two cases within the context of Bangladesh's food system.

The first archetype (Figure 26) relates to the dramatic increase in *boro* rice production, which occurred due to its high yielding potential compared to other rice varieties. Between 1991 and 2013, *boro* rice production increased from 6.8 to 18.8 million tons. This grain, however, requires irrigation for growth during the dry winter season. Subsequently, 73% of groundwater irrigation is used exclusively for *boro* rice production (Qureshi et al., 2014), which has consequently led to the extensive exploitation of groundwater sources across Bangladesh. The result is serious implications relating to groundwater quality and water accessibility, which may amplify in the future and affect the Bangladesh's rice production (Sumaiya et al., 2020).

The second archetype (Figure 27) emerges as Bangladesh's growing population causes increased food demand. Subsequently, farmers have begun growing high yielding crops which warrant the increased use of pesticides. Consequently, pesticide overuse is widely reported, with 47% of farmers involved in *boro* rice, potato, bean, eggplant, cabbage, sugarcane and mango farming overusing pesticides (Sumon, 2018). Such usage leads to environmental and aquatic toxicity affecting human health and biodiversity.

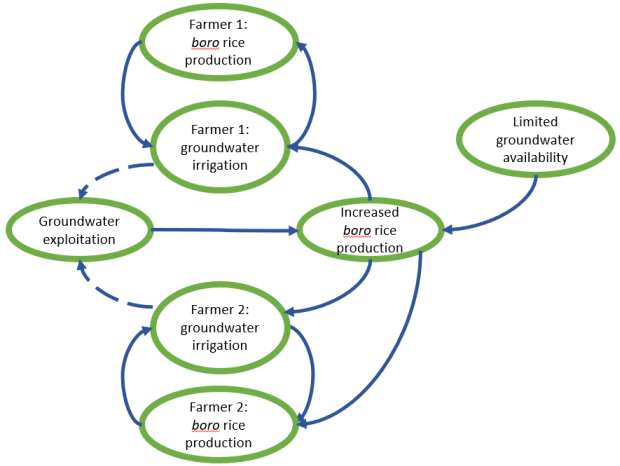

Figure 26 *Tragedy of the commons: Rice surplus vs natural resource degradation*
N.B Dashed arrows indicate possible outcomes, no specific evidence found.

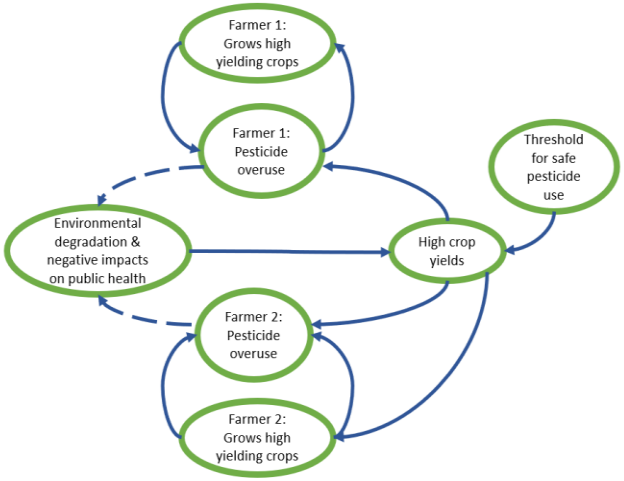

Figure 27 *Tragedy of the commons: High yields vs environmental and human health degradation*
N.B Dashed arrows indicate possible outcomes, no specific evidence found.

Limits to success

This archetype emphasises that continued efforts lead to improved performance. However, over time, a system limit causes a decrease or slowing down of the improvement despite continued efforts (WUR & KIT, 2018).

In Bangladesh, focus is placed on rice production, enabling the country to reach levels of self-sufficiency. As a result, there is less capacity to produce other types of food, causing decreased accessibility to diversified and nutritious food items on the market. Consequently, 43% of households are unable to afford the food based dietary guidelines (Islam et al., 2023), which has led to a high proportion of imbalanced diets and negatively impacted food security. This archetype highlights the limiting of rice production and achieving food security (Figure 28).

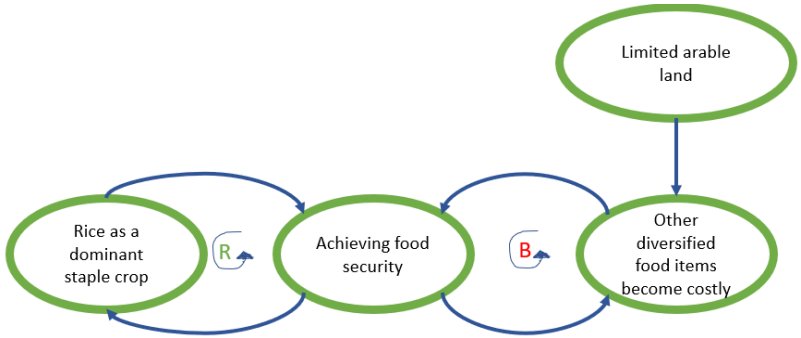

Figure 28 *Limits to success: Rice production and diversified diets*
(B) balancing feedback loop, (R) reinforcing feedback loop.

Bangladesh is one of the most vulnerable countries to the risks imposed by climate change. The low lying plains and flat topographies heighten flooding and waterlogging risks. Despite the wet season becoming shorter, higher annual rainfall indicates that rainfall during this period will increase by 12-15% (Clarke et al., 2015). Consequently, Bangladesh is heavily impacted by floods and droughts that limit the success of agricultural production (Mondal, 2010). Despite this, approximately 50% of the Bangladesh population is engaged in agricultural employment, leading to increased agricultural production and food security (FAO, 2023a). However, due to continuous population growth, more people must engage in agriculture to meet growing food demand – meaning the cycle continues to reinforce the archetype (Figure 2).

This archetype highlights the balancing nature of climate change on agricultural production. Importantly, one must recognise climate change as a consequence of human activity.

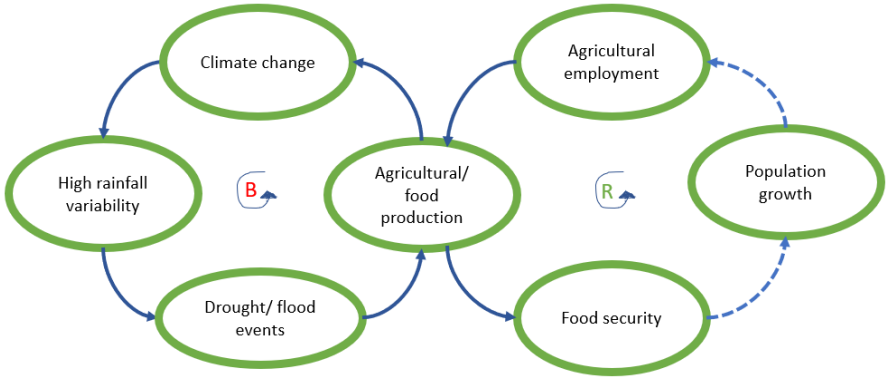

Figure 29 *Limits to Success: Climate change and food production*
N.B Dashed arrows indicate possible outcomes, no specific evidence found.
(B) balancing feedback loop, (R) reinforcing feedback loop.

7.3 Trade-offs and synergies

Using a food systems approach permits the potential trade-offs and synergies between competing goals to be acknowledged. This enables important institutional issues and political dilemmas to be addressed, supporting food system transformation (Brouwer et al., 2020).

Trade-offs

This food system overview has highlighted *several key trade-offs* within the Bangladesh food system.

Food export vs food security

Fish consumption contributes to 63% of protein supply within Bangladesh's national diets (Haque et al., 2019). However, over 50% of agricultural exports comprise fish and crustaceans, which raises the question of ensuring national food security vs the benefits gained through exporting essential food items.

Food imports vs food safety

Bangladesh has a rapidly growing population. A growth rate of 1.1% in 2021, coupled with the country's densely populated area, Bangladesh meets its growing demand for food through imports. Imports rose from US$3 billion in 2007 to US$10.7 billion in 2017 (FAO, 2020b; The World Bank, 2020b). Food imports from developed countries usually maintain strict standards; however, those from developing countries sometimes follow minimal adherence to food safety guidelines and regulations. Alternative buyers are subsequently sought, disregarding public health and safety (Dizon et al., 2019).

Food imports vs food security

Bangladesh's high dependency on food imports to feed its growing population may have contributed towards unaffordable food prices. Islam et al. (2023) illustrated that 43% of households are unable to afford the cost of the national recommended daily diets. Import dependency and low incomes hamper food affordability and thus food security.

Nutrition vs income assets

Similar to many other contexts, rising incomes, in combination with urbanisation, are creating a shift in dietary preferences towards higher value-added items consisting of more fats, oils, sugars and processed foods (Ecker & Comstock, 2021; Mottaleb et al., 2018b. Such changes in consumer demand pose as a potential trade-off as unhealthy diets become more apparent.

Synergies

Synergies in a food system occur when a desirable change in one outcome simultaneously contributes (directly or indirectly) towards other desired outcomes (Jagustović et al., 2021). This food system overview has highlighted different (potential) synergies within the Bangladesh food system.

Food security & climate adaptation

During several months a year, about one quarter of Bangladesh is flooded. These areas are especially vulnerable to climate shocks and stresses, which affect agricultural production. In these water-rich areas, many people face food shortages and nutrient deficiencies during the monsoon months. Floating vegetable gardens have been introduced in these tidal flooded areas which help farmers not only to adapt to the impacts of climate change but also to increase food and nutrition security (Pyka et al, 2020).

Poverty reduction & healthy diets

Social protection programmes, such as cash transfer programs, social safety net programs and food subsidies, are shown to have a positive impact on poverty reduction in Bangladesh (Chakarvarti, 2022). Research shows that social protection programmes also contribute to higher food security, especially when coupled with behavior change communication (Ahmed, 2021). On average, social protection programmes increase the value of food consumed by 13% and increase caloric acquisition with 8% (Hidabro et a, 2018).

Productivity & food security

Over the past decades, Bangladesh has had a consistent policy of investing in agricultural technology, leading to a surge in the use of irrigation, fertilisers and agricultural machinery (Ahmed, Saint-Geours & Gitau, 2021; The World Bank, 2016). This mechanization of agriculture has enabled Bangladesh to triple its rice production since the 1970's and feed its fast-growing population. As a consequence, food security in Bangladesh has improved significantly over the past decades. Stunting rates among children under 5 have dropped from 71% in 1985 to 28% in 2018 (UNICEF, 2023). Prevalence of undernourishment in Bangladesh has decreased from 16% in 2000 to 11% in 2020 (FAO, 2023).

Sustainability & healthy diets

The rapid expansion of aquaculture in Bangladesh has contributed to the increased availability of an affordable source of protein (Lahiri, 2022). At the same time, this intensification of aquaculture in Bangladesh has contributed to acidification, eutrophication and freshwater ecotoxicity. Feed provisioning is the main driver behind these impacts. Exploring ways to produce more fish with less feed can significantly reduce these environmental impacts (Henriksson et al, 2018). Changing to different fish species can also lower feed requirements and environmental impacts. Extensive aquaculture systems that co-produce fish and rice can also lower the environmental burden of fish farming. A shift to highly nutrient-dense small indigenous fish species (SIS) can improve the nutrition benefits of farmed fish (Shepon et al, 2020).

8 Conclusions

The food system in Bangladesh has rapidly evolved over the last few decades to meet the needs of its growing population. The food system delivers well on several outcomes, in turn reducing poverty rates and food insecurity. However, recent external shocks, such as the COVID-19 pandemic and the Russia-Ukraine war, have hindered progress, calling for adjustments to be made to anti-poverty strategies. Despite challenges, Bangladesh continues to drive forward to achieve their commitments. This is, in part, done so through the country's strategic investment in food and nutrition security as part of the nation's commitment towards achieving the SDGs. With broad governmental engagement across ministries and comprehensive policy frameworks, Bangladesh is aspiring to become a developed nation by 2041.

In addition to the external shocks, Bangladesh faces a myriad of challenges that are persistent and internally focused. These include the impacts of climate change, land degradation and population growth, all of which exacerbate issues within the food system. Two key questions pertain to whether the food system is sufficiently capable of meeting society's needs in the future and whether it is resilient against a variety of future shocks. This report is an attempt to create a solid foundation from which multiple stakeholders in the Bangladesh food system can discuss such matters. By collectively envisioning the future and exploring measures to enhance the country's resilience and the effectiveness of its food system, this report aims to foster constructive dialogue and action.

Food system outcomes

This assessment of Bangladesh's food system reveals a multifaceted landscape marked by both progress and challenges. While significant progress has been made in enhancing food and nutrition security – evidenced by a notable reduction in chronic food insecurity levels and improvements in child stunting and underweight rates – disparities in food accessibility and utilisation persist. Although the country achieved self-sufficiency in rice and fish, continual population growth and limited land availability, impeded by the impacts of climate change, means that insufficient diversified foods reach the market, hindering progress in food and nutrition security. Whilst obesity rates are low compared to regional counterparts, changing dietary patterns favour calorie-dense foods, leading to an increase in NCDs.

The impact of the Bangladesh food system on both the economy and social well-being is evident. While the contribution of agriculture, forestry and fishing to GDP has decreased, agriculture remains a crucial source of employment, particularly in rural areas where the majority of people depend on it for their livelihoods. Despite progress in women's engagement in agriculture, significant challenges persist, calling for tailored support to address gender disparities in women's ability to access markets, finance and services. To further progress, continual effort is needed to strengthen the resilience and inclusivity of the agri-food sector, ensuring sustainable economic growth and improved social well-being for all Bangladeshis.

In terms of environmental sustainability outcomes, Bangladesh is struggling to provide for its rapidly expanding population on limited and densely populated land. To increase crop yields and maintain agricultural production, many farmers have increased pesticide use and aqua-chemical use, often without proper training or protective measures. These actions not only pose risks to a farmer's health, but also contribute to environmental and aquatic toxicity. As rice production continues to expand, reliance on irrigation and groundwater use further strains natural resources, threatening water security and soil health. Addressing these complex issues requires holistic approaches that prioritise sustainable agricultural practices, effective regulation, and enhanced farmer education to ensure food security without compromising environmental sustainability.

Food system drivers

A complex interplay of drivers shapes Bangladesh's food system outcomes and its future trajectory. With a rapidly growing population and an increasing

urbanisation trend, demographic dynamics are significantly influencing food security challenges, emphasising the need to address diverse socio-economic disparities. Despite facing economic fluctuations, Bangladesh has made substantial progress in poverty reduction and economic growth.

Government initiatives, such as increased spending in the agricultural sector and subsidised food programmes, play pivotal roles in boosting food accessibility and security. However, challenges persist – such as lower foreign direct investment and increased investment projects in the processing sector which are expected to cause a surge in processed food availability – and these may have widespread consequences for human health.

Urbanisation and rising incomes are driving changes in consumption patterns, leading to a gradual shift towards higher-value diets and increased demand for processed foods, particularly in urban areas. Moreover, food distribution mechanisms and globalisation have significantly diversified food options but simultaneously raised concerns about food safety and nutritional health. Technological innovations have boosted agricultural productivity, yet their implementation faces accessibility challenges, especially in rural areas. Market dynamics, including reliance on food imports to supplement domestic food production, impact food security and price stability. Climate change poses severe threats, exacerbating risks of flooding, soil salinity and crop loss. Migration, both internal and international, and external shocks like the COVID-19 pandemic and the conflict in Ukraine, further compound challenges, affecting livelihoods, remittance flows and food security.

Navigating this diverse array of drivers and the challenges they impose on the food system requires a multifaceted approach encompassing policy formulation, technological innovation, climate adaptation and social support mechanisms. By strategically investing in these areas and implementing policy reforms, Bangladesh can build a resilient and sustainable food system capable of meeting the diverse needs of its population. Targeted interventions aimed at enhancing productivity, promoting equitable access to resources, and fostering inclusive growth will be essential in achieving this goal. As Bangladesh continues to evolve in the face of global uncertainties, a concerted effort towards building a resilient and inclusive food system will not only ensure food security but also drive the country's sustainable economic development.

Food system activities

With over 70% of its land dedicated to agriculture and more than half of its population engaged in farming, Bangladesh relies heavily on smallholder farmers, particularly in rural areas, to produce the majority of domestic food. The fisheries sector stands out as one of the most productive globally, ranking third in inland fish production and contributing significantly to the country's GDP. However, challenges such as food waste, inadequate food safety standards, and the increasing demand for processed and imported foods emphasise the need for strategic interventions and improvements in infrastructure and institutional support.

Bangladesh's advancements in infrastructure and national services have significantly strengthened its food system. With improved access to electricity, sanitation and safe drinking water, the country has laid the foundation for a productive agri-food sector. Government initiatives, such as cash incentives for imports and reduced interest rates on agricultural loans, are driving productivity. The wealth of ministries working in the food system highlight the country's commitment to improving food system outcomes. The Food Planning and Monitoring Committee ensures coordination across these ministries for effective policy implementation. Despite progress, challenges with regards to food safety persist, calling for further efforts to enforce safety regulations and promote sustainable food production. By continuing to prioritise infrastructure development, coordination among ministries and food safety measures, Bangladesh can sustain its progress toward a resilient and healthy food system.

To ensure the future of the Bangladesh food system, continued collaboration among food system stakeholders, including government agencies, private sector actors and civil society organizations, is crucial for navigating the uncertainties that will shape its future.

Food system dynamics

Food systems are dynamic in nature and change over time due to the interplay between drivers, trends and internal forces that steer the system in certain directions. The simplified causal loop diagram, co-created with FoSTr's research partners, highlights several key drivers shaping the food system: population growth and density, globalisation, and urbanization. Key activities comprising multiple interactions within the food system are staple food production and

aquaculture production. Finally, it is important to note that the majority of farmers being smallholder farmers shapes the characteristics of many activities along the food value chain, including food production, retailing and storage, subsequently influencing the state of food and nutrition security in the country.

In addition to these key elements, several patterns can be identified in the food system, each with their own feedback loop, whereby changes in one part of the system affects another, creating a continuous cycle of two interacting elements. By understanding these dynamics, interventions can be tailored to drive systemic changes for improved outcomes. Several archetypes identified in the Bangladesh food system highlight both challenges and opportunities. One example relates to when individual actions lead to collective harm. For instance, in Bangladesh, extensive boro rice production has strained groundwater resources, jeopardising future rice production and water accessibility. Similarly, pesticide overuse in response to growing food demand poses environmental and health risks, perpetuating a cycle of degradation. These archetypes are a useful tool to identify trade-offs and synergies in the food system which accompany the outcomes we see today. Understanding these interactions is essential for effective policymaking and interventions which accommodate the food system's many stakeholders.

Key examples of trade-offs seen within the Bangladesh food system include balancing food exports with domestic food security and managing food imports to ensure safety and affordability, among others. Key examples of synergies include efforts to reduce poverty, enhance agricultural productivity and promote self-sufficiency, which can synergistically contribute to improved food security and livelihoods. Overall, adopting a food systems approach facilitates a nuanced understanding of complex interactions and trade-offs, enabling informed decision-making to promote sustainable food security and resilience in Bangladesh.

Making Bangladesh's food system future-proof is a highly dynamic process whereby all policymakers and key stakeholders have a role to play. This document, with its description of system components and their dynamics, trade-offs and synergies, is meant to inform a participatory, evidence-based foresight processes that enable food system stakeholders to explore a range of food system futures and successfully navigate the uncertainties that lie ahead. Beyond this, it can be used as a reference document for all actors involved in transforming the food system in Bangladesh.

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The Foresight for Food System Transformation (FoSTr) is a programme that supports policymakers and other key stakeholders in the food system with scenarios and foresight analysis about the food system of the future. The programme is financed by the Kingdom of the Netherlands, overseen by IFAD and implemented by the University of Oxford's Environmental Change Institute, Wageningen University & Research and key partners in the international Foresight4Food network.